



Town Council Work Session
Tuesday, July 25, 2023, 2:00 PM
Town Hall Council Chambers
150 Ski Hill Road
Breckenridge, Colorado

THE TOWN OF BRECKENRIDGE IS HOLDING HYBRID MEETINGS. This meeting will be held in person at Breckenridge Town Hall and will also be broadcast live over Zoom. Login information is available in the calendar section of our website: www.townofbreckenridge.com. If you will need special assistance in order to attend any of the Town's public meetings, please notify the Town Clerk's Office at (970) 547-3127, at least 72 hours in advance of the meeting.

- I. ALTA VERDE II SITE VISIT (2:00-3:00pm)**
- II. ALTA VERDE UPDATE (3:00-3:45pm)**
Alta Verde Update
- III. BRECKENRIDGE FILM UPDATE (3:45-4:05pm)**
- IV. PLANNING COMMISSION DECISIONS (4:05-4:10pm)**
Planning Commission Decisions
- V. LEGISLATIVE REVIEW (4:10-4:35pm)**
Roofing Materials Ordinance (Second Reading)
Building Code Amendments (Second Reading)
Parking Code Amendments (Second Reading)
Outdoor Sales Days Amendment (Second Reading)
2023 Budget Appropriations (Resolution)
911 Communications Center IGA (Resolution)
- VI. MANAGERS REPORT (4:35-5:30pm)**
2022 Audit Report
Public Projects Update
Mobility Update
Sustainability Update
Housing and Childcare Update
Committee Reports
Breckenridge Events Committee
Financials
Town Attorney Update

VII. ADMINISTRATIVE RULES AND REGULATIONS (5:30-5:40pm)

Engineering Standards Rules and Regulations

VIII. EXECUTIVE SESSION - Open Space Acquisitions (5:40pm)



Memo

To: Breckenridge Town Council Members
From: Laurie Best, Housing Manager
Date: 7/19/2023 (7/25/2023 Council Worksession)
Subject: Alta Verde 2 Site Visit and Alta Verde 1 Recap

A site visit to the Alta Verde Apartments is scheduled for July 25th at 2pm to be followed by an Alta Verde discussion/recap which is the first item on your worksession agenda at 3pm.

Alta Verde 2-We will meet on site at 2pm and Kimball Crangle will provide a quick tour of the Alta Verde 2 Apartments. The initial site work was completed last fall and all four buildings are now under construction and scheduled for completion in the summer of 2024. This complex will include 172 apartments (14 studios, 38 one bedroom, 78 two bedroom and 42 three bedroom units). The operating budget will not be finalized until next spring, so rents have not been set, but our agreement with Corum is to provide 50% of the units at 80% AMI, 40% of the units at 120% AMI, and 10% are workforce only without a rent cap. Pursuant to the Town's covenant the 80% AMI units will have an income cap at 100% AMI. We have asked Kimball to describe current plans for the lease up including process, schedule, and outreach.

Alta Verde 1-We have also asked Kimball to provide a brief summary of the Alta Verde 1 project, including the final number of applications that were received and evaluated to fill the 80 apartments, the number of over-income applicants, and what if any lessons may improve the Alta Verde 2 lease up.

Staff will also be available for this discussion.



Memo

To: Breckenridge Town Council Members
From: Mark Truckey, Director of Community Development
Date: July 19, 2023
Subject: Planning Commission Decisions of the July 18, 2023 Meeting

DECISIONS FROM THE PLANNING COMMISSION MEETING, July 18, 2023:

CLASS A APPLICATIONS: None.

CLASS B APPLICATIONS: None.

CLASS C APPLICATIONS: None.

TOWN PROJECT HEARINGS: None.

OTHER: None.



PLANNING COMMISSION MEETING

The meeting was called to order at 5:30 pm by Chair Frechter.

ROLL CALL

Mike Giller	Mark Leas	Allen Frechter	Susan Propper
Ethan Guerra - remote	Steve Gerard	Elaine Gort	

APPROVAL OF MINUTES

With no changes, the June 20, 2023, Planning Commission Minutes were approved.

APPROVAL OF AGENDA

With no changes, the July 18, 2023, Planning Commission Agenda was approved.

PUBLIC COMMENT ON HISTORIC PRESERVATION ISSUES:

- No public comments.

PRELIMINARY HEARINGS:

1. 114 S. Main Street Redevelopment (SVC), 114 S. Main Street, PL-2023-0077

Ms. Crump presented a proposal to construct a new two-story building of 5,640 sq. ft., containing commercial and restaurant uses. The following questions were asked of the Commission:

1. Is the Commission supportive of the preliminary point analysis?
2. Does the Commission have any additional comments on the proposed project design?
3. Does the Commission believe the project is ready for a final hearing?

Commissioner Questions / Comments:

Ms. Gort: I have questions about the front windows. They look a lot lower than the adjacent building's upper level. I assume that is because of the floor of the rooftop? (Ms. Crump: As long as there is separation between the upper and lower floors, there are not design guidelines that would insist the windows are at the exact same height as the neighboring buildings. But if that is a recommended change, we can take a look at it.) If you look at the front elevation, there is a large blank space above the upper-level windows. Maybe we can make the windows a little taller. (Mr. Kulick: On the lower level you are supposed to have a lower solid-to-void area and more solid on the upper level.) If you look at the two buildings next to it, upstairs their windows are way higher than the proposed building which is equal height. (Mr. Kulick: We have a design diagram of the recommended design for new construction of commercial buildings. Looking at the proposal against the template, the current design matches up very well with that standard.) Additionally, I feel like the steel kickplates below the windows do not mirror what is within our Historic District. Policy 225 talks about the use of natural materials. (Ms. Crump: The kickplates are proposed to be steel.)

Mr. Guerra makes a disclosure that the applicant architect, Suzanne Alan Sabo of Allen-Guerra Architecture is his ex-wife and business partner. However, he has no connection nor financial interest in this project. No Commissioners object to his participation in the discussion and Mr. Guerra continues.

Mr. Giller: Some of the Commissioners were concerned that the size of the windows on the ground floor were not compatible with the design standards and the surrounding buildings. This report does not speak to that. Is there a reason? (Ms. Crump: Page 4 of the report says, despite the difference in height between the windows of the neighboring building and those in the proposal, Design Standard 218 does not require the windows to be perfectly

aligned. It says that they need to reinforce the pedestrian scale. It was previously discussed that you could use a plinth to make up the window height change. These revisions do not propose that. Staff believes that it does comply with Design Standard 218, and it is not necessary for all the elements of the windows to align exactly with the adjacent buildings. The important part of the standard is that the commercial building elements are present.) So, the applicant did not adjust the windows? (Ms. Crump: It is Staff's understanding that they did not revise the windows.) We can ask the applicant, but I would like to follow up with them on adjusting the amount of glazing, the window height, and the mullions. (Mr. Kulick: We looked at it internally afterwards and compared with the diagram in the Design Standards. Staff believes the proportionality of the proposal at the lower level is in alignment with the diagram. Rather than comparing to the non-historic building to the north or even the historic building to the south, if you are looking at the amount of glazing and the overall height of the kickplate, the other two buildings have a much larger kickplate than what is depicted in the Handbook of Design Standards.)

Ms. Gort: How tall is the proposed kickplate? (Mr. Mariethoz: It is about two feet tall.)

Mr. Giller: The renderings are different scales. If I use the door as a point of reference, the kickplate and the design guidelines are larger or taller than the kickplate in the applicant's preliminary design. If I look at the ground floor glazing in totality, the scale of the mullions, the fact that every window has a transom, the face the kickplate itself is lower, the fact that there is not a base or plinth collectively, it is a lot of glass.

Ms. Propper: I wasn't clear on what the proposal does to show energy savings that exceed the IECC or SSBC minimum standards under 33 R. (Ms. Crump: An energy audit firm would rate the building based on the proposed materials, suggest a target energy rating for points before the final hearing, and then staff reviews the final energy rating after construction and prior to the CO to confirm it complies.)

Applicant, Yves Mariethoz, Allen-Guerra Architecture: Thank you to Sarah and Chris. We met with them after the last meeting to review the points that were discussed. We used the Town of Breckenridge sign as inspiration for the front elevation. On the front elevation, we removed a lot of the trim that we proposed previously, like the vertical pieces of wood that were out of the historical character. We also removed most of the proposed steel on the front elevation. We do have some steel along the elevation on the main floor and the upper cornice. The height was adjusted to be below the absolute building height of thirty feet. I know there was a comment about the roof deck and what is proposed. The parapet is to minimize the risks of the roof deck with a 42" railing all the way around. In the rear, we were over the maximum height and revised to comply. The upper windows are a bit lower in the elevation but look similar to other historical buildings that had space for signs above the windows. If we look at the Breckenridge Design Standard for the Conservation District on page 38, there is a sketch and you can see where the sign is located. Without a sign there, you do have a taller space above the windows. Regarding the kickplate, we still have a steel kickplate. We can change that. I don't think it's a problem if we want to have stone or something like that. Regarding the window height at the main floor, I think they are about 9' 6" right now. We slightly lowered the main floor a little bit, but we try to still keep the trim aligned with elements on each side of the adjacent buildings. We can increase the trim on the lower-level windows to make them more similar to those on the northern building. Also, once we start designing with the structural engineer, we may have to do a bit of adjustment depending on what thickness of the floor we end up having at the main floor and the roof. Maybe there is a little adjustment that can be done there for the upper-level windows. And then regarding the energy rating, we will meet with an energy auditor and we can do a highly insulated wall or R-Value in the windows to reach the required level.

Applicant, Susanne Allen-Sabo, Allen-Guerra Architecture: I wanted to respond to your questions, Mike. Regarding the transom, months ago, we didn't have a transom, and then I think Chris or Sarah

pointed that out to us. Hey, you must have a transom in this district, we added the transom at that point. And then because we lowered the height of the windows, I think that reduced the proportion of the glazing on the street. We also looked at raising that kickplate further but when you start raising that kickplate up, the proportion of that glass becomes less vertical, and it just does not look good. So, we felt that the two-foot kickplate with that lowered height to 9'6" made the most sense aesthetically.

Mr. Kulick: When you read Priority Design Standard 220, the first bullet says the first floor should be predominantly glass with a smaller percentage of opaque materials. First floor should include the traditional kickplate columns or blasters and sign bands, and then it says the upper-floor should be the reverse. Opaque materials should dominate; windows should be smaller, more vertically oriented openings that appear to puncture the more solid wall plane. To Sarah's earlier point, we don't have anything that says it has to line up with the next building, but from our standpoint, the design that's proposed seems to meet both the standards of 220, as well as, what the diagram shows for a traditional storefront within our handbook.

Mr. Giller: The height to width ratio of the main glazing on the ground floor is as vertical as the upper story windows. That's a matter of adjusting the transom or kickplate height. If one takes individual design criteria out of context or by themselves, sometimes they do not work as well. We have approximately 40 feet of curtain wall. Yes, it is articulated with some transoms and some windows, but that is the biggest amount of glazing on Main St. If you look at the design standards on either side, there's about a 2-foot solid, whether it's wood or stone on either side and the plinth itself is taller; I don't think they're following the design standard because they have pushed the extent, the length, the height, and the base of the glazing throughout. (Mr. Kulick: All the standards that you are mentioning are not listed under Design Standard 220. It only says that storefronts should be predominantly glass with a small percentage of opaque materials. If you look around town, the handbook shows the design from the Gold Pan Saloon which also has a very low kickplate that has a very different style window, there's a variety of storefront windows within the Downtown area. What you are saying may be of sound architectural form, but that's not what the design standard states; you're asking for a higher level of design than the standards.)

Ms. Gort: The large aluminum clad windows that look like an office building on the first floor. It might meet the code literally but it does not have a look that appears historic or matches the historic look of the surrounding buildings (Mr. Kulick: We're trying to pull it into a code based reasoning. Similar to the comments that Steve made about the mullions and the windows, our handbook says that there's a variety of window designs that are appropriate, and they show some that are divided and some that are not. There may be an overall preference for certain types of windows, or a personal style, but for setting precedent and potentially layering more criteria on there's already a lot of standards that the designers have to meet. We really need to be looking at the code versus trying to make preferences that are beyond the code.)

Mr. Guerra: No questions or comments for the applicant.

Mr. Gerard: You mentioned the side walls of the roof top are going to be 42" from the floor to the top of the wall? (Mr. Mariethoz: That is correct.) Do you have a plan for water and snowmelt onto the roof from the taller building? (Mr. Mariethoz: Right now, most of the roof is sloping towards the adjacent buildings. We will need some type of drain at the center of the roof top. We will have a thick floor system that should allow us to have a center drain that will drain the water to the side of one of the walls. We may have some type of floating tile system with a waterproof deck system underneath or something like that with a slope to address the drainage on that rooftop.) It looks to me from the drawings that

their rooftop to the north and the side wall is going to be above this roof. (Mr. Mariethoz: We match the front of the cornice with the building to the north, so you are correct that when we keep going with the slope the roof is slightly lower. We can study that a bit and the operation of the drain.) One of the things that I commented before is making sure that people are dissuaded from going from one roof to another, so maybe at the final hearing you might look at that, look at the design on the proposed rooftop next door and just see how they match up.

Mr. Leas: What is the material on the front of the building? (Mr. Mariethoz: It is wood lap siding.) Ms. Crump: It is proposed as western red cedar and to be painted, four-inch lap siding.) There will be some corner boards and other trimming details that are not shown? (Mr. Mariethoz: That is correct. Corner trim and other detailing will have the lap siding tie into each corner.) Is it not true that those windows are adjusted so that the head of the window is not above the ceiling of the second floor? (Mr. Mariethoz: That is correct. In the graphic, you can see the floor plate and where the window is. Currently we're showing like a 20-inch-thick floor. If our Engineer tells us that we can raise, we don't need that thick of a floor system, then we could maybe raise the window in the front slightly.) The other potentially objectionable thing that people on the panel are looking at in terms of that space is just due to the fact that this cornice is not as deep as the first proposed cornice, correct? (Mr. Mariethoz: That is correct. Right now, it is about 6 inches deep. It is slightly different because before we had a larger step in the center that was making it look thick and tall. So right now, we try to keep a consistent thickness all the way across.)

Ms. Propper: No further questions.

Mr. Frechter: My questions have been answered.

A public comment period was opened; there were no public comments, and the period was closed.

Final Commissioner Comments:

Ms. Gort: 1. I am supportive of the point analysis. 2. The upper windows need to be taller, and the kickplate detail should not be steel, and the tons of glazing on the first level can be reduced. 3. It is ready for a final hearing.

Mr. Guerra: 1. The design is attractive. I am supportive of the point analysis. 2. I have no additional comments. 3. It is ready for a final hearing.

Mr. Gerard: 1. The point analysis is correct. 2. I am generally pleased with the response to the comments made from last time. It is a great idea to incorporate the Town's seal in the roof form. I appreciate the simplicity in the upper windows. I understand their placement and how they do not match with the adjacent buildings and that may change based on the Structural Engineers opinion. I don't really have a problem with them. I agree with Mr. Giller and Ms. Gort about the ground floor windows. In addition to the fact that it's a lot of glazing, the aluminum mullions look cheap. They do not look as important as the building really is. A little wider mullion, maybe a different material would change the appearance. They look like a strip mall window. You came up with a great solution for the elevator to the rooftop deck. Even though I am not a fan of rooftop decks, this is much better design than the first one that came through the Commission. You have done a good job addressing our concerns. 3. We are ready for final hearing.

Mr. Leas: 1. The point analysis is accurate. 2. The panel has thrown a lot of architectural constrictions out from our first review and the architects have done a great job of addressing each of those objections and making this a passing project. The upper deck is more contained than the previous design resulting in the floor level lowered and the windows lowered. There's a concession made for each step forward and what we've got is accumulation of many concessions that the architects have made. It's important that

this panel understands that that our function here is to look for compliance with the Design Standards; we have to be careful what we ask for. I think that we've gotten what we asked for but I think that what we've gotten is a less architecturally interesting building than what was proposed before. It's now very plain and I feel that the previous design had a lot of nice elements that are gone. 3. It's ready for final hearing.

Mr. Giller: 1. I am not supportive of the point analysis because the design doesn't comply with the intent for ground floor glazing in the 2019 Handbook of Design Standards. 2. The upper deck and cornice design is sound and complies. Though there is too much first floor glazing. 3. It could be ready for a Final Hearing with a reduction in glazing in the first-floor windows, strengthening the mullion size, and raising the kickplate height.

Ms. Propper: I appreciate the adjustments made from the last hearing. 1. I am supportive of the point analysis. 2. I do not have additional comments other than my comments about energy conservation. 3. The project is ready for a final hearing.

Mr. Frechter: I thank the applicant for making the building height and the elevator work, I thought those were clever changes in design. In Policy 211, it says the amount of facade devoted to wall surfaces compared to that devoted to openings should be compatible within the neighborhood and with the function of the building. So, we have to interpret what is a gray area. It appears the proportion of solid to glazing is very high, higher on the upper level. But perhaps it'll look better if we could see the lines of the horizontal siding in the rendering shown in the next hearing. The floor and window lines do not line up with the neighboring buildings. The first-floor windows do have shorter kickplates if you look at the three buildings, this building looks different but if you look at the whole block, there's no consistency in design. We need to think about if we really want three buildings in a row that match or do we want some variation? I thought that lining up the floor plates and windows was important but when I look at the whole block I'm okay with the windows and the floor plates not lining up. I would defer to the architects and design folks to say if the higher kickplate would look awkward, maybe we can look at both at the next hearing. When you look at the whole block, I do not think these differences are significant. The lower window framing needs to be beefed up. 1. I support the point analysis. 3. They are ready for a final hearing.

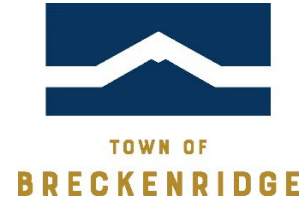
OTHER MATTERS:

1. Town Council Summary
2. Class D Majors, Q2 2023 (Memo Only)
3. Class C Subdivisions, Q2 2023 (Memo Only)

ADJOURNMENT:

The meeting was adjourned at 7:02 pm.

Allen Frechter, Chair



Memo

To: Town Council
From: Rick Fout, Chief Building Official
Date: 7/19/2023 for the Council Meeting on 7/25/2023
Subject: 2nd Reading: Proposed Prohibition on Wood Roof Shingles

This will be the 2nd reading to adopt an Ordinance prohibiting real wood shingles on roofs in Breckenridge, on new construction projects and re-roof projects as well. There are no changes from the 1st reading on July 11th, 2023.

Main Reasons for This Proposed Prohibition Are:

- Insurance on structures with wood shingled roofs is difficult to impossible to secure.
- Wood shingled roofs are a leading cause of fire ignition and of fire spread.

Staff will be available to answer any questions at the meeting.

A BILL FOR AN ORDINANCE PROHIBITING WOOD SHINGLES ON ROOFS.

NOW, THEREFORE, BE IT ORDAINED BY THE TOWN COUNCIL OF THE TOWN OF BRECKENRIDGE, COLORADO:

Section 1. That paragraph 29 of section 8-1-4A of the International Building Code, Edition 2018, is hereby repealed and replaced with the language underlined to read as follows:

29. Section 1505.1 is amended to read as follows:

1505.1 General. All roof coverings shall be Class A. Wood shakes and shingles are not permitted unless exempted for replacement or repair as defined in Section 1501.1.1. Where the roof profile allows space between the roof covering and the roof decking at the eave ends, the spaces shall be constructed to prevent intrusion of flames and embers or have one layer of 72-pound (32.4kg) mineral-surfaced non-perforated cap sheet complying with ASTM D3909 installed over the combustible decking.

Exception: Skylights and sloped glazing that comply with Chapter 24 or Section 2610.”

Section 1505.1.1: Section 1505.1.1 is added as follows:

Replacement or Repair: Each structure with a nonconforming roof covering or roof assembly shall be allowed one replacement or repair of 25% or less of the roof area. Replacement or repair in excess of 25% or a second replacement or repair of the roof covering or roof assembly shall trigger replacement of the nonconforming covering or assembly in its entirety. For purposes of this section, a two-family dwelling shall be considered two separate structures. Emergency repairs of less than 10 sq/ft shall not be subject to the 25% rule.

Table 1505.1 is deleted.

Section 1505.3, 1505.4, 1505.5, 1505.6 and 1505.7 are deleted.

Section 2. That paragraphs 30, 33, 34, and 35 of 8-1-4A are hereby deleted and reserved.

Section 3. That paragraph 37 of section 8-1-5A of the International Residential Code, 2018 Edition, is hereby repealed and replaced with the language underlined to read as follows:

37. Section R902.1 is amended to read as follows:

R902.1 Roofing covering materials. All roof assemblies and roof coverings shall be Class A. Wood shakes and shingles are prohibited unless exempted for replacement or repair as defined below. Where the roof profile allows space between the roof covering and the roof decking at the eave ends, the spaces shall be constructed to prevent intrusion of flames and embers, or

1 have one layer of 72-pound (32.4kg) mineral-surfaced non-perforated cap sheet complying with
2 ASTM D3909 installed over the combustible decking.

3 Section R902.1 is amended to read as follows:

4 Replacement or Repair: Each structure with a nonconforming roof covering or roof assembly
5 shall be allowed one replacement or repair of 25% or less of the roof area. Replacement or
6 repair in excess of 25% or a second replacement or repair of the roof covering or roof assembly
7 shall trigger replacement of the nonconforming covering or assembly in its entirety. Emergency
8 repairs of less than 10 sq/ft shall not be subject to the 25% rule.

9 For purposes of this section, a two-family dwelling shall be considered two separate structures.

10 Exception: Metal and concrete roofing systems.

11 Section R902.2 Fire-retardant-treated wood shingles and shakes is deleted.

12 **Section 4.** Except as specifically amended hereby, the Breckenridge Town Code, and
13 the various secondary codes adopted by reference therein, shall continue in full force and effect.

14 **Section 5.** The Town Council hereby finds, determines and declares that this ordinance
15 is necessary and proper to provide for the safety, preserve the health, promote the prosperity,
16 and improve the order, comfort and convenience of the Town of Breckenridge and the
17 inhabitants thereof.

18 **Section 6.** This ordinance shall be published and become effective as provided by
19 Section 5.9 of the Breckenridge Town Charter.

20
21 INTRODUCED, READ ON FIRST READING, APPROVED AND ORDERED
22 PUBLISHED IN FULL this ____ day of ____, 2023. A Public Hearing shall be held at the
23 regular meeting of the Town Council of the Town of Breckenridge, Colorado on the ____ day of
24 ____, 2023, at 7:00 P.M., or as soon thereafter as possible in the Municipal Building of the
25 Town.

26
27 TOWN OF BRECKENRIDGE, a Colorado
28 municipal corporation
29

30
31
32 By: _____
33 Eric S. Mamula, Mayor
34

35 ATTEST:
36
37
38

1
2 _____
3 Helen Cospolich, CMC,
4 Town Clerk



Memo

To: Breckenridge Town Council Members
From: Jessie Launder, Administrative Supervisor
Date: July 19, 2023 (For July 25th Council Meeting)
Subject: Building Code Update

This Council Bill proposes to make a minor update and correction to Title 8, Chapter 1, Building Regulations. Below is a summary of the changes:

- Update the *Standard Codes Adopted by Reference* section to more clearly reference all applicable codes already utilized by the Building Division.
- Correct an error in the Electrical Permit Fee Schedule. In the right side of the fee chart, 4th row from the top, the number "1000" should be "100."

There are no changes since the First Reading. Staff will be available to answer questions.

COUNCIL BILL NO. ____

Series 2023

A BILL FOR AN ORDINANCE UPDATING THE BUILDING CODE.

NOW, THEREFORE, BE IT ORDAINED BY THE TOWN COUNCIL OF THE TOWN OF BRECKENRIDGE, COLORADO:

Section 1. That section 8-1-3, entitled "Standard Codes Adopted by Reference", be amended by adding the new language underlined to read as follows:

K. International Fire Code, 2018 Edition, including Appendix B, C, D, E, F, G, H, I, J, K, M, N, O, and P, published by the International Code Council, Inc.

L. Accessible and Usable Buildings and Facilities, ICC A117.1-2009 Edition, Published by the International Code Council, Inc.

M. International Swimming Pool & Spa Code, 2018 Edition, Published by the International Code Council, Inc.

Section 2. That paragraph 14 of section 8-1-4 be amended to strike the zero (0) in the Electrical Permit Fees schedule for Unit Area over 2,000 sq. ft. to read as follows:

Section 109.2 Schedule of permit fees is amended to read as follows:
109.2 Schedule of permit fees. On buildings, structures, electrical, gas mechanical and plumbing systems or alterations requiring a permit, a fee for each permit shall be paid as required, in accordance with the following Town of Breckenridge Building Permit and Inspection Fee Schedule:

Electrical Permit Fees

Unit Area	Permit Fee
Not more than 1,000 sq. ft.	\$120.00
Over 1,000 sq. ft., and not more than 1,500 sq. ft.	\$168.00
Over 1,500 sq. ft., and not more than 2,000 sq. ft.	\$216.00
Over 2,000 sq. ft.	\$216.00 plus \$9.60 per 1000 sq. ft. or fraction thereof over 2,000 sq. ft.

Unit Area	Permit Fee
All Other Fees: Except for inspection in mobile homes and travel parks, all other permit fees shall be computed on the dollar value of the electrical installation, including labor and material, and such fees shall be computed as follows:	
Valuation	Permit Fee
Not more than \$2,000.00	\$120.00
More than \$2,000.00	\$9.60 per thousand or fraction thereof plus \$120.00
Mobile homes and travel parks per space	\$120.00
Additional plan review	\$65.00 per hour or fraction thereof
Re-inspection on all above	\$65.00
Temporary Power Permit	\$65.00
Hot Tub Electrical Permit	\$120.00
Plan review fees – The plan review fees for electrical work shall be calculated as 65 percent of the electrical permit fee.	

Section 3. This ordinance shall be published and become effective as provided by Section 5.9 of the Breckenridge Town Charter.

INTRODUCED, READ ON FIRST READING, APPROVED AND ORDERED
PUBLISHED IN FULL this ____ day of ____, 2023. A Public Hearing shall be held at the regular meeting of the Town Council of the Town of Breckenridge, Colorado on the ____ day of ____, 2023, at 7:00 P.M., or as soon thereafter as possible in the Municipal Building of the Town.

TOWN OF BRECKENRIDGE, a Colorado
municipal corporation

By: _____
Eric S. Mamula, Mayor

ATTEST:

1
2
3
4
5
6

Helen Cospolich, CMC,
Town Clerk



Memo

To: Town Council
From: Sarah Crump, Planner III
Date: July 19, 2023 for meeting of July 25, 2023
Subject: Parking Code Amendment Bill (Second Reading)

The proposed Code amendments regarding parking requirements for duplexes and townhomes were approved by Town Council at first reading on July 11, 2023. There have been no changes to the proposed amendments since first reading.

The proposed changes to Section 9-3-8 Off Street Parking Requirement will add townhome units to the land use category column where they were omitted previously. The “duplex” land use category is proposed to be changed to “duplex and townhome” both inside and outside the parking service area (downtown core). The changes will also clarify the application of parking maximums for duplex and townhome units in the parking service area to allow parking maximums to be rounded up to the nearest number. This will allow for an equal distribution of parking among duplex and townhome units. Outside the service area, the minimum required number of spaces for duplex and townhome units has been modified from 1.5 to 2.0. There is also clarification that no parking maximum requirements exist for single-family, duplex, townhome, or accessory apartment land use categories outside the parking service area.

The draft Code for the Council’s review and approval are attached. Staff will be available at the meeting for any questions.

Series 2023

AN ORDINANCE AMENDING THE DEVELOPMENT CODE PERTAINING TO OFF STREET PARKING REQUIREMENTS.

NOW, THEREFORE, BE IT ORDAINED BY THE TOWN COUNCIL OF THE TOWN OF BRECKENRIDGE, COLORADO:

Section 1. That section 9-3-8 of the Breckenridge Town Code, entitled "OFF STREET PARKING REQUIREMENT", be amended by adding the language underlined to the list of definitions and placed in alphabetical order, to read as follows:

A. Within the Service Area: In connection with the development of all property within the service area there shall be provided the following amount of off street parking:

Land Use Category	Number of Required Off Street Parking Spaces (Per TSF-GFA Unless Otherwise Noted); no additional parking shall be allowed.**
Residential:	
Single-family	1.1
Duplex or Townhome	1.1
Multi-family; efficiency, studio	1.1
Multi-family; 1 bedroom plus	1.1
Condominium; efficiency, studio	1.1
Condominium; 1 bedroom plus	1.1
Divisible unit	1.1
Lodging, hotel, motel	1.1
Dormitory	1.1
Commercial:	
Retail sale, commercial:	
General retail, commercial	1.4
Supermarket	2.5
Financial	1.9
Office:	
General office	1.4
Government office	2.2
Auto service station	3.0 per bay plus 1 per pump
Restaurant, sit down	3.5
Auditorium, theater	0.3 per seat
Church	0.5
Convention center	3.1

Library, museum	1.8
Medical/dental clinic	3.3
Commercial recreation	2.0

*TSF-GFA = 1,000 square feet of gross floor area. Note: If the required parking is less than one (1) space, and for any fractional parking space required, the applicant shall be required to pay the in lieu fee provided in section [9-3-12](#) of this chapter.

**For duplex and townhome units where the parking maximum would result in dedicated parking spaces distributed unevenly across units, the allowed number of spaces may be rounded up to the nearest number that would provide for an even distribution of parking spaces between units.

B. *Outside the Service Area:* In connection with the development of all property outside the service area there shall be provided the following amount of off street parking:

Land Use Category	Minimum Required	Maximum Allowed
Residential:		
Single-family	2.0 per dwelling unit*	~~None~~ <u>No maximum</u>
Duplex or Townhome	~~1.5 per dwelling unit~~ <u>2 per dwelling unit</u>	~~None~~ <u>No maximum</u>
Accessory apartment	1.0 per dwelling unit	~~None~~ <u>No maximum</u>
Multi-unit residential and condominiums:		
Efficiency - studio	1.0 per dwelling unit	1.1 per dwelling unit
1 bedroom and larger	1.5 per dwelling unit	1.65 per dwelling unit
Divisible unit	+0.5 for each divisible room	+0.6 for each divisible room
Lodging, hotel, motel	1.0 per guestroom	1.1 per guestroom
Dormitory	0.5 per bed	0.6 per bed
Schools:		
Elementary and junior high	2 per classroom	2.2 per classroom
High school	1 per 4 students and faculty	1.1 per 4 students and faculty
College	1 per 4 students and faculty	1.1 per 4 students and faculty
Commercial:		
Retail sale, commercial and office	1 per 400 square feet GFA (minimum 2 per building)	1.1 per 400 square feet GFA
Construction - contracting	1 per 200 square feet	1.1 per 200 square feet
Manufacturing	1 per 400 square feet	1.1 per 400 square feet
Warehouse	1 per 1,000 square feet	1.1 per 1,000 square feet

	Gas station/convenience market	1 per pump plus 1 per 250 square feet GFA	1.1 per pump plus 1.1 per 250 square feet GFA
	Restaurants - sit down, breweries, and distilleries	1 per 125 square feet	1.1 per 125 square feet
	Restaurants - drive-in	1 per 100 square feet GFA	1.1 per 100 square feet GFA
	Supermarket/grocery store	1 per 250 square feet GFA	1.1 per 250 square feet GFA
	Auditoriums - theaters	1 per 4 seats	1.1 per 4 seats
	Churches	1 per 6 seats	1.1 per 6 seats
	Convention center facility	By special review of the director and planning commission	By special review of the director and planning commission
	Library and museum	1 per 500 square feet GFA	1.1 per 500 square feet GFA
	Medical and dental clinics	1 per 300 square feet GFA	1.1 per 300 square feet GFA
	Hospital	1 per 3 beds	1.1 per 3 beds
	Commercial recreation indoor and outdoor	By special review of the director and planning commission	By special review of the director and planning commission
	Recreation and leisure amenity club	No additional parking shall be required or allowed for a development that includes a recreation and leisure amenity club beyond the required residential or commercial parking, as applicable.	

Section 4. This ordinance shall be published and become effective as provided by Section 5.9 of the Breckenridge Town Charter.

INTRODUCED, READ ON FIRST READING, APPROVED AND ORDERED
PUBLISHED IN FULL this ____ day of ____, 2023. A Public Hearing shall be held at the regular meeting of the Town Council of the Town of Breckenridge, Colorado on the ____ day of ____, 2023.

TOWN OF BRECKENRIDGE, a Colorado
municipal corporation

1
2
3
4
5
6
7
8
9
10
11
12
13
14

By: _____

Eric S. Mamula, Mayor

ATTEST:

Helen Cospolich, CMC,
Town Clerk



Memo

To: Town Council
From: Mark Truckey, Community Development Director
Date: 7/19/2023, for the meeting of July 25, 2023
Subject: Outdoor Sales Days Second Reading

Attached for review is the ordinance establishing Outdoor Sales Days weekends, which allow merchants to display multiple items of merchandise outside. There are no changes from the first reading.

COUNCIL BILL NO. ____

Series 2023

**A BILL FOR AN ORDINANCE AMENDING THE MUNICIPAL CODE TO
ALLOW THE DISPLAY OF MERCHANDISE OUTSIDE DURING MEMORIAL
AND LABOR DAY WEEKENDS.**

NOW, THEREFORE, BE IT ORDAINED BY THE TOWN COUNCIL OF THE TOWN OF
BRECKENRIDGE, COLORADO:

Section 1. That subsection I of section 9-7-6, entitled "Exemptions" be amended by
deleting the language stricken and adding the underlined to read as follows:
I. Outdoor Sales Days: Outdoor displays of merchandise conducted on the following Outdoor
Sales Days: Memorial Day weekend including Friday through Monday and Labor Day Weekend
including Friday through Monday. ~~as established by the town manager. In setting Outdoor Sales~~
~~Days, the town manager shall consult with representatives of the business community to~~
~~determine appropriate dates. At least thirty (30) days before setting Outdoor Sales Days each~~
~~year, the town manager shall advise the town council of the proposed dates of such event.~~

Section 2. This ordinance shall be published and become effective as provided by
Section 5.9 of the Breckenridge Town Charter.

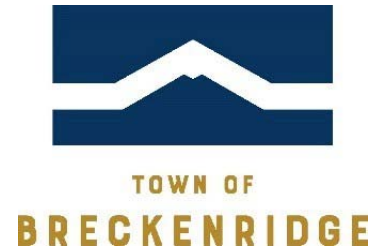
INTRODUCED, READ ON FIRST READING, APPROVED AND ORDERED
PUBLISHED IN FULL this 11th day of July, 2023. A Public Hearing shall be held at the regular
meeting of the Town Council of the Town of Breckenridge, Colorado on the 25th day of July,
2023, at 7:00 P.M., or as soon thereafter as possible in the Municipal Building of the Town.

TOWN OF BRECKENRIDGE, a Colorado
municipal corporation

By: _____
Eric S. Mamula, Mayor

ATTEST:

Helen Cospolich, CMC,
Town Clerk



Memo

To: Breckenridge Town Council
 From: Dave Byrd, Director of Finance
 Date: 07.25.2023
 Subject: 2023 Supplemental Budget Appropriations

Background

The Town Council approves a budget each year. From time to time, it is necessary to make changes to the budget as circumstances necessitate. These changes must be adopted by Council resolution.
 Below is a list of those changes and attached is the official resolution submitted for approval.

Supplemental Appropriations to the 2023 Budget

The following is a list of appropriations by fund for the 2023 budgets based on updates which occurred after the budget approval November 2022 and approved appropriations in February 2023.

#	FUND	REVENUE	EXPENSE	NOTES
1	GENERAL FUND #1	\$ (800)	\$ 891,262	Revenue: Reconciliation Fix Expense: \$74,262: ADA Consultant Expense: \$500,000: FIRC Grant Expense: \$200,000: Public Safety Evacuation Signs Expense: \$1,500: Retirement Committee Expense: \$100,000: Summit County Rescue Grant Expense: \$15,000: Sales Tax Audit Consultant
2	UTILITY FUND #2	\$(5,911,307)		Revenue: Accounting Change for CWRPDA Loan
3	CAPITAL FUND #3	\$ (800)	\$ 212,948	Revenue: Reconciliation Fix Expense: Broken Lance Sidewalk
4	EXCISE FUND #6	\$ 385,000		Revenue: FirstBank CD
5	AFFORDABLE HOUSING FUND #7		\$ 10,000	Expense: FIRC Workforce Rent Assistance
6	OPEN SPACE FUND #8		\$ 3,669,250	Expense: \$3,412,500: Dry Gulch Purchase Expense: \$250,000: Purchased Building Upgrade Expense: \$6,750: Reconciliation Fix
7	GARAGE FUND #10		\$ 2,519,000	Expense: \$2,304,000: 3 Proterra Buses (Grant Revenue in Approved Budget) Expense: \$215,000: Snowplow (Carry-over from 2022)

TOTAL \$(5,527,907) \$ 7,302,460

RESOLUTION NO.15

SERIES 2023

A RESOLUTION MAKING SUPPLEMENTAL AND REDUCED APPROPRIATIONS TO THE
2023 TOWN BUDGET

WHEREAS the Town Council of the Town of Breckenridge desires to amend the Town's 2023 budget by making appropriations in the amount of \$(5,527,907) in reduced revenue and \$7,302,460 in increased expenditures; and

WHEREAS, pursuant to Section 10.12(a) of the Breckenridge Town Charter, the Finance Department, on behalf of the Town Manager, has certified that there are available for appropriation expenses more than those estimated in the Town's 2023 budget not previously appropriated in an amount sufficient for the proposed supplemental appropriations; and

WHEREAS, pursuant to Section 10.12(c) of the Breckenridge Town Charter, the Town Council determines that it is necessary and appropriate to approve certain appropriations previously made in the adopted 2023 budget, all as more fully set forth hereafter; and

WHEREAS a public hearing on the proposed revised appropriations was held on July 25, 2023, in accordance with the requirements of Section 10.12(a) of the Breckenridge Town Charter.

NOW, THEREFORE, BE IT RESOLVED BY THE TOWN COUNCIL OF THE TOWN OF BRECKENRIDGE, COLORADO that:

Section 1. The 2023 budget is amended, and revised appropriations for the amended 2023 Town budget are made as follows:

#	FUND	REVENUE	EXPENSE	NOTES
1	GENERAL FUND #1	\$ (800)	\$ 891,262	Revenue: Reconciliation Fix Expense: \$74,262: ADA Consultant Expense: \$500,000: FIRC Grant Expense: \$200,000: Public Safety Evacuation Signs Expense: \$1,500: Retirement Committee Expense: \$100,000: Summit County Rescue Grant Expense: \$15,000: Sales Tax Audit Consultant
2	UTILITY FUND #2	\$(5,911,307)		Revenue: Accounting Change for CWRPDA Loan
3	CAPITAL FUND #3	\$ (800)	\$ 212,948	Revenue: Reconciliation Fix Expense: Broken Lance Sidewalk
4	EXCISE FUND #6	\$ 385,000		Revenue: FirstBank CD
5	AFFORDABLE HOUSING FUND #7		\$ 10,000	Expense: FIRC Workforce Rent Assistance
6	OPEN SPACE FUND #8		\$ 3,669,250	Expense: \$3,412,500: Dry Gulch Purchase Expense: \$250,000: Purchased Building Upgrade Expense: \$6,750: Reconciliation Fix
7	GARAGE FUND #10		\$ 2,519,000	Expense: \$2,304,000: 3 Proterra Buses (Grant Revenue in Approved Budget) Expense: \$215,000: Snowplow (Carry-over from 2022)

TOTAL \$(5,527,907) \$ 7,302,460

Section 2. This Resolution shall become effective upon its adoption.

RESOLUTION APPROVED AND ADOPTED THIS 25th DAY OF JULY 2023.

ATTEST

TOWN OF BRECKENRIDGE

1

2

3

By _____
Helen Cospolich, Town Clerk

By _____
Eric Mamula, Mayor

4

5

6

7

8

9

10

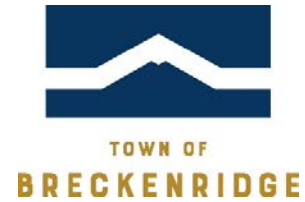
11

APPROVED IN FORM

12

By _____
Town Attorney Date

Memo



To: Breckenridge Town Council Members
From: Jim Baird, Police Chief
Date: 7/19/2023
Subject: Resolution approving an amended IGA with the Summit County Communication Center

The attached resolution, if passed by council, would approve an amended intergovernmental agreement for the operation, administration and financial support of the Summit County Communications Center.

The center recently underwent an assessment. This assessment recommended changes to the governance structure of the center. With the approval of this IGA, the center will move from having both a Policy Board and an Operations Board to a one Board of Governors model with the Town of Breckenridge Police Chief as one of the nine voting members.

1 RESOLUTION NO. ____

2
3 Series 2023

4
5 **A RESOLUTION APPROVING AN AMENDED AND RESTATED**
6 **INTERGOVERNMENTAL AGREEMENT FOR THE OPERATION,**
7 **ADMINISTRATION, AND FINANCIAL SUPPORT OF THE SUMMIT COUNTY**
8 **COMMUNICATIONS CENTER.**
9

10
11 NOW, THEREFORE, BE IT RESOLVED BY THE TOWN COUNCIL OF THE TOWN OF
12 BRECKENRIDGE, COLORADO:

13 .
14 **Section 1.** That the Town Council hereby approves by Resolution an Amended and
15 Restated Intergovernmental Agreement for the Operation, Administration, And Financial
16 Support of the Summit County Communications Center

17 **Section 2.** All resolutions, or parts thereof, inconsistent herewith are hereby repealed to
18 the extent only of such inconsistency. This repealer shall not be construed to revive any such
19 resolution, or part thereof, heretofore repealed.

20 **Section 3.** This resolution is effective upon adoption.

21 **Section 4.** Minor changes to or amendments of the approved agreement may be made
22 by the Town Attorney if the proposed changes or amendments do not substantially affect the
23 consideration to be received or paid by the Town pursuant to the approved agreement, or the
24 essential elements of the approved agreement.

25
26 RESOLUTION APPROVED AND ADOPTED this ____ day of ____, 2023.

27
28 TOWN OF BRECKENRIDGE
29

30
31
32 By: _____

33 Eric S. Mamula, Mayor
34

35 ATTEST:
36
37

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

Helen Cospolich, CMC,
Town Clerk

APPROVED IN FORM

Town Attorney Date

**AMENDED AND RESTATED INTERGOVERNMENTAL AGREEMENT FOR
THE OPERATION, ADMINISTRATION AND FINANCIAL SUPPORT OF THE
SUMMIT COUNTY COMMUNICATIONS CENTER**

This Amended and Restated Intergovernmental Agreement for the Operation, Administration and Financial Support of the Summit County 911 Communications Center (“IGA”), is hereby made and entered into this 31 day of July, 2023, by and between the Town of Blue River, Town of Breckenridge, Town of Dillon, Town of Frisco, Town of Silverthorne, the Board of County Commissioners (“BOCC”) of Summit County (“County”), Summit County Sheriff’s Office, Summit Fire and EMS Protection District, and the Red, White and Blue Fire Protection District, and hereinafter severally referred to by name or collectively as the “Participating Members”, for the operation, administration and financial support provision of the Summit County 911 Communications Center, hereinafter referred to as “SCCC”, in exchange for the continuation of SCCC services, subject to the following provisions:

WITNESSETH:

WHEREAS, Participating Members entered into an Intergovernmental Agreement on January 1, 2002, establishing a consortium and covenants for the operation, administration, and financial support of the Summit County Communications Center (“SCCC”). (See Addendum A, Amended Intergovernmental Agreement for the Operation, Administration and Financial Support of the Summit County Communications Center, May 18, 2010).

WHEREAS, the Participating Members in the performance of their governmental functions, do furnish fire, emergency medical services, and law enforcement protection or other public safety services to the residents and visitors within the boundaries of their respective service areas, and

WHEREAS, the Participating Members are severally authorized to maintain and operate radio communications systems for the transmission and dispatching of messages relating to fire, emergency medical services, law enforcement protection or other public safety services, and engage in the dispatching of public safety and emergency vehicles and services to citizens and residents in need from their own organizations, as well as from other public or private entities providing public safety services (hereinafter referred to as “**Services**”); and,

WHEREAS, such Services to date have been provided to all the Participating Members by the SCCC as a County Department under shared direction and supervision of Summit County Government, the SCCC Policy Board, and the SCCC Operations Group; and

WHEREAS, the parties hereto desire to update the current agreement to reflect current practices; and

WHEREAS, pursuant to the provisions of Section 29-1-201, et seq., Colorado Revised Statutes, as amended and Article XIV of the Constitution of the State of Colorado, each of the Participating Members is legally authorized to cooperate and contract with the others for the purpose of providing, on an intergovernmental basis, any function, service or facility authorized to it, including without limit the sharing of costs and incurring of debt, and further including authority to provide for the joint exercise of such function, service or facility; and

WHEREAS, the Participating Members do hereby severally and collectively determine and declare that this IGA is necessary, proper and convenient for the continued fostering and preservation of the public peace, health and safety.

NOW, THEREFORE, in consideration of the premises and of the respective covenants and undertakings of the parties hereto, each covenanting to and with each other jointly and severally, as herein set forth, IT IS AGREED UPON as follows, to-wit:

ARTICLE I – TERM AND EFFECT

1. **Effect of IGA.** Except as expressly provided herein, this Amended and Restated IGA shall replace and supersede all prior agreements of any kind between all or any of the Participating Members and any or all other Participating Members hereto, to the extent and for the limited purpose as such other agreements may be related to the provision of services by the SCCC.
2. **Term.** The initial term of this IGA shall commence on July 1, 2023, and expire on December 31, 2027. Upon the expiration of the initial term, the IGA shall automatically renew for an additional five (5) year renewal term and will automatically renew for additional five (5) year terms thereafter, subject to the provisions of “Article V, Default, Termination & Withdrawal”,

ARTICLE II – SUMMIT COUNTY 911 COMMUNICATIONS CENTER

1. **Board of Directors Governance of the SCCC and Summit County 911 Communication Center Director.**
 - a. Board of Governors (“the Board”) shall directly govern the SCCC, as such entity is described and empowered below.
 - b. The Board’s purposes include the following:

- i. To maintain consolidated public safety communications services,
 - ii. To continuously improve fire, medical aid, and law enforcement service communications within the Participating Members' service areas,
 - iii. To provide consolidated emergency telephone, radio, and alarm communications services for Participating Members,
 - iv. To establish and maintain such services that will be of substantial benefit to the citizens of the service areas and the public in general.
- c. The Board shall be comprised of the following nine (9) positions representing each Participating Member:
 - i. Summit County Manager
 - ii. Summit County Sheriff's Office, Sheriff
 - iii. Town of Blue River, Chief of Police
 - iv. Town of Breckenridge, Chief of Police
 - v. Town of Dillon, Chief of Police
 - vi. Town of Frisco, Chief of Police
 - vii. Town of Silverthorne, Chief of Police
 - viii. Red, White and Blue Fire, Fire Chief
 - ix. Summit Fire and EMS, Fire Chief
- d. The term length for all the Board members shall be perpetual for the term of this IGA.
- e. A majority of the appointed Board members or their designee will constitute a quorum for the purpose of conducting its business and exercising its powers and for all other purposes. Except as this IGA and/or applicable law requires otherwise, majority vote of a quorum is necessary to decide any question before the Board.
- f. Board meetings are subject to the Colorado Open Meeting Act and all other laws of the State of Colorado.
- g. Regular meetings of the Board will be held at least monthly at such day, time, and place as determined by the Board. Subject to applicable law, special meetings may be called by the chairperson as needed and within seven days after receiving a request from two or more members of the Board. Subject to applicable law, the Board has the authority to cancel or

reschedule a regularly scheduled meeting should there be no business to conduct or if a quorum is unable to be established.

- h. Each Board member will be entitled to an equal vote in all Board decisions.
- i. The specific duties and responsibilities of the Board, in addition to those general duties and authorities discussed above, are as follows:
 - i. Establish and adopt by-laws governing the functional aspects of the Board.
 - ii. Define and establish necessary Operational Workgroups representing the areas of law enforcement, fire, and emergency medical services for technical and operational support of the Board, the 911 Director and SCCC.
 - iii. Make decisions regarding the Summit County 911 Communication Center Director (911 Director) including: hiring, performance evaluation, and discipline, up to and including termination, provided such decisions are made in accordance with and subject to all applicable County personnel policies and procedures.
 - iv. Provide direction for the 911 Director related to SCCC operations and services.
 - v. Conducting yearly performance evaluations of the 911 Director subject to all applicable County personnel policies and procedures.
 - vi. Approve and recommend an annual budget, developed by the 911 Director, in partnership with other County staff as needed, to the Summit County Board of County Commissioners (“BOCC”) for final BOCC approval and/or modification.
 - vii. Define service level agreements (“SLAs”) related to the delivery of services by the 911 Director and SCCC
 - viii. Provide oversight and approval of policies and standard operating procedures (“SOPs”) of the SCCC,
 - ix. Provide oversight of operational goals and guidelines for the SCCC.
 - x. Report regularly to the member agencies of the SCCC.
 - xi. Serve in the capacity as the E911 Authority Board.
 - xii. Evaluate the SCCC Payment Calculation Formula (as such term is defined in Paragraph 3 of Article III) as part of the budget process, and make recommendations to the BOCC regarding said formula, as an element of the overall budget process, based upon such evaluations.
 - xiii. Make determinations regarding the definition of emergency services and the fees for such services.

2. **Summit County 911 Director**

- a. The 911 Director shall be a full-time employee of County and bound by all policies and guidelines of Summit County Government.
- b. The 911 Director will have a dual reporting relationship:
 - i. Reporting to the Board on all aspects related to the general operational policies and functions of the SCCC governed by this IGA.
 - ii. Reporting to County management regarding any matters related to the day-to-day administrative and personnel function governed by County policies and procedures.
- c. The 911 Director will operate and manage the SCCC, supervise the SCCC services, and serve as the operational head for the SCCC subject to the direction and oversight of the Board.
- d. The 911 Director will be responsible for delivering SCCC services to meet Service Level Agreements (SLAs) as defined and approved by the Board. The 911 Director will also be responsible for negotiating and meeting any individual Participating Member SLAs required.
- e. Subject to the terms and conditions contained in this IGA, and in accordance with and subject to all applicable County policies and procedures, the 911 Director will be responsible for all day-to-day operations, administration, and personnel functions of the SCCC, including dispatching, record-keeping, communications, and other SCCC functions subject to and in accordance with the SCCC's SOPs.
- f. Subject to the terms and conditions contained in this IGA, and subject to Board approval, the 911 Director will be responsible for all SCCC specific technology selections and implementations, with support from Participating Members as required,
- g. The 911 Director will perform financial and administrative functions of SCCC including the following:
 - i. Contracting, employing, and supervising all personnel assigned to and/or employed by SCCC, including, without limitation, hiring, firing, disciplining, and all other SCCC employment decisions, provided such decisions are made in accordance with and subject to all applicable County personnel policies and procedures.
 - ii. Managing and supervising all contractors assigned SCCC duties.

- iii. Except as expressly provided otherwise by this IGA, SCCC personnel will report to the 911 Director.
- iv. Incurring expenses in accordance with this IGA and subject to the SCCC's Board-approved budget.
- v. Expending funds in accordance with SCCC's Board-approved budget and County purchasing policies.
- vi. Providing (or causing to be provided) all technology, personnel administration, financial, insurance, legal advice, management, and facilities services and support related SCCC services and functionality in accordance with this IGA, the approved SCCC budget, and partnership with the Board and County Management
 - The 911 Director working with the Board and County Department Directors and Management will determine the manner in which support services are delivered to and/or managed by the SCCC.
- vii. Coordinate with the County Finance Department on the billing and collecting from each Participating Member its share of the cost of SCCC's operations as provided in this IGA and the approved annual budget of SCCC.
- viii. Provide the audit, accounting for, receipt, and custody of SCCC funds and expenditures in the form of a monthly budget report to the Board, which will include a full report on operating expenses, fund balances, and capital project expenditures.
- ix. Attend all meetings of the Board and provide the Board assistance and advice when requested.

3. SCCC is a County Department.

- a. The SCCC shall remain a department of the Summit County Government.
- b. The SCCC shall be administered and supervised by the 911 Director.
- c. All persons employed by the SCCC, including the 911 Director, shall remain as County employees, subject to all County personnel policies and procedures, and eligible for all County employee benefits available to like employees.
- d. Employment actions for the 911 Director will be conducted by the County, at the request and recommendation of the Board.
- e. Employment actions for all SCCC employees excluding the 911 Director will be conducted

by the County at the recommendation of the 911 Director, in accordance with all County policies and procedures.

- f. The financial and budgetary process for the SCCC shall, at all times, for the duration of this IGA, follow County policy and procedure regarding such matters.
- g. The SCCC operational center is located in the Summit County Emergency Services Building, 0227 County Shops Road, within the Summit County Library and Service Center Planned Unit Development area (“County Commons PUD”).
- h. The County shall provide defined overhead services for the SCCC (“Support Services”), including payroll administration, legal services, information systems services, and building and grounds support, as provided for herein.

ARTICLE III – ANNUAL OPERATIONS CHARGES FOR SERVICES

1. The Participating Members hereby agree to the payment of an allocated annual share of the overall budgeted operating costs of the SCCC, which shall include but not be limited to the costs of salaries and fringe benefits for employees, telephones, supplies, utilities, maintenance, insurance premiums and deductibles, and any other expenses related to the efficient operation and administration of the communications center. Such payment obligation (“Annual Operations Payment”) shall be assessed annually to each Participating Member, based on a proposed budget for each fiscal calendar year (“Proposed Budget”). Said Proposed budget, and accordingly Annual Operations Payment for each Participating Member, may be modified from time to time to reflect the actual operating costs of the SCCC, as provided herein.
2. Participating Members for every fiscal and calendar year of the term of this IGA shall reimburse Summit County for their pro rata share of the total operating expenses of the SCCC, in accordance with and through the application of the SCCC Annual Operations Payment Process (AOPP), as modified from the original 2002 agreement payment process as specified below.
3. An Annual Operations Payment (“AOP”) shall be determined by the Board and calculated on an annual basis in accordance with the following guiding principles. Modifications to this formula must be adopted by the amendment of this Agreement.

- a. All Participating Members shall pay an allocated share of the Direct Overhead Base Rate as defined by the Board, and summarized in the proposed budget, unless such participation is specifically exempted or reduced for an agency by the Board due to hardship or minimal SCCC use, as evidenced in the SCCC's incident/audit record.
 - b. Prior to calculating the AOP for each Participating Member any funding budgeted by the County from the applicable ballot measures for foundational support, which remains after funding the Capital Expenditure Budget (see Article IV Paragraph 6), or any funding source independent of the Participating Members will be applied to the proposed budget.
 - c. Prior to calculating the AOP the Board has the authority to apply any existing fund balance to the proposed budget, in accordance with any funding limitations established previously.
 - d. After netting out the Direct Overhead Base Payments and any other participation revenues, Participating Members' remaining AOP shall be calculated using their annual percentage of use for incident processed for the agency during the fiscal and calendar year, using data two years prior to the subject proposed budget.
4. The AOP for each Participating Member shall initially be based off the Proposed Budget. Nevertheless, the actual operations costs of the SCCC shall at all times reflect the actual SCCC operations budget. Accordingly, the Proposed Budget, and the initial estimate of each Participating Member's AOP, may be subject to modification through the proper budget modification process.
5. All payments due by each Participating Member pursuant to the provisions of this Article III to the IGA shall be collected quarterly, with said payments due on the first day of the first month of each quarter (i.e., January 1, April 1, July 1, and October 1). Notification of the estimated Percentage of Use payments due from each Participating Member for the ensuing fiscal and calendar year shall be distributed as early as practicable of the prior year, based off the Proposed Budget for that ensuing year.
6. The County shall define the kind and level of County overhead services for the SCCC and charges for such services, if any, to be allocated to the SCCC, using the most recent cost allocation study commissioned by the County as a basis and in accordance with standard County policies and procedures.

ARTICLE IV – CAPITAL EXPENDITURE BUDGET

1. Capital expenditures shall be budgeted as part of the SCCC general operating budget (“Capital Expenditure Budget”). Capital expenditures will be divided into three categories within the operating budget:
 - a. A category for General Capital, which is defined as capital expenditures that benefit or impact all Participating Members.
 - b. A category for Law Enforcement Capital, which is defined as capital expenditures that only benefit or impact the Participating Member of law enforcement, consisting of Summit County Sheriff’s Office, Town of Blue River, Town of Breckenridge, Town of Dillon, Town of Frisco, and Town of Silverthorne.
 - c. A category for Fire/EMS Capital, which is defined as capital expenditures that only benefit or impact the Participating Members of fire/EMS, consisting of Red, White, and Blue Fire Protection District and Summit Fire and EMS Protection District.
 - d. The Board will be responsible for determining the appropriate categorization of each capital item with support from the 911 Director.
2. A five-year rolling Capital Expenditure Plan will be defined and updated each year by the Board with support from the 911 Director.
3. The overall Capital Expenditure Budget of the SCCC shall be calculated based on the expenditures defined in the Capital Expenditure Plan.
4. Each budgeted expense in the Capital Expenditure Budget will be categorized into one of the three Capital Expenditure Fund categories as defined in Paragraph 1 of Article IV.
5. Funds from the Capital Expenditure Budget will be expended in accordance with the subject fiscal year approved SCCC operating budget as defined in the Capital Expenditures Plan determined by the Board with support from the 911 Director, and approved by the BOCC.
6. Funding for General Capital expenditures will first use any funding budgeted by the County from the applicable ballot measures for foundational support or any funding source independent of the Participating Members before any Participating Member contribution is calculated.
7. In the event that funding independent of the Participating Members will not cover the total of budgeted

General Capital expenditures or if a capital expenditure is categorized as Law Enforcement or Fire/EMS Capital the following contribution formulas will apply:

- a. General Capital expenditures contributions will be determined by using an annual percentage of use. This shall be calculated for each Participating Member utilizing the SCCC services based on the total number of incidents processed for that agency by the SCCC during the most recent complete fiscal year prior to the subject fiscal year, divided by the aggregate number of incidents processed by the SCCC in total during the most recent complete fiscal year. The Board may adopt modifications to this formula.
 - b. Law Enforcement Capital expenditures contributions will be determined by using a percentage of total population. This shall be calculated for each Law Enforcement Participating Member utilizing the most recent United States Census Bureau national census data. Based on this data the total population of each individual entity and all entities combined shall be determined, and then a percentage of said total population shall be established for each governing entity represented by the Law Enforcement Participating Members. For purposes of this agreement the Sheriff's Office population shall be deemed to be the population of unincorporated Summit County. The Board may adopt modifications to this formula.
 - c. Fire/EMS Capital expenditures contributions will be determined by using an annual percentage of use. This shall be calculated for each Fire/EMS Participating Member utilizing the SCCC services based on the total number of incidents processed for that agency by the SCCC during the most recent complete fiscal year prior to the subject fiscal year, divided by the aggregate number of incidents processed by the SCCC in total for all Fire/EMS Participating Members during the most recent complete fiscal year. The Board may adopt modifications to this formula.
8. Modifications to the Capital Expenditure Budget, in terms of monetary obligations, as well as the contribution formula, may be recommended by the Board as deemed appropriate. Said Capital Expenditure Budget, and accordingly the Capital Expenditure contributions for each Participating Member, may therefore be subject to modification from time to time in accordance with the same policies and procedures as set forth for the Annual Operations Payment in Article III above.
 9. Capital expenditure payments for each Participating Member shall be made quarterly, in accordance

with the schedule for payment set forth for the operations costs in Article III above.

ARTICLE V – DEFAULT, TERMINATION & WITHDRAWAL

1. **Notice of Default.** In the event any Participating Member fails to pay its share of the operating costs when due, or otherwise default under its obligations per this IGA, the Board shall cause written notice of default to be given to the defaulting Participating Member’s legislative body or other authority that approved this IGA. The notice shall include a statement of the SCCC’s intention to suspend performance of SCCC Services under this IGA as to such Participating Member in default unless such default is cured within twenty (20) days from the date of such notice. Such notice shall set forth the nature of the default in reasonable detail and shall specify the required action to cure the default. The Board is authorized to provide additional time for the cure of a default.
2. **Suspension of Performance.** Upon failure to timely cure a default, performance of SCCC Services under this IGA shall be suspended by the Board, as to the defaulting Participating Member.
3. **Emergency SCCC Services.** Notwithstanding anything above to the contrary, said suspension of performance of SCCC Services under this IGA shall not include any suspension of performance of “Emergency Services” by the SCCC, as such term is defined by the Board, for the defaulting Participating Member. Said Emergency Services shall continue to be performed by the SCCC for the defaulting Participating Member, and the Board shall invoice the defaulting Participating Member for such emergency services at a rate as determined to be appropriate by the Board, for the duration of such suspension. All parties hereto concur that such invoices shall be considered a good and valid debt for the payment of services provided, which may be collected and/or assigned through all available legal and equitable means.
4. **Termination.** If, after default under this IGA which necessitates a suspension of performance of SCCC services as provided above, any defaulting Participating Member that continues to fail to correct any default under the performance of this IGA for an additional period of three months, the Board may provide said defaulting Participating Member with a notice of intention to terminate the IGA with respect to said defaulting Participating Member upon the end of the current fiscal and calendar year. Such termination shall effectively eliminate any and all rights the defaulting Participating Member may have to rely on the provision of any SCCC services, including without limit all emergency services as defined herein. Any SCCC assets that were partially or fully purchased with that Participating Member’s funding shall stay with the SCCC. The defaulting Participating Member will receive no

repayment for any moneys, which were expended for the purchase of such assets under this IGA as such agreement now stands or may be amended from time to time.

5. **Withdrawal.** If a Participating Member wishes to withdraw from the SCCC, a one-year written notice must be submitted to the Board stating such intentions. Any SCCC assets that were partially or fully purchased with that Participating Member's funding shall stay with the SCCC. The withdrawing Participating Member will receive no repayment for any moneys, which were expended for the purchase of such assets under either this IGA as such agreement now stands or may be amended from time to time.
6. **Survival of Agreement.** Notwithstanding anything herein to the contrary, Participating Members understand and agree that all terms and conditions for this IGA shall remain in full force and effect regardless of a Participating Member's withdrawal or termination.

ARTICLE VI – GENERAL PROVISIONS

1. **Waiver.** The failure of any Participating Member to exercise any of its rights under this IGA shall not be deemed to be a waiver of any rights provided for under this IGA.
2. **Appropriation of funds.**
 - a. Notwithstanding anything herein to the contrary, the obligations of each individual Participating Member under this IGA shall be subject to an annual appropriation, by that Participating Member's governing body, of funds sufficient to meet those obligations provided by this IGA. In the event that sufficient funds are not so appropriated by a Participating Member, as required by this IGA, this Agreement may be terminated by either said Participating Member or the Board as to said Participating Member.
 - b. Nevertheless, no Participating Member shall be permitted to terminate or withdraw from this IGA prior to the end of a fiscal or calendar year due to such non-appropriation of funds, and in no circumstances shall any portion of any type of contribution of the Participating Member failing to so appropriate sufficient funds be returned or pro-rated due to such non- appropriation.
 - c. No obligation provided in this IGA is intended to or shall be interpreted to constitute a multiple year direct or indirect debt or other financial obligation whatsoever within the meaning of the Constitution or laws of the State of Colorado.

3. **Notice.** Any notice or communication given pursuant to this IGA shall be given in writing, either in person or by certified mail, return receipt requested to the addresses listed in **Addendum B, Notification and Contact Information**, to this IGA, which is subject to modification from time to time. If given in person, notice shall be deemed given when actually given. If given by certified mail, notice shall be deemed given at the time indicated on the duly completed return receipt.

Any Participating Member may change the address to which notices, requests, consents, approvals, written instructions, reports, or other communications are to be given by a notice of change of address given in the manner set forth in this paragraph.

4. **No Benefit to Inure to Third Parties.** This IGA does not, and shall not be deemed to, confer upon or grant to any third party any right to claim damages or to bring any lawsuit, action or other proceedings against any Participating Member because of any breach hereof, or because of any terms, covenants, agreements or conditions contained herein.
5. **Modifications.** No modification or waiver of this IGA, or modification of any covenant, condition, or provision herein contained, shall be valid unless said modification is first considered and recommended for approval by the Board at a formal Board meeting, and then adopted in writing and duly executed by a three quarters (75%) majority of the Participating Members.
6. **Agreement.** This IGA constitutes the entire agreement and understanding between the Participating Members on the subject matter hereof and supersedes any prior agreements or understandings relating to the subject matter of this IGA, except for other written agreements and understandings referred to herein.
7. **Benefit.** This IGA shall be binding upon and shall inure to the benefit of the parties hereto, their successors or assigns.
8. **Severability.** All agreements and covenants contained herein are severable, and in the event that any such agreement or covenant is held invalid, by a court of competent jurisdiction, this IGA shall be interpreted as if such invalid agreement or covenant were not contained herein.
9. **Governmental Immunity.** No Participating Member hereto intends to waive, expressly or implicitly, by any provision of this IGA, the monetary limits or any other rights, immunities and protections

provided by the Colorado Governmental Immunity Act, Section 24-10-101, et seq., C.R.S., as amended from time to time, or any other privilege or immunity provided by law.

10. **Attorney's Fees.** If an action is brought to enforce this IGA, the prevailing party shall be entitled to reasonable attorney's fees and costs.
11. **Applicable Law.** This IGA shall be interpreted in all respects in accordance with the laws of the State of Colorado. Venue shall only be proper in Summit County, Colorado.
12. **Paragraph Headings.** Paragraph headings are inserted for convenience only and in no way limit or define the interpretation to be placed upon this IGA.
13. **Indemnity.** All actions or omissions by any Participating Member, and/or its designated representative, in the course and scope of its performance of any obligations, responsibilities, or duties under this IGA and/or as a member of the Board, shall be insured by the insurance policies and coverage to be obtained by Summit County for the SCCC and made a part of the total operating costs of the SCCC. However, any and all actions or omissions by any Participating Member, and/or its designated representative, outside of the proper course and scope of its performance of any obligations, responsibilities, or duties under this IGA and/or as a member of the Board (hereinafter referred to as "non- authorized acts or omissions"), shall be the sole responsibility of the Participating Member, and/or its designated representative. Accordingly, each Participating Members hereto shall, without waiving governmental immunity, fully indemnify, to the extent permissible under Colorado law, for all injuries to person or property as are directly or indirectly caused by any such non-authorized acts or omissions of that Participating Member or a representative of such Participating Member, which result in any damages, claims, costs or liability of any manner, including without limit reasonable attorney's fees, each and every other Participating Member, and the SCCC as an entity.
14. **Insurance.** Regardless of the obligation for the SCCC to carry all proper and necessary insurance to provide appropriate coverage for its operations, all Participating Members shall also be required to maintain insurance coverage (through such policy or means determined appropriate by each Participating Member) at a minimum of the limits for liability set forth by the Colorado Governmental Immunity Act, Section 24-10-101, et seq., C.R.S., as amended from time to time.
15. **Hold harmless.** Each Participating Member shall hold harmless the SCCC, its officers, employees, and agents against the loss of any service due to circumstances beyond the control of the SCCC. Such

agreement shall extend to the Board, and the Summit County Government as well.

16. **Individual obligations.** Each Participating Member is required to carry out and perform all the obligations of a Participating Member under this IGA independently of the actions of any and all other Participating Members. No Participating Member shall be responsible or liable for the failure of any other Participating Member to perform its obligations herein.

ARTICLE VII – FUTURE CONTRACTS BY THE SCCC FOR COMMUNICATIONS SERVICES

It is agreed by and between the Participating Members that the SCCC may be in a position to furnish radio communications services to other governmental, quasi-governmental, or non- governmental entities, and in this regard, the Participating Members hereby expressly agree and consent that any such contract or agreement for the provision of services to such other entities and the SCCC shall be either through amendment to this IGA, or through a separate document on the same terms and condition as this IGA, including the formula used for annual cost calculations, as well as any other terms and conditions that the Board may deem appropriate which are not inconsistent with this IGA, do not lessen the service to, or increase the charges due from the other Participating Members. Notwithstanding the foregoing, Participating Members all acknowledge that certain governmental entities, at a maximum threshold of service demand as set by the Board, may potentially opt to forego participating membership into the SCCC per this agreement, and instead contract with the SCCC for services.

Addendum A
Amended Intergovernmental Agreement for the Operation, Administration
and Financial Support of the Summit County Communications Center
May 18, 2010



**AMENDED INTERGOVERNMENTAL AGREEMENT FOR THE OPERATION,
ADMINISTRATION AND FINANCIAL SUPPORT OF THE SUMMIT COUNTY
COMMUNICATIONS CENTER**

This Intergovernmental Agreement For The Operation, Administration And Financial Support Of The Summit County Communications Center (“IGA”), is hereby made and entered into this 18th day of May, 2010, by and between the Towns of Blue River, Breckenridge, Dillon, Frisco, and Silverthorne, the Summit County Government, the Lake Dillon Fire Protection District, the Red, White and Blue Fire Protection District, the Copper Mountain Consolidated Metropolitan District, and the Lower Blue Fire Protection District (collectively referred to herein as the “Special Districts”) , each being a political subdivision and a governmental entity within the boundaries of the County of Summit, State of Colorado, and hereinafter severally referred to by name or collectively as the **”Participating Members”**, for the operation, administration and financial support provision of the Summit County Communications Center, hereinafter referred to as **“SCCC”**, in exchange for the continuation of SCCC services, subject to the following provisions:

WITNESSETH:

WHEREAS, Participating Members entered into an Intergovernmental Agreement on January 1, 2002 establishing a consortium and covenants for the operation, administration and financial support of the Summit County Communications Center (See Addendum A, *Intergovernmental agreement for the operation, administration and financial support of the summit county communications center*, January 1, 2002).

WHEREAS, the Participating Members in the performance of their governmental functions, do furnish fire and/or police protection and other public safety services to the citizens and residents within the boundaries and areas of their respective service areas, and

WHEREAS, the Participating Members are severally authorized to maintain and operate radio communications systems for the transmission and dispatching of messages relating to fire and/or police protection and other public safety services, and engage in the dispatching of public safety and emergency vehicles and services to citizens and residents in need from their own organizations, as well as from other public or private entities providing public safety services (hereinafter referred to as “Services”); and,

WHEREAS, such Services to date have been provided to all the Participating Members by the SCCC as a Department under the direct control and supervision of the Summit County Government; and

WHEREAS, the parties hereto desire to update the current agreement to reflect current practices; and

WHEREAS, pursuant to the provisions of Section 29-1-201, et seq., Colorado Revised Statutes, as amended and Article XIV of the Constitution of the State of Colorado, each of the Participating Members is legally authorized to cooperate and contract with the others for the purpose of providing, on an intergovernmental basis, any function, service or facility authorized to it, including without limit the sharing of costs and incurring of debt, and further including authority to provide for the joint exercise of such function, service or facility; and

WHEREAS, the Participating Members do hereby severally and collectively determine and declare that this IGA is necessary, proper and convenient for the continued fostering and preservation of the public peace, health and safety.

NOW, THEREFORE, in consideration of the premises and of the respective covenants and undertakings of the parties hereto, each covenanting to and with each other jointly and severally, as herein set forth, IT IS AGREED UPON as follows, to-wit:

ARTICLE I – TERM AND EFFECT

1. **Effect of IGA.** Except as expressly provided herein, this IGA shall replace and supersede all prior agreements of any kind between all or any of the Participating Members and any or all other Participating Members hereto, to the extent and for the limited purpose as such other agreements may be related to the provision of services by the SCCC.
2. **Term.** The initial term of this IGA shall commence on January 1, 2011 and expire on December 31, 2015. Upon the expiration of the initial term, the IGA shall automatically renew for an additional five (5) year renewal term and will automatically renew for additional five (5) year terms thereafter, subject to the provisions of “Article V, Default, Termination & Withdrawal”.

ARTICLE II – COMMUNICATIONS CENTER

1. **SCCC is a County Department.**
 - a. The SCCC shall remain a department of the Summit County Government.
 - b. The SCCC shall be administered and supervised by the SCCC Communications Director, or otherwise designated by the County. All persons employed by the SCCC, including the Communications Director, shall remain as Summit County Government employees, subject to all Summit County personnel policies and procedures, and eligible for all Summit County employee benefits available to like employees.
 - c. The financial and budgetary process for the SCCC shall, at all times for the duration of this IGA, also follow Summit County policy and procedure regarding such matters.
 - d. The SCCC operational center is located in the Summit County Emergency Services Building, 0227 County Shops Road, within the Summit County Library and Service Center Planned Unit Development area (“County Commons PUD”).
 - e. The Summit County Government shall provide defined overhead services for the SCCC (“Support Services”), including payroll administration, legal services, information systems services, and building and grounds support, as provided for herein.

2. **Policy Board Governance of the SCCC.**

- a. Notwithstanding the foregoing, the SCCC Policy Board (“Policy Board”) shall directly govern the Summit County Communications Center, as such entity is described and empowered below. The Policy Board shall make all decisions regarding hiring, supervision, and discipline, up to and including termination, of the Communications Director, provided such decisions are made in accordance with and subject to all applicable Summit County personnel policies and procedures.
- b. The Policy Board shall be comprised of the following individuals:
 - i. Summit County Manager
 - ii. Breckenridge Town Manager
 - iii. Dillon Town Manager
 - iv. Frisco Town Manager
 - v. Silverthorne Town Manager
 - vi. Red, White and Blue Fire Chief
 - vii. Lake Dillon Fire Chief
 - viii. Assistant Summit County Manager

The term length for all Policy Board members shall be perpetual for the duration of this IGA.

- c. The specific duties and responsibilities of the Policy Board, in addition to those general duties and authorities discussed above, are as follows:
 - i. Develop and recommend an annual budget to the Summit County Board of County Commissioners (“BOCC”) for final BOCC approval and/or modification;
 - ii. Oversight and approval of policies and procedures of the SCCC
 - iii. Oversight of operational goals and guidelines for the SCCC
 - iv. Report regularly to the member agencies of the SCCC
 - v. E911 Authority Board
 - vi. Evaluate the SCCC Payment Calculation Formula (as such term is defined in Paragraph 3 of Article III) as part of the budget process, and make recommendations to the BOCC regarding said formula, as an element of the overall budget process, based upon such evaluations.
 - vii. Make determinations regarding the definition of emergency services and the fees for such services, in consideration of the recommendations made by the Operations Group (as such term is defined in Paragraph 3(a) of this Article below) on such issues, as contemplated in Article V herein.

3. Operations Group oversight and assistance with SCCC operations.

- a. An Operations Group (“Ops Group”) shall be established to assist with the development of day-to-day SCCC operating policies and procedures, and to provide assistance and oversight, as needed, for the day-to-day SCCC operations.
- b. The Ops Group shall be comprised of the head of each Participating Member agency that participates in the funding of the SCCC, and the Communications Director. No other agency representative may be a member of the Ops Group, unless expressly approved in advance by the Policy Board.
- c. The Ops Groups shall set and maintain its own by-laws, policies and procedures related to the conduct of meetings, standards for members, and all other internal matters, provided such policies and the like in no way interfere with the express duties of the Ops Group set forth herein, and further refrain from the interference or abrogation of any duties or powers granted to the Policy Board herein.
- d. Term length for each Ops Group member is perpetual, as long as their agency remains in compliance with the terms and conditions of this IGA.
- e. The Ops Group shall assume and carry out the following duties and responsibilities:
 - i. Recommend day-to-day operating policies and procedures
 - ii. Work regularly with the Communications Director to develop operational protocols
 - iii. Work with the Communications Director to make budget recommendations to the Policy Board
 - iv. Oversee NCIC/CCIC computer system. Only those members who work within the criminal justice system shall resolve any issue directly related to NCIC/CCIC.
 - v. Recommend to the Policy Board a definition of emergency services, to be provided to defaulting Participating Members despite such default, in accordance with the provisions of Article V herein.
 - vi. Recommend to the Policy Board an appropriate rate of compensation for services provided to (1) those entities contracting with the SCCC for limited services, as well as (2) any and all Participating Members in default still receiving emergency services from the SCCC.
 - vii. Provide written comments regarding the performance of the Communications Director, as appropriate, to the Policy Board for formal consideration during the Communications Director’s appraisals.

ARTICLE III – ANNUAL OPERATIONS CHARGES FOR SERVICES

1. The Participating Members hereby agree to the payment of an allocated annual share of the overall operating costs of the communications center, which shall include but not be limited to the costs of salaries and fringe benefits for employees, telephones, supplies, utilities, maintenance, insurance premiums and deductibles, and any other expenses related to the efficient operation and administration of the communications center. Such payment obligation

(“Annual Operations Payment”) shall be assessed annually to each Participating Member, based on a proposed budget for each fiscal calendar year (“Proposed Budget”). Said Proposed budget, and accordingly Annual Operations Payment for each Participating Member, may be modified from time to time to reflect the actual operating costs of the SCCC, as provided herein.

2. Participating Members for every fiscal and calendar year of the term of this IGA shall reimburse Summit County for one hundred percent (100%) of the total operating expenses of the SCCC, less the share allocated to the County in accordance with and through the application of the SCCC Annual Operations Payment Process (AOPP), which is modified here from the original 2002 agreement (See Addendum A, Intergovernmental agreement for the operation, administration and financial support of the summit county communications center, January 1, 2002), and set forth below, and subject to future modification by the Policy Board as provided herein:
3. An Annual Operations Payment (“AOP”) shall be determined by the Policy Board and calculated on an annual basis in accordance with the following guiding principles. Modifications to this formula may be adopted by the Policy Board.
 - a. All Participating Members shall pay an allocated share of the Direct Overhead Base Rate as defined by the Policy Board, and summarized in the proposed budget, unless such participation is specifically exempted or reduced for an agency by the Policy Board due to hardship or minimal SCCC use, as evidenced in the SCCC’s incident/audit record.
 - b. After netting out the Direct Overhead Base Payments and any other participation revenues, Participating Members’ remaining AOP shall be calculated using their annual percentage of use for incident/audits processed for the agency during the fiscal and calendar year, using data two years prior to the subject proposed budget.
4. The AOP for each Participating Member shall initially be based off the Proposed Budget. Nevertheless, the actual operations costs of the SCCC shall at all times reflect the actual SCCC operations budget. Accordingly, the Proposed Budget, and the initial estimate of each Participating Member’s AOP, may be subject to modification through the proper budget modification process.

5. All payments due by each Participating Member pursuant to the provisions of this Article III to the IGA shall be collected quarterly, with said payments due on the first day of the first month of each quarter (i.e., January 1, April 1, July 1, and October 1). Notification of the estimated Percentage of Use payments due from each Participating Member for the ensuing fiscal and calendar year shall be distributed as early as practicable of the prior year, based off the Proposed Budget for that ensuing year.
6. The Policy Board shall define the desired kind and level of County overhead services for the SCCC and charges for such services, if any, to be allocated to the SCCC, using the most recent cost allocation study commissioned by the County as a basis.

ARTICLE IV – CAPITAL EXPENDITURE PARTICIPATION FUND

1. Capital expenditures shall remain a separate Fund of the SCCC budget as prepared by the Policy Board in accordance with the applicable provisions herein (hereafter referred to as the “Capital Expenditure Budget Item”).
2. The contribution formula for the Capital Expenditure Budget Item shall be as follows:
 - a. A subgroup designated as the “County and Municipal Participating Members” shall be established, consisting of Summit County, and the Towns of Blue River, Breckenridge, Dillon, Frisco, and Silverthorne.
 - b. A subgroup designated as the “Special Districts/Other Participating Members” shall be established, consisting of all Special Districts and the Summit County Ambulance Service acting as Participating Members.
 - c. An annual Percentage of Use shall be calculated for each Participating Member utilizing the SCCC services based on the total number of incidents and audits processed for that agency by the SCCC during the fiscal and calendar year two years prior to the subject fiscal and calendar year, divided by the aggregate number of incidents and audits processed by the SCCC in total during the fiscal and calendar year two years prior. The Policy Board may adopt modifications to this formula.
 - d. The overall Capital Expenditure Budget of the SCCC shall be calculated as the “Total Expenditure Budget”;

- e. Each Special District/Other Participating Members shall be charged in accordance with their Percentage of Use, as applied to the “Total Expenditure Budget” for the SCCC established for that fiscal and calendar year, in order to derive the required monetary obligation for such agency.
- f. The total each Special Districts/Other Participating Member Payments shall be subtracted from the Total Expenditure Budget, to derive the “Remainder Expenditure Budget”; and
- g. The first 25% of the Remainder Expenditure Budget shall be paid for by the County and Municipal Participating Members as follows:
 - i. The population of each County and Municipal Participating Member shall be established by utilization of the appropriate records, the total population of all entities combined shall be determined, and then a percentage of said total population shall be established for each County and Municipal Participating Member;
 - ii. Each County and Municipal Participating Member shall make a payment based off the total of the 25% portion of the Remainder Expenditure Budget, multiplied by the percentage of total population prescribed to that County and Municipal Participating Member. This payment shall be called the “Expenditure Population Payment”.
- h. The remaining 75% of the Remainder Expenditure Budget shall be paid for by the County and Municipal Participating Members as follows:
 - i. The Percentage of Use of each County and Municipal Participating Member shall be multiplied by the total of the 75% portion of the Remainder Expenditure Budget, in order to determine the payment each County and Municipal Participating Member shall make.
 - ii. This payment, which is in addition to the Expenditure Population Payment, shall be referred to as the “Expenditure Use Payment”.
- i. Each County and Municipal Participating Member shall be responsible for a “Total Capital Expenditure Payment” equal to the Expenditure Population Payment plus the

Expenditure Use Payment, as such figures are calculated for each such entity in accordance with the formula set forth above.

3. Modifications to the Capital Expenditure Budget Item, in terms of monetary obligations, as well as the contribution formula, may be recommended by the Policy Board as deemed appropriate. Said budget, and accordingly the Total Capital Expenditure Payment for each Participating Member, may therefore be subject to modification from time to time in accordance with the same policies and procedures as set forth for the Annual Operations Payment in Article III above.
4. Capital expenditure payments for each Participating Member shall be made quarterly, in accordance with the schedule for payment set forth for the operations costs in Article III above.

ARTICLE V – DEFAULT, TERMINATION & WITHDRAWAL

1. **Notice of Default.** In the event any Participating Member fails to pay its share of the operating costs when due, or otherwise default under its obligations per this IGA, the Policy Board shall cause written notice to be given to the defaulting Participating Member's legislative body or other authority that approved this IGA, of the SCCC's intention to suspend performance of SCCC Services under this IGA as to such Participating Member in default unless such default is cured within twenty (20) days from the date of such notice. Such notice shall set forth in reasonable detail, with the nature of the default and the required action to cure the same.
2. **Suspension of Performance.** Upon failure to cure said default within the said twenty (20) days period, performance of SCCC Services under this IGA shall be immediately suspended by the Policy Board, as to the defaulting Participating Member only.
3. **Emergency SCCC Services.** Notwithstanding anything above to the contrary, said suspension of performance of SCCC Services under this IGA shall not include any suspension of performance of "Emergency Services" by the SCCC, as such term is defined by the Ops Group, for the defaulting Participating Member. Said "Emergency Services" shall continue to be performed by the SCCC for the defaulting Participating Member, and the Policy Board shall invoice the defaulting Participating Member for such emergency services at a premium rate as determined to be appropriate by the Ops Board, for the duration of such suspension. All parties hereto concur that such invoices shall be considered a good and valid debt for the payment of

services provided, which may be collected and/or assigned through all available legal and equitable means.

4. **Termination.** If, after committing default under this IGA which necessitates a suspension of performance of SCCC services as discussed above, any defaulting Participating Member continues to fail to correct any default under the performance of this IGA for an additional period of three months, the Policy Board may provide said defaulting Participating Member with a notice of intention to terminate the IGA with respect to said defaulting Participating Member upon the end of the current fiscal and calendar year. Such termination shall effectively eliminate any and all rights the defaulting Participating Member may have to rely on the provision of any SCCC services, including without limit all emergency services as defined herein. Any SCCC assets that were partially or fully purchased with that Participating Member's funding shall stay with the SCCC. The defaulting Participating Member will receive no repayment for any moneys, which were expended for the purchase of such assets under either this IGA, or the CEPF IGA, as either such agreement now stands or may be amended from time to time.
5. **Withdrawal.** If a Participating Member wishes to withdraw from the SCCC, a one year written notice must be submitted to the Policy Board stating such intentions. Any SCCC assets that were partially or fully purchased with that Participating Member's funding shall stay with the SCCC. The withdrawing Participating Member will receive no repayment for any moneys, which were expended for the purchase of such assets under either this IGA, or the CEPF IGA, as either such agreement now stands or may be amended from time to time.
6. **Survival of Agreement.** Notwithstanding anything herein to the contrary, participating Members understand and agree that all terms and conditions for this IGA shall remain in full force and effect regardless of an individual member's withdrawal or termination.

ARTICLE VI – GENERAL PROVISIONS

1. **Waiver.** The failure of any party to exercise any of its rights under this IGA shall not be deemed to be a waiver of any rights provided for under this IGA.
2. **Appropriation of funds.**
 - a. Notwithstanding anything herein to the contrary, the obligations of each individual Participating Member under this IGA shall be, where appropriate, subject to the annual

appropriation, by that Participating Member's governing body, of funds sufficient to meet those obligations provided herein. In the event that sufficient funds are not so appropriated by any Participating Member, as required hereunder, this Agreement may be terminated by either said Participating Member or the Policy Board as to said Participating Member.

- b. Nevertheless, no Participating Member shall be permitted to terminate or withdraw from this IGA prior to the end of a fiscal or calendar year due to such non-appropriation of funds, and in no circumstances shall any portion of any type of contribution of the Participating Member failing to so appropriate sufficient funds be returned or pro-rated due to such non-appropriation.
- c. No obligation provided in this IGA is intended to or shall be interpreted to constitute a multiple year direct or indirect debt or other financial obligation whatsoever within the meaning of the Constitution or laws of the State of Colorado.

- 3. **Notice.** Any notice or communication given pursuant to this IGA shall be given in writing, either in person or by certified mail, return receipt requested to the addresses listed in **Addendum B, Notification and Contact Information**, to this IGA, which is subject to modification from time to time. If given in person, notice shall be deemed given when actually given. If given by certified mail, notice shall be deemed given at the time indicated on the duly completed return receipt.

Any Participating Member may change the address to which notices, requests, consents, approvals, written instructions, reports or other communications are to be given by a notice of change of address given in the manner set forth in this paragraph.

- 4. **No Benefit to Inure to Third Parties.** This IGA does not, and shall not be deemed to, confer upon or grant to any third party any right to claim damages or to bring any lawsuit, action or other proceedings against any Participating Member because of any breach hereof, or because of any terms, covenants, agreements or conditions contained herein.
- 5. **Modifications.** No modification or waiver of this IGA, or modification of any covenant, condition, or provision herein contained, shall be valid unless said modification is first considered and recommended for approval by the Policy Board at a formal Policy Board meeting, and then adopted in writing and duly executed by a three quarters (75%) majority of the Participating Members.
- 6. **Agreement.** This IGA constitutes the entire agreement and understanding between the Participating Members on the subject matter hereof, and supersedes any prior agreements or understandings relating to the subject matter of this IGA, except for other written agreements and understandings referred to herein.
- 7. **Benefit.** This IGA shall be binding upon and shall inure to the benefit of the parties hereto, their successors or assigns.

8. **Severability.** All agreements and covenants contained herein are severable, and in the event that any such agreement or covenant is held invalid, by a court of competent jurisdiction, this IGA shall be interpreted as if such invalid agreement or covenant were not contained herein.
9. **Governmental Immunity.** No Participating Member hereto intends to waive, expressly or implicitly, by any provision of this IGA, the monetary limits or any other rights, immunities and protections provided by the Colorado Governmental Immunity Act, Section 24-10-101, et seq., C.R.S., as amended from time to time, or any other privilege or immunity provided by law.
10. **Attorney's Fees.** If an action is brought to enforce this IGA, the prevailing party shall be entitled to reasonable attorney's fees and costs.
11. **Applicable Law.** This IGA shall be interpreted in all respects in accordance with the laws of the State of Colorado. Venue shall only be proper in Summit County, Colorado.
12. **Paragraph Headings.** Paragraph headings are inserted for convenience only and in no way limit or define the interpretation to be placed upon this IGA.
13. **Indemnity.** All actions or omissions by any Participating Member, and/or its designated representative, in the course and scope of its performance of any obligations, responsibilities, or duties under this IGA and/or as a member of the Policy Board or Ops Group, shall be insured by the insurance policies and coverage to be obtained by Summit County for the SCCC and made a part of the total operating costs of the SCCC. However, any and all actions or omissions by any Participating Member, and/or its designated representative, outside of the proper course and scope of its performance of any obligations, responsibilities, or duties under this IGA and/or as a member of the Policy Board or Ops Group (hereinafter referred to as “non-authorized acts or omissions”), shall be the sole responsibility of the Participating Member, and/or its designated representative. Accordingly, each Participating Members hereto shall, without waiving governmental immunity, fully indemnify, to the extent permissible under Colorado law, for all injuries to person or property as are directly or indirectly caused by any such non-authorized acts or omissions of that Participating Member or a representative of such Participating Member, which result in any damages, claims, costs or liability of any manner, including without limit reasonable attorneys fees, each and every other Participating Member, and the SCCC as an entity.
14. **Insurance.** Regardless of the obligation for the SCCC to carry all proper and necessary insurance to provide appropriate coverage for its operations, all Participating Members hereto shall also be required to maintain insurance coverage at a minimum of the limits for liability set

forth by the Colorado Governmental Immunity Act, Section 24-10-101, et seq., C.R.S., as amended from time to time.

15. **Hold harmless.** Each Participating Member shall hold harmless the SCCC, its officers, employees, and agents against the loss of any service due to circumstances beyond the control of the SCCC. Such agreement shall extend to the Policy Board, the Ops Group, and the Summit County Government as well.
16. **Individual obligations.** Each Participating Member is required to carry out and perform all the obligations of a Participating Member under this IGA independently of the actions of any and all other Participating Members. No Participating Member shall be responsible or liable for the failure of any other Participating Member to perform its obligations herein.

ARTICLE VII – FUTURE CONTRACTS BY THE SCCC FOR COMMUNICATIONS SERVICES

It is agreed by and between the Participating Members that the SCCC may be in a position to furnish radio communications services to other governmental, quasi-governmental, or non-governmental entities, and in this regard, the Participating Members hereby expressly agree and consent that any such contract or agreement for the provision of services to such other entities and the SCCC shall be either through amendment to this IGA, or through a separate document on the same terms and condition as this IGA, including the formula used for annual cost calculations, as well as any other terms and conditions that the SCCC may deem appropriate which are not inconsistent with this IGA, do not lessen the service to, or increase the charges due from the other Participating Members. Notwithstanding the foregoing, Participating Members all acknowledge that certain governmental entities, at a maximum threshold of service demand as set by the Policy Board, may potentially opt to forego participating membership into the SCCC per this agreement, and instead contract with the SCCC for services.

Addendum B

Notification and Contact Information

Red, White, and Blue Fire Protection District
Jay Nelson
Co-Interim Fire Chief
316 N. Main Street/PO Box 710, Breckenridge, CO
80424
(970) 453-2474
jnelson@rwbfire.org

Summit County Government
Phillip Gonshak
County Manager
PO Box 68 Breckenridge, CO 80424
(970) 453-3403

Summit County Sheriff's Office
Jaime FitzSimons
Sheriff
P.O. Box 210 / 501 N. Park Avenue Breckenridge,
CO 80424
(970) 423-8934
jaime.fitzsimons@SummitCountyCO.Gov

Summit Fire and EMS
Travis Davis
Fire Chief
P.O. Box 4910 Frisco, CO 80443
(970) 262-5100 Ext. 128
TDavis@summitfire.org

Town of Blue River
Michelle Eddy
Town Manager/Clerk
0110 Whispering Pines Circle, Blue River CO
80424
PO Box 1784, Breckenridge
(970) 547-0545 ext. 1
michelle@townofblueriver.org

Town of Breckenridge
Rick G. Holman
Town Manager
150 Ski Hill Rd, Breckenridge, CO 80424
(970) 453-3171
rickh@townofbreckenridge.com

Town of Dillon
Cale Osborn
Police Chief
275 Lake Dillon Drive, PO Box 8, Dillon, CO 80435
(970) 262-3417
caleo@townofdillon.com

Town of Frisco
Tom Fisher
Town Manager
1 Main Street, PO Box 4100, Frisco, CO 80443
(970) 668-9123
tomf@townoffrisco.com

Town of Silverthorne
Ryan Hyland
Town Manager
601 Center Circle, Silverthorne CO 80498
(970) 262-7319
ryan.hyland@silverthorne.org

Memo

To: Breckenridge Town Council Members
From: Dave Byrd, Finance Director
Date: 7/20/2023
Subject: 2022 Financial Statements

Background

The Town is required to be audited annually by an independent auditing firm. Hinkle & Company PC performed the independent audit for the Town of Breckenridge.

Summary

The 2022 Financial Statements are being presented for Council's review. During the work session, the third-party auditing firm, Hinkle & Company will present the financial statement to Council. Below is a description of each document that includes the purpose and highlighted information.

Introductory Section

The Introductory Section (pages 7-13) includes the Town's high level organization structure, an introductory letter from the Town Manager and Director of Finance and the GFOA Award of Financial Reporting Achievement.

Independent Auditors' Report

The Independent Auditor's Report is included as pages 15-17 and indicates a 'clean' opinion meaning that the 2022 financial statements are presented fairly and are in conformance with generally accepted accounting principles.

Management Discussion and Analysis

The Management Discussion and Analysis on pages 18-23 provides an overview of the 2022 financial statements, a financial analysis of the Statement of Net Position and Statement of Activities, and a financial analysis of fund performance.

Basic Financial Statements

The Town has two types of activities – governmental and business-type. The governmental include the General, Affordable Housing, Capital, and Other Governmental Funds (Special Revenue/Internal Services). The business-type include the Utility and Golf Fund. Pages 27-28 provides a summary of these funds.

Total net position increased by \$41,099,107 which breaks down as an increase in the governmental activities of \$34,632,005 and an increase in the business-type activities of \$6,467,102. The increase in the governmental is the result of a strong 2022 economy and resulting tax revenue. The increase in business type is the result of increased revenues for utilities and golf along with increased investments.

Pages 29-32 are the Balance Sheet and Statement of Revenue, Expenditures and Changes in Fund Balance for the Governmental Funds. Pages 33-35 are the Statements of Net Position, Statement of Revenues, Expenses and Changes in Fund Net Position and Statement of Cash Flows for the Business-Type activities.

Notes to Financial Statements

The footnotes are included on pages 37-67 and outline the Town's accounting policies, cash, and investments, note receivable, assets held for resale, capital assets, long-term debt, interfund balance and transfers, retirement commitments, commitments and contingencies, risk management and other post-employment benefits.

Budgetary Comparison Schedule

Pages 69-72 provide an overview of the budget vs actual performance for the General Fund and the Affordable Housing Fund.

Supplementary Information

The Required Supplementary Information and Supplementary Information sections (pages 73-96) provide budget comparisons for all funds and the Combining Balance Sheet and Combining Statement of Revenues, Expenditures and Changes in Fund Balance for the non-major Governmental Funds. All the fund's expenditures are within budget except for the Health Benefits Fund. This is primarily due to timing of all 2022 payments after the December final budget appropriations.

Statistical Section

Pages 97-188 provide an overview of financial trends, revenue capacity, debt capacity, demographic and economic information, and operating information for the Town.

State Compliance

The Town receives Highway Users Tax from the State of Colorado. The money must be used for Town roads or State highways within the Town. The Town is required to provide a finance report to the State on an annual basis and it must be included in our annual financial statements on pages 120-121.

The 2022 financial statements must be submitted to the State Auditor's Office and the Department of Local Affairs no later than July 31, 2023.

DRAFT

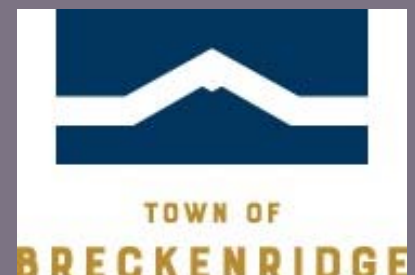
Comprehensive Annual Financial Report

For the year ended December 31, 2022

2
0
2
2



Watson roundabout- The Town of Breckenridge is constantly working to improve traffic, most recently by constructing a new multi-lane roundabout at the intersection of Park Ave and Watson Ave as the previous intersection was not meeting traffic demand. This improved safety and traffic flow in that area.



DRAFT

Town of Breckenridge, Colorado

**Annual Comprehensive
Financial Report**

Year Ended December 31, 2022

Prepared By:

Finance Department

Town of Breckenridge, Colorado
Table of Contents
December 31, 2022

DRAFT

Introductory Section

List of Principal Officials	7
Letter of Transmittal	8
Certificate of Achievement	12
Organization Chart	13

Financial Section

Independent Auditor's Report	15

Management's Discussion and Analysis	18

Basic Financial Statements

Government-wide Financial Statements

Statement of Net Position	27
Statement of Activities	28

Governmental Funds

Balance Sheet	29
Reconciliation of the Balance Sheet of Governmental Funds to the Statement of Net Position	30
Statement of Revenues, Expenditures and Changes in Fund Balances	31
Reconciliation of the Statement of Revenues, Expenditures and Changes in Fund Balances of Governmental Funds to the Statement of Activities	32

Proprietary Funds

Statement of Net Position	33
Statement of Revenues, Expenses and Changes in Net Position	34
Statement of Cash Flows	35

<i>Notes to Financial Statements</i>	36

Required Supplementary Information

Budgetary Comparison Schedule - General Fund	69
Budgetary Comparison Schedule - Affordable Housing Fund	72
Schedule of Changes in the Total OPEB Liability and Related Ratios - Last Ten Years	73

<i>Notes to Required Supplementary Information</i>	74

Supplementary Information

Combining Schedules - Nonmajor Governmental Funds

Combining Balance Sheet	76
Combining Statement of Revenues, Expenditures and Changes in Fund Balances	77

Town of Breckenridge, Colorado
Table of Contents
December 31, 2022
(Continued)

DRAFT

Financial Section (Continued)

Supplementary Schedules (Continued)

Budgetary Comparison Schedules - Nonmajor Governmental Funds

Open Space Acquisition Fund	78
Marketing Fund	79
Conversation Trust Fund	80
Accommodation Unit Compliance Fund	81

Budgetary Comparison Schedules - Capital Projects Fund

Capital Projects Fund	82

Combining Schedules – Nonmajor Proprietary Funds

Combining Statement of Net Position	83
Combining Statement of Revenues, Expenditures and Changes in Net Position	84
Combining Statement of Cash Flows	85

Budgetary Comparison Schedules - Enterprises Funds

Utility Fund	86
Golf Course Fund	87
Cemetery Fund	88

Combining Schedules - Internal Service Funds

Combining Statement of Net Position	89
Combining Statement of Revenues, Expenditures and Changes in Net Position	90
Combining Statement of Cash Flows	91

Budgetary Comparison Schedules - Internal Service Funds

Garage Services Fund	92
Information Technology Fund	93
Facility Maintenance Fund	94
Health Benefits Fund	95

Statistical Section

Table of Contents	97

Financial Trends

Net Position by Component	98
Changes in Net Position	99
Fund Balances of Government Funds	101
Changes in Fund Balances, Government Funds	102

(Continued)

Town of Breckenridge, Colorado
Table of Contents
December 31, 2022
(Continued)

DRAFT

Statistical Section (Continued)

Revenue Capacity

Assessed Value and Actual Value of Taxable Property	103
Property Tax Rates - All Direct and Overlapping Governments	104
Top Ten Principal Property Tax Payers	105
Taxable Sales and Sales Tax Collections by Category	106
Direct and Overlapping Sales Tax Rates	107
Property Tax Levies and Collections	108

Debt Capacity

Ratios of Outstanding Debt by Type	109
Ratios of General Bonded Debt Outstanding	110
Computation of Direct and Overlapping General Obligation Debt	111
Legal Debt Margin Information	112
Pledge Revenue Coverage	113

Demographic and Economic Information

Demographic and Economic Statistics	114
Principal Employers	115
Town Government Employees by Department	116

Operating Information

Operating Indicators by Function/Program	117
Capital Asset Indicators by Function/Program	118

State Compliance

Local Highway Finance Report	120

Introductory Section

TOWN OF BRECKENRIDGE, COLORADO

LIST OF PRINCIPAL OFFICIALS

TOWN COUNCIL

Eric Mamula, Mayor

Kelly Owens, Mayor Pro Tem

Jeffrey Bergeron

Dick Carleton

Jay Beckerman

Todd Rankin

Carol Saade

TOWN STAFF

Rick Holman – Town Manager

Shannon Haynes – Deputy Town Manager

Kirsten Crawford – Town Attorney

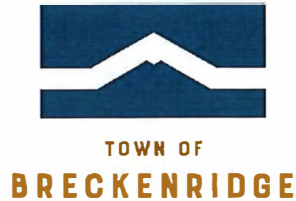
Mark Truckey – Community Development Director

James Phelps – Public Works Director

Dave Byrd – Finance Director

Jim Baird – Chief of Police

Scott Reid – Recreation Director



DRAFT

July 17, 2023

To the Honorable Mayor, Members of the Town Council, and the Citizens of the Town of Breckenridge:

Formal Transmittal of the Annual Comprehensive Financial Report

The comprehensive annual financial report of the Town of Breckenridge for the fiscal year ended December 31, 2022, is hereby submitted. Responsibility for both the accuracy of the data, and the completeness and fairness of the presentation, including all disclosures, rests with the Town. To the best of our knowledge and belief, the enclosed data is accurate in all material respects and is reported in a manner designed to present fairly the financial position and results of operations of the various funds of the Town. Disclosures necessary to enable the reader to gain an understanding of the Town's financial activities have been included.

The Town provides a full range of services including police protection, cultural and recreational facilities, events, open space acquisition, public transportation, construction and maintenance of streets & infrastructure, affordable housing, and water service. This letter of transmittal is designed to complement Management's Discussion and Analysis, which can be found in the Financial Section of this report.

Profile of the Government

The Town of Breckenridge is a municipal corporation duly organized and existing under the laws of the State of Colorado. By vote of the electorate, the Town of Breckenridge adopted a charter pursuant to Article XX of the Constitution of the State of Colorado, creating a home-rule municipality.

The Town operates under the council-manager form of government. The Town Council, an elected body consisting of a mayor and six council members, is responsible for creating policy, including ordinances, resolutions, budget adoption and appointment of the Town Manager. The Town Manager is the Chief Administrative Officer and is responsible for carrying out the Council's policies and overseeing day-to-day operations. The Town of Breckenridge is located in Summit County, 86 miles west of Denver at 9,603 feet above sea level.

Information Useful in Assessing the Government's Economic Condition

Economic Condition and Outlook.

2022 financials reflect the continued strong economic turnaround after the impact of the COVID-19 pandemic on the tourism sector in 2020. While the Town took a conservative approach to the 2022 Budget, the Town found itself in a significantly better position than anticipated for the entire year of 2022 as tourism rebounded along with a strong year for Real Estate investment. 2022 sales tax figures portray a resilient economy across all sectors.

As Town management relies on a conservative projection philosophy, revenue growth was much higher for 2022 than originally budgeted. This philosophy ensures sufficient reserves, in the case of another shift in the economy. The Town, as a result, has implemented investments in Town departments and capital projects that were deferred in 2020. These projects will continue into 2023 and beyond based upon the approved 2023 Budget.

2022 had a strong year for Real Estate Transfer Taxes although there was a 37% reduction from 2021's record year. The Town recorded \$6.9M in revenue vs a budget of \$6M. The Town expects continued

decline in 2023 based upon the increase in mortgage rates and inflation pressure.

DRAFT

Financial Information.

Town Management is responsible for establishing and maintaining an internal control structure designed to ensure that the assets of the Town are protected from loss, theft or misuse and to ensure that adequate accounting data is compiled to allow for the preparation of financial statements in conformity with generally accepted accounting principles. The internal control structure is designed to provide reasonable, but not absolute, assurance that these objectives are met. The concept of reasonable assurance recognizes that (1) the cost of a control should not exceed the benefits likely to be derived; and (2) the valuation of costs and benefits requires estimates and judgments by management.

Budgetary Controls.

The objective of budgetary controls is to ensure compliance with legal provisions in the annual appropriated budget approved by the Town Council. Expenditures may not legally exceed appropriations at the Fund level. In the event changes occur during the year, budget appropriations will be present to Town Council for approval.

Primary responsibility for fiscal analysis of the budget to actual cash flows and overall program fiscal standing rests with the operating departments along with support from Finance.

Debt Administration.

2022 COP funding supported \$19.5M for the Justice Center apartments. This project will deliver 52 apartments which will assist in providing Work Force Housing. This project will be completed in early 2024.

Required debt covenants are currently being met. Notes to the financial statements provide additional detailed information about the specific debt issues and repayment terms. In addition, the statistical section of the Annual Comprehensive Financial Report includes information relating to general bonded debt to assessed valuation and the amount of general bonded debt per capita, which can be useful indicators of the Town's debt position for the Town's management, citizens and investors.

The Past Year.

The Town of Breckenridge exemplifies exceptional values and philosophies. The Town has successfully transitioned out of the COVID-19 pandemic and has been able to provide staffing and services to the citizens and tourists of Breckenridge. The Town also launched the core values program focusing on Community, Adaptability, Integrity, Communication, and Innovation. All the departments focus on practicing these values while working both internally and externally.

In addition, the Town has continued to focus initiatives including Sustainability, Affordable Housing, Utility improvements, Parking, and Infrastructure, and hiring employees necessary to support all these efforts.

Looking Forward.

The Town is looking forward to new opportunities and meeting the challenges of 2023. The Town started off the year on a very strong note, and has continued the Community and Council Goals, which include the following:

- Goal 1: More boots and bikes, less cars
- Goal 2: Leading environmental stewardship
- Goal 3: Deliver a balanced year-round economy
- Goal 4: Hometown feel and authentic character

Other goal-specific accomplishments include:

- Additional housing units have or will be added to the current inventory, including the Alta Verde I: eighty (80) unit apartment project, completion of Block 11 Apartments: twenty-seven (27) units, Alta Verde II: one hundred and seventy-two (172) unit apartments, and the Justice Center: fifty-two (52) unit apartments, along with continued programs for deed-restricted buy-down units and deed-restriction acquisitions through Housing Helps. The targeted completion for the projects listed above is 2024/2025. In addition, future projects are in the pipeline to continue to address housing needs

including Stables Village, Block 11 Homes, and the redevelopment of the Wayside Inn. These projects will provide single family housing along with duplexes, townhomes, and efficient units for the workforce of Summit County.

DRAFT

Housing Crisis.

Workforce Housing is an issue in many communities throughout Colorado and is especially critical in resort communities.

The housing shortage was exacerbated by the pandemic, resulting in individuals leaving the county and the workforce shortage has impacted many businesses in the community. Post pandemic, the real estate market skyrocketed due to limited housing supply and unprecedented demand further stressing the local housing market. There are currently approximately 1,200 deed restricted units. Despite increases to wages we estimate that Countywide the housing available to local workforce is approximately 2,000 units short of the housing needed to meet the demands of the local workforce. The goal of the Breckenridge Housing Program is to house approximately 50% of the Breckenridge workforce in the Upper Blue Basin. In February of 2022, the Town Council committed to a 5 Year Blueprint to add almost 1,000 additional units over the next 5 years.

Independent Audit.

State statutes and the Town Charter require an annual audit by independent certified public accountants. The Town has engaged Hinkle & Company to complete the 2022 Single Audit and Financial Audit. The Town has been able to complete the audit by June 2023. This falls within the Town Charter and the State of Colorado requirements. In addition to meeting the requirements set forth in state statutes, the audit was also designed to meet the requirements of GASB Statement No. 34, Basic Financial Statements-and Management's Discussion and Analysis for State and Local Governments.

The goal of the independent audit was to provide reasonable assurance that the financial statements of the Town of Breckenridge for the fiscal year ended December 31, 2022, are free of material misstatement. The independent audit involved examining on a test basis, evidence supporting the amounts and disclosures in the financial statements; assessing the accounting principles used and significant estimates made by management; and evaluating the overall financial statement presentation. The independent auditor concluded based upon the audit, that there was a reasonable basis for rendering an unmodified opinion that the Town of Breckenridge's financial statements for the fiscal year ended December 31, 2022, are fairly presented in conformity with GAAP.

The Independent Auditor's Report is presented as the first component of the financial section of this report. The report covers the financial statements of the governmental activities, business-type activities, and each major fund, collectively comprising the Town's basic financial statements.

Awards and Acknowledgements.

Government Finance Officers Association of the United States and Canada (GFOA) awarded a Certificate of Achievement for Excellence in Financial Reporting to the Town of Breckenridge for its annual comprehensive financial report for the fiscal year ended December 31, 2021. This was the 10th consecutive year that the government has achieved this prestigious award. In order to be awarded a Certificate of Achievement, a government must publish an easily readable and efficiently organized annual comprehensive financial report. This report must satisfy both generally accepted accounting principles and applicable legal requirements.

A Certificate of Achievement is valid for a period of one year only. We believe that our current annual comprehensive financial report continues to meet the Certificate of Achievement Program's requirements and we are submitting it to GFOA to determine its eligibility for another certificate.

The preparation and completion of this financial report could not have been accomplished without the efforts of the finance staff and other Town Departments. A special thanks is extended to all members of the independent certified public accounting firm for their able assistance and for the professional manner in which they have accomplished this assignment. I also would like to thank the Mayor and Town Council for their interest and support in planning and conducting the financial operations of the Town in a fiscally responsible and progressive manner.

DRAFT

Respectfully submitted,



Rick Holman
Town Manager



Dave Byrd, CPA
Director of Finance



**The Government Finance Officers Association of
the United States and Canada**

DRAFT

presents this

AWARD OF FINANCIAL REPORTING ACHIEVEMENT

to

Finance Department
Town of Breckenridge, Colorado

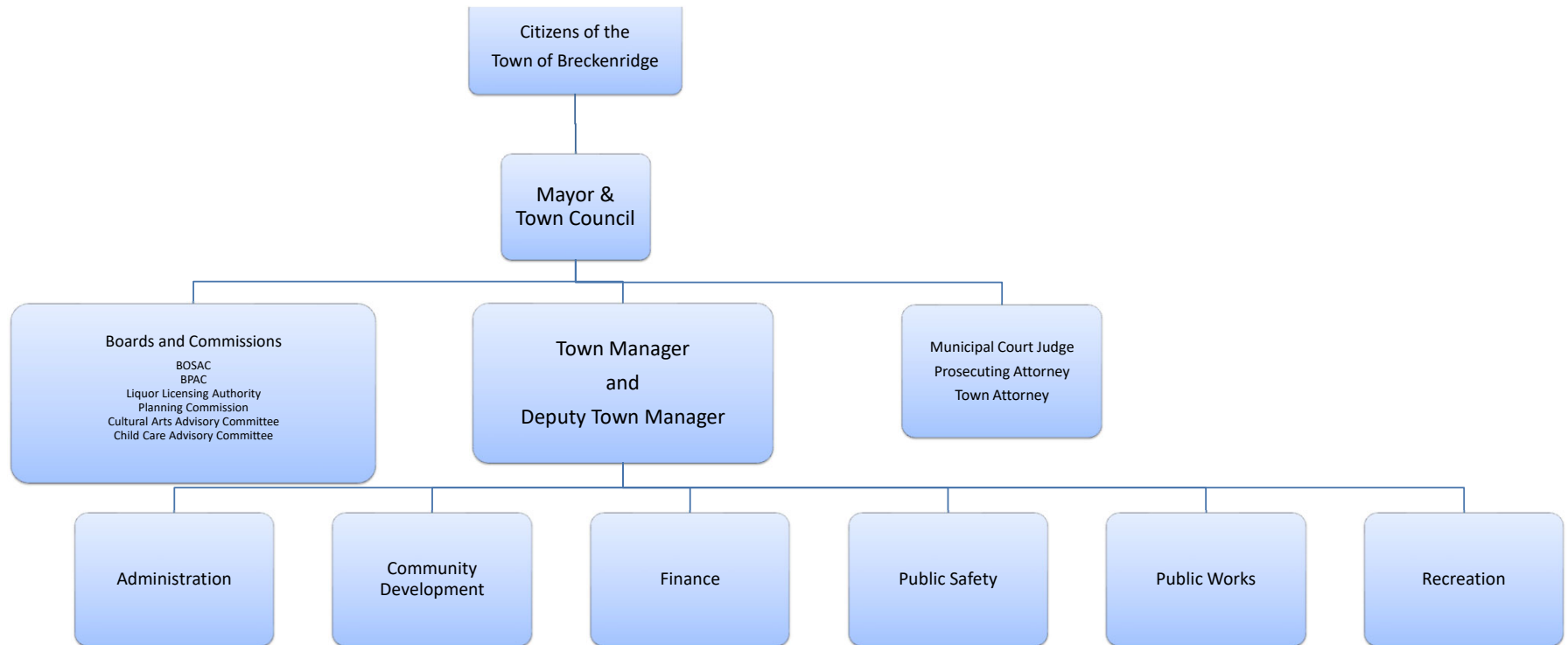


The Award of Financial Reporting Achievement is presented by the Government Finance Officers Association to the department or individual designated as instrumental in the government unit achieving a Certificate of Achievement for Excellence in Financial Reporting. A Certificate of Achievement is presented to those government units whose annual financial reports are judged to adhere to program standards and represents the highest award in government financial reporting.

Executive Director

Christopher P. Morill

Date: 6/20/2023



Financial Section

Independent Auditor's Report

Honorable Mayor and Members of the Town Council
Town of Breckenridge, Colorado
Breckenridge, Colorado

Report on the Audit of the Financial Statements

Opinions

We have audited the financial statements of the governmental activities, the business-type activities, the discretely presented component unit, and each major fund of the Town of Breckenridge, Colorado (the Town), as of and for the year ended December 31, 2022, and the related notes to the financial statements, which collectively comprise the Town's basic financial statements as listed in the table of contents.

In our opinion, the accompanying financial statements present fairly, in all material respects, the respective financial position of the governmental activities, the business-type activities, the discretely presented component unit, and each major fund of the Town, as of December 31, 2022, and the respective changes in financial position and, where applicable, cash flows thereof for the year then ended in accordance with accounting principles generally accepted in the United States of America.

Basis for Opinions

We conducted our audit in accordance with auditing standards generally accepted in the United States of America (GAAS) and the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States. Our responsibilities under those standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are required to be independent of the Town and to meet our other ethical responsibilities, in accordance with the relevant ethical requirements relating to our audit. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinions.

Responsibilities of Management for the Financial Statements

The Town's management is responsible for the preparation and fair presentation of the financial statements in accordance with accounting principles generally accepted in the United States of America, and for the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, management is required to evaluate whether there are conditions or events, considered in the aggregate, that raise substantial doubt about the Town's ability to continue as a going concern for one year after the date that the financial statements are issued.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinions. Reasonable assurance is a high level of assurance but is not absolute assurance and therefore is not a guarantee that an audit conducted in accordance with GAAS will always detect a material misstatement when it exists. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control. Misstatements are considered material if there is a substantial likelihood that, individually or in the aggregate, they would influence the judgment made by a reasonable user based on the financial statements.

In performing an audit in accordance with GAAS, we:

- Exercise professional judgment and maintain professional skepticism throughout the audit.
- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, and design and perform audit procedures responsive to those risks. Such procedures include examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Town's internal control. Accordingly, no such opinion is expressed.
- Evaluate the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluate the overall presentation of the financial statements.
- Conclude whether, in our judgment, there are conditions or events, considered in the aggregate, that raise substantial doubt about the Town's ability to continue as a going concern for a reasonable period of time.

We are required to communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit, significant audit findings, and certain internal control-related matters that we identified during the audit.

Required Supplementary Information

Accounting principles generally accepted in the United States of America require that the management's discussion and analysis and budgetary comparison information be presented to supplement the basic financial statements. Such information is the responsibility of management and, although not a part of the basic financial statements, is required by the Governmental Accounting Standards Board who considers it to be an essential part of financial reporting for placing the basic financial statements in an appropriate operational, economic, or historical context. We have applied certain limited procedures to the required supplementary information in accordance with auditing standards generally accepted in the United States of America, which consisted of inquiries of management about the methods of preparing the information and comparing the information for consistency with management's responses to our inquiries, the basic financial statements, and other knowledge we obtained during our audit of the basic financial statements. We do not express an opinion or provide any assurance on the information because the limited procedures do not provide us with sufficient evidence to express an opinion or provide any assurance.

Other Information

Management is responsible for the other information included in the Supplementary Information and the local highway finance report, as listed in the table of contents. The other information comprises the Supplementary Information and the local highway finance report but does not include the financial statements and our auditor's report thereon. Our opinions on the financial statements do not cover the other information, and we do not express an opinion or any form of assurance thereon. In connection with our audit of the financial statements, our responsibility is to read the other information and consider whether a material inconsistency exists between the other information and the financial statements, or the other information otherwise appears to be materially misstated. If, based on the work performed, we conclude that an uncorrected material misstatement of the other information exists, we are required to describe it in our report.

Englewood, Colorado
(DATE)

This section of the Town of Breckenridge's financial statements provides a narrative overview and analysis of the financial activities of the Town for the fiscal year ended December 31, 2022. We encourage readers to consider the information presented here in conjunction with additional information that we have furnished in our letter of transmittal at the front of this report and the Town's financial statements which follow within this section, as well as the accompanying statistical information, and state compliance sections.

I. FINANCIAL HIGHLIGHTS

- The Town of Breckenridge remains in a financially sound condition. The Town's increase in net position and continued investments in infrastructure demonstrate our continued positive overall financial health.
- The assets and deferred outflows of resources of the Town of Breckenridge exceeded its liabilities and deferred inflows of resources at the close of fiscal year 2022 by \$420,560,662 (net position). Of this amount, \$102,175,893 (unrestricted net position) may be used to meet the Town's ongoing obligations or unforeseen expenses.
- General fund 2022 revenues increased by \$9 million or 13.2% as compared to 2021. Governmental funds tax revenues increased by 9.3% compared to 2021. This continued rebound is due to the Town's businesses opening up versus the impact for the COVID-19 pandemic. In comparison to 2019 (pre COVID-19), overall, 2022 taxable sales increased by 39% versus 2019. Retail increased 42%, Restaurants/Bars increased 24%, Short Term Lodging increased 71% and Grocery/Liquor increased 19%.
- Since revenues exceeded budget and expenditures were below budget in 2022, the Town was able to increase its fund balances. As of the close of fiscal year 2022, the Town of Breckenridge's governmental funds reported a combined ending fund balance of \$174,621,461, an increase of \$27.5 million compared to fiscal year 2021. \$31,667,476 of the total is unassigned and equal to 30.7% of governmental expenditures.
- Certificates of Participation (COP) totaling \$19,667,049 were issued in December 2022 for Justice Center Apartments as part of the Affordable Housing Program. The COPs is payable over 20 years at an all-in true interest cost of 5.0% per annum.

II. OVERVIEW OF THE FINANCIAL STATEMENTS

This discussion and analysis are intended to serve as an introduction to the Town of Breckenridge's basic financial statements. The Town of Breckenridge's basic financial statements comprise three components: 1) government-wide financial statements, 2) fund financial statements and 3) notes to financial statements. This report also contains other supplementary information in addition to the basic financial statements themselves.

1. Government-wide Financial Statements

The government-wide financial statements are intended to provide readers with a broad overview of the Town's financial condition. They are presented using accounting methods very similar to a private-sector business, or the economic resources measurement focus, and full accrual accounting.

- *The Statement of Net Position* presents information on all of the Town's assets, liabilities, and deferred inflows of resources, with the difference reported as *Net Position*. Over time, increases or decreases in net position can serve as an indicator of the Town's financial condition.
- *The Statement of Activities* presents information showing how the Town's net position changed during the given fiscal year. All changes in net position are reported as soon as the underlying event giving rise to the change occurs, regardless of the timing of related cash flows. Capital expenditures are not included in this statement; however capital grant revenues are reported.

2. Fund Financial Statements

A *fund* is a grouping that is used to maintain control over resources that have been segregated for specific activities or objectives. Some funds are required to be established by State law and bond covenants; however, Town Council establishes other funds to help control and manage money for particular purposes. All of the Town's funds can be divided into two categories: Governmental Funds and Proprietary Funds.

Governmental Funds

The governmental funds presentation is different from the governmental activities section of the government-wide financial statements even though these two statements account for essentially the same activities. Governmental funds presented have a budgetary or *current financial resources* measurement focus and use the modified accrual basis of accounting. That is, the governmental funds presentation focuses on the Town's near-term financial position and changes thereto.

Proprietary Funds

Proprietary funds are unlike governmental funds in that they report the business-type activities of the Town.

- *Enterprise funds* account for the operation of governmental programs that are intended to be supported primarily by user fees. These funds are presented as business-type activities on the government-wide financial statements but are presented in greater detail in the fund financial statements. In both cases, enterprise funds are presented using the *economic resources* measurement focus and full accrual accounting.
- *Internal service funds* account for goods and services provided by specific programs on a fee basis to the Town's other departments and programs.

3. Notes to the Basic Financial Statements

The notes to the basic financial statements provide additional information that is essential to a thorough understanding of the data provided in the government-wide and the fund financial statements.

III. GOVERNMENT-WIDE FINANCIAL STATEMENT ANALYSIS

Statement of Net Position

As noted earlier, the Statement of Net Position can serve as an indicator of the overall financial condition of the Town. As of December 31, 2022, the Town had total assets of \$577,426,729. As of December 31, 2022, the Town's net position was \$420,560,662.

Condensed Statement of Net Position							
	Governmental Activities		Business-type Activities		Total		Discretely Presented
	2022	2021	2022	2021	2022	2021	Component-Unit
Current Assets	\$ 157,455,742	\$ 115,723,447	\$ 7,438,263	\$ 13,849,223	\$ 164,894,005	\$ 129,572,670	\$ 253,030
Capital Assets, net	245,811,755	224,787,100	106,862,231	97,502,649	352,673,986	322,289,749	6,599,333
Other Noncurrent Assets	40,309,122	53,951,340	19,549,616	6,419,616	59,858,738	60,370,956	230,679
Total Assets	<u>443,576,619</u>	<u>394,461,887</u>	<u>133,850,110</u>	<u>117,771,488</u>	<u>577,426,729</u>	<u>512,233,375</u>	<u>7,083,042</u>
Deferred Outflows of Resources	539,678	519,494	-	-	539,678	519,494	-
Current Liabilities	6,503,842	11,425,578	1,474,484	4,887,340	7,978,326	16,312,918	140,998
Noncurrent Liabilities	85,375,650	65,978,927	60,049,349	47,024,973	145,424,999	113,003,900	6,012,385
Total Liabilities	<u>91,879,492</u>	<u>77,404,505</u>	<u>61,523,833</u>	<u>51,912,313</u>	<u>153,403,325</u>	<u>129,316,818</u>	<u>6,153,383</u>
Deferred Inflows of Resources	4,002,420	3,974,496	-	-	4,002,420	3,974,496	-
Net Investment in Capital Assets	186,702,912	200,212,421	66,489,635	54,679,049	253,192,547	254,891,470	586,948
Restricted	65,192,222	49,081,979	-	-	65,192,222	49,081,979	-
Unrestricted	96,339,251	64,307,980	5,836,642	11,180,126	102,175,893	75,488,106	342,711
Total Net Position	<u>\$ 348,234,385</u>	<u>\$ 313,602,380</u>	<u>\$ 72,326,277</u>	<u>\$ 65,859,175</u>	<u>\$ 420,560,662</u>	<u>\$ 379,461,555</u>	<u>\$ 929,659</u>

Capital Assets make up the largest portion of the Town's Net Position. Capital assets include items such as infrastructure, buildings, equipment, machinery, land, art, and other tangible items. Infrastructure includes streets, traffic signals, buildings, and sidewalks. The Town uses capital assets to provide services to the community and thus they are not available for immediate spending. Although the Town of Breckenridge's investment in its capital assets is reported net of related debt, it should be noted that the resources needed to repay this debt must be provided from other sources, since the capital assets themselves cannot be used to liquidate these liabilities. Unrestricted net position may be used to meet the Town's ongoing obligations to citizens and creditors. During 2022, the Town added the following to its capital assets:

- The Town of Breckenridge's investment in capital assets for its governmental and business type activities as of December 31, 2022, amounts to \$352,673,986, up from

\$322,289,749 in the preceding year. This investment in capital assets includes land, buildings, vehicles, art, equipment, roads, bridges, and utility system infrastructure.

- The total increase in the Town of Breckenridge's investment in capital assets (net of related debt) for the fiscal year ending 2022 was \$30,384,237. This is primarily due to the investments in affordable housing, parking and infrastructure.

Additional information on the Town's capital assets can be found in the Capital Assets Note 5 in the Notes to the Financial Statements section.

At the end of the current fiscal year, the Town of Breckenridge had no bonded debt outstanding in the form of General Obligation Bonds.

Additional information on the Town's long-term debt can be found in the Long-Term Debt Note 6 in the Notes to the Financial Statements section.

The \$199,227,801 in Current Assets of the total Primary Government includes \$173,324,285 in equity in pooled cash and investments. This reflects the strong cash balances that the Town of Breckenridge has maintained during 2022.

At the end of 2022, the Town of Breckenridge is able to report positive balances in all three categories of net position, both for the government as a whole, as well as for its separate Governmental, Business-type, and Component-unit activities. The net position, unrestricted for the Governmental activities, equals 125.14% of total expenses in the statement of activities for governmental activities for 2022 and 114.90% of the total government-wide expenses, including Business-Type activities.

Statement of Activities

This statement presents information showing how the Town's net position changed during the given fiscal year. The following reflects the Town's change in net position:

	Condensed Statement of Activities						Discretely Presented	
	Governmental Activities		Business-type Activities		Total		Component-Unit	
	2022	2021	2022	2021	2022	2021	2022	2021
Program Revenues								
Charges for Services	\$ 25,914,958	\$ 11,747,146	\$ 11,005,135	\$ 9,786,223	\$ 36,920,093	\$ 21,533,369	\$ 481,770	\$ 479,501
Operating Grants and Contributions	5,894,535	3,105,621	-	-	5,894,535	3,105,621	-	-
Capital Grants and Contributions	97,228	1,622,813	7,334,250	2,191,713	7,431,478	3,814,526	-	-
Total Program Revenues	31,906,721	16,475,580	18,339,385	11,977,936	50,246,106	28,453,516	481,770	479,501
General Revenues								
Unrestricted Grants and Contribution	-	-	-	-	-	-	-	-
Unrestricted Investment Earnings	628,064	54,642	79,642	25,410	707,706	80,052	982	-
Gain on Sale of Assets	(2,144,588)	4,323,488	-	(72,544)	(2,144,588)	4,250,944	-	6,758
Other General Revenues	6,587,725	1,716,475	-	530	6,587,725	1,717,005	3,023	-
Total General Revenues	5,071,201	6,094,605	79,642	(46,604)	5,150,843	6,048,001	4,005	6,758
Total Revenues	36,977,922	22,570,185	18,419,027	11,931,332	55,396,949	34,501,517	485,775	486,259
Expenses								
General Government	16,973,930	12,171,546	-	-	16,973,930	12,171,546	-	-
Public Safety	8,013,471	7,230,812	-	-	8,013,471	7,230,812	-	-
Public Works	22,536,647	13,257,302	-	-	22,536,647	13,257,302	847,878	876,667
Community Development	14,425,719	5,077,048	-	-	14,425,719	5,077,048	-	-
Culture and Recreation	9,948,687	8,060,391	-	-	9,948,687	8,060,391	-	-
Open Space Acquisition	1,572,929	1,479,997	-	-	1,572,929	1,479,997	-	-
Grants to Other Agencies	1,490,585	2,052,920	-	-	1,490,585	2,052,920	-	-
Debt Issuance Costs	153,845	106,916	-	-	153,845	106,916	-	-
Interest Expense not Allocated	1,865,769	1,803,419	-	-	1,865,769	1,803,419	-	-
Utility Operations	-	-	8,995,467	5,619,712	8,995,467	5,619,712	-	-
Golf Operations	-	-	2,923,207	2,920,361	2,923,207	2,920,361	-	-
Cemetery Operations	-	-	19,498	37	19,498	37	-	-
Total Expenses	76,981,582	51,240,351	11,938,172	8,540,110	88,919,754	59,780,461	847,878	876,667
Excess Before Transfers	(40,003,660)	(28,670,166)	6,480,855	3,391,222	(33,522,805)	(25,278,944)	(362,103)	(390,408)
Capital Contributions & Transfers	13,753	361,298	(13,753)	(361,298)	-	-	-	-
Change in Net Position	(39,989,907)	(28,308,868)	6,467,102	3,029,924	(33,522,805)	(25,278,944)	(362,103)	(390,408)
Net Position - Beginning	313,602,380	273,364,194	65,859,175	62,829,251	379,461,555	336,193,445	1,291,762	1,682,170
Net Position - Ending	\$ 273,612,473	\$ 245,055,326	\$ 72,326,277	\$ 65,859,175	\$ 345,938,750	\$ 310,914,501	\$ 929,659	\$ 1,291,762

IV. FUND FINANCIAL STATEMENT ANALYSIS

As noted earlier, the Town uses fund accounting so as to segregate resources for the purpose of carrying on a specific activity or attaining certain objectives in accordance with regulations, restrictions or other limitations on the use of the funds.

Governmental Fund Balances

The focus on the Town of Breckenridge's governmental funds is to provide information on short-term inflows, outflows and balances of spendable resources. Such information is useful in assessing the Town's financing requirements. In particular, unassigned fund balance may serve as a useful measure of a government's net resources available for spending at the end of the fiscal year.

As the Town completed the year, its governmental funds reported a combined fund balance of \$174,621,461. Of that fund balance, \$31,667,476 constitutes unassigned fund balance which is available for spending at the government's discretion. The remainder of the fund balance is categorized to indicate that it is not available for new spending, the largest of which is restricted for Capital Projects totaling \$61,226,900.

The General Fund is the chief operating fund of the Town of Breckenridge. At the end of 2022, the General Fund balance was \$102,282,919 and 34.55% of the fund balance was unassigned. The General Fund balance increased in 2022 by \$10,045,480 or approximately 10.9%. This balance allows the Town to be in a strong financial position for future projects and investments.

The Capital Projects Fund has a total fund balance of \$15,176,007. The decrease in fund balance during the current year was \$3,672,714. This decrease is primarily due to the reduced transfers from the Excise Tax Fund. Balances remain in the Capital Projects Fund to provide spending for previously appropriated projects. The major revenue source for the Capital Projects Fund is a transfer from the Excise Tax Fund, which is rolled into the General Fund for financial reporting purposes.

Special Revenue Funds – These funds have a total combined fund balance of \$57,162,535. The main ongoing revenue sources for the special revenue funds are taxes (sales and accommodations). These tax revenues amounted to \$15,616,734 in 2022.

The Affordable Housing Fund balance increased by \$11,391,741. Fund balance has increased as a result of the Justice Center COP; this project is due to be completed in 2023. The Breckenridge Housing Authority is a blended component unit of this fund; resales of the housing units developed by the Town are sold through this Authority.

Other Special Revenue Funds balance increased by \$9,720,061 in 2022 due to decreases in open space land acquisitions.

Proprietary Funds - The Town of Breckenridge's proprietary funds provide the same type of information found in the government wide financial statements, but in more detail. Unrestricted net position of the Utility, Golf Course, and Cemetery funds at the end of the year amounted to \$25,386,257.

The Utility Fund net position increased by \$5,451,466. Fund balance has increased as a result of a rate structure that allows for planned increases in Net Position designed to pay for upcoming infrastructure projects.

The Golf Fund net position increased by \$992,938. The performance of the Golf Course continued to be strong.

General Fund Budgetary Highlights

Over the course of the year, the Town Council revised the Town budget. These budget amendments fell into the following categories:

- Supplemental appropriations approved shortly after the beginning of the year to reflect projects and purchases not completed in the previous year.
- Supplemental appropriations approved after the beginning of the year to reflect new projects or revenues not previously considered.

Differences in the General Fund between the original budget and the final amended budget were related to both revenue and expenditures. The 2022 expenditure budget was increased by approximately \$1.2M. This was primarily due to the purchase of a building in town. In addition, \$6.4M was added to other Funds, primarily focused on capital for Affordable Housing, Parking and Transportation and Health Benefits.

Economic Factors and Next Year's Budget

Tax (including property, sales, accommodations and real estate transfer) revenues are the main source of governmental revenues and are an important source for providing funds for the general operations and maintenance of the Town of Breckenridge.

- The national, state and local economies are currently in a state of uncertainty in relation to current economic conditions and a potential recession.
- The Town of Breckenridge is well positioned to weather this uncertainty due to healthy fund balances and conservative budget practices.
- For 2023, revenue budgeted for the General Fund (excluding transfers in and other financing sources) totals \$78,563,174, as compared to the (revised) 2022 budget of \$65,646,493.
- Tax revenues are budgeted in line with actual collections of sales tax and accommodation tax; while Real Estate Transfer Tax revenue for 2023 is budgeted at \$5,405,283, a 21.3% decrease from 2022 actual collections of \$6,872,481.
- Budgeted expenditures for 2023 were based on projections of 2022 annual budget, with the exception of the Capital Fund. The budgeted expenditures for 2023 are \$150,902,781, excluding transfers.

The Town of Breckenridge will continue to closely monitor its financial position throughout 2023. Continued fiscal discipline and scrutiny of initiatives will ensure that future annual operational expenditures remain in balance with future revenues in light of overall local and national economic conditions.

IV. REQUESTS FOR INFORMATION

This financial report is designed to provide a general overview of the Town's finances. Questions concerning the information provided in this report or other financial information should be addressed to the Finance Department, Town of Breckenridge, 150 Ski Hill Road, Breckenridge, CO 80424, via telephone at (970) 453-3382, or via e-mail at websitefinance@townofbreckenridge.com.

Basic Financial Statements

Town of Breckenridge, Colorado
Statement of Net Position
December 31, 2022

DRAFT

	Governmental Activities	Business-Type Activities	Totals	Component Unit
Assets				
Cash and Investments	\$ 122,928,481	\$ 5,788,604	\$ 128,717,085	\$ 253,030
Restricted Cash and Investments	25,057,584	19,549,616	44,607,200	202,199
Receivables				
Accounts	693,530	1,649,659	2,343,189	-
Taxes	8,466,826	-	8,466,826	-
Intergovernmental Receivables	15,092,597	-	15,092,597	-
Prepaid Expenses and Deposits	904	-	904	-
Assets Held for Resale	10,273,404	-	10,273,404	-
Notes Receivable	15,251,538	-	15,251,538	-
Capital Assets				
Not Being Depreciated	131,454,482	30,263,880	161,718,362	-
Being Depreciated, <i>Net of Accumulated Depreciation</i>	114,357,273	76,598,351	190,955,624	6,599,333
Other Assets	-	-	-	28,480
Total Assets	443,576,619	133,850,110	577,426,729	7,083,042
Deferred Outflows of Resources				
OPEB, <i>Net of Accumulated Amortization</i>	539,678	-	539,678	-
Total Deferred Outflows of Resources	539,678	-	539,678	-
Liabilities				
Accounts Payable	3,266,550	179,343	3,445,893	37,748
Retainage Payable	665,186	868,746	1,533,932	-
Accrued Interest Payable	223,252	358,764	582,016	55,109
Accrued Liabilities	25,249	-	25,249	-
Accrued Salaries	711,018	61,422	772,440	-
Funds Held for Others	95,289	6,209	101,498	48,141
Unearned Revenues	9,336	-	9,336	-
Net OPEB Liability	1,507,962	-	1,507,962	-
Noncurrent Liabilities				
Due Within One Year	3,087,429	2,733,483	5,820,912	-
Due in More Than One Year	82,288,221	57,315,866	139,604,087	6,012,385
Total Liabilities	91,879,492	61,523,833	153,403,325	6,153,383
Deferred Inflows of Resources				
Property Taxes	3,693,864	-	3,693,864	-
OPEB, <i>Net of Accumulated Amortizations</i>	308,556	-	308,556	-
Total Deferred Inflows of Resources	4,002,420	-	4,002,420	-
Net Position				
Net Investment in Capital Assets	186,702,912	66,489,635	253,192,547	586,948
Restricted For				
Emergencies	3,345,000	-	3,345,000	-
Public Safety	33,500,903	-	33,500,903	-
Culture and Recreation	28,346,319	-	28,346,319	-
Unrestricted	96,339,251	5,836,642	102,175,893	342,711
Total Net Position	\$ 348,234,385	\$ 72,326,277	\$ 420,560,662	\$ 929,659

See Notes to the Financial Statements.

Town of Breckenridge, Colorado
Statement of Activities
For the Year Ended December 31, 2022

DRAFT

		Program Revenues			Net (Expense) Revenue and Change in Net Position			
Functions/Programs	Expenses	Charges for Services	Operating Grants and Contributions	Capital Grants and Contributions	Governmental Activities	Business-Type Activities	Totals	Component Unit
Primary Government								
<i>Governmental Activities</i>								
General Government	\$ 16,973,930	\$ 14,663,863	\$ 2,020,911	\$ -	\$ (289,156)	\$ -	\$ (289,156)	\$ -
Public Safety	8,013,471	2,950,489	23,027	-	(5,039,955)	-	(5,039,955)	-
Public Works	22,536,647	815,046	3,031,311	-	(18,690,290)	-	(18,690,290)	-
Community Development	14,425,719	1,065,662	691,686	32,500	(12,635,871)	-	(12,635,871)	-
Culture and Recreation	9,948,687	5,954,726	70,000	64,728	(3,859,233)	-	(3,859,233)	-
Open Space	1,572,929	465,172	57,600	-	(1,050,157)	-	(1,050,157)	-
Grants to Other Agencies	1,490,585	-	-	-	(1,490,585)	-	(1,490,585)	-
Interest Expense								
not Allocated	1,865,769	-	-	-	(1,865,769)	-	(1,865,769)	-
Debt Issuance Costs	153,845	-	-	-	(153,845)	-	(153,845)	-
Total Government Activities	76,981,582	25,914,958	5,894,535	97,228	(45,074,861)	-	(45,074,861)	-
<i>Business-Type Activities</i>								
Utility Fund	8,995,467	6,915,606	-	594,870	-	(1,484,991)	(1,484,991)	-
Golf Course	2,923,207	4,047,379	-	6,739,380	-	7,863,552	7,863,552	-
Cemetery Fund	19,498	42,150	-	-	-	22,652	22,652	-
Total Business-Type Activities	11,938,172	11,005,135	-	7,334,250	-	6,401,213	6,401,213	-
Total Primary Government	\$ 88,919,754	\$ 36,920,093	\$ 5,894,535	\$ 7,431,478	(45,074,861)	6,401,213	(38,673,648)	-
Component Unit								
Pinewood 2, LLLP	\$ 847,878	\$ 481,770	\$ -	\$ -	-	-	-	(366,108)
General Revenues								
Property Taxes					3,792,934	-	3,792,934	-
Specific Ownership Taxes					178,543	-	178,543	-
Sales and Use Taxes								
Marketing					630,112	-	630,112	-
Open Space					4,497,841	-	4,497,841	-
Other					41,890,395	-	41,890,395	-
Accommodation Taxes								
Marketing					4,278,516	-	4,278,516	-
Other					6,830,813	-	6,830,813	-
Marijuana Taxes					658,274	-	658,274	-
Franchise Fees					998,167	-	998,167	-
Real Estate Transfer Taxes					6,872,481	-	6,872,481	-
Lift Ticket Taxes					3,993,836	-	3,993,836	-
Investment Earnings					628,064	79,642	707,706	982
Gain (Loss) on Sale of Assets					(2,144,588)	-	(2,144,588)	-
Other Revenues					6,587,725	-	6,587,725	3,023
Transfers					13,753	(13,753)	-	-
Total General Revenues					79,706,866	65,889	79,772,755	4,005
Change in Net Position					34,632,005	6,467,102	41,099,107	(362,103)
Net Position, Beginning of year					313,602,380	65,859,175	379,461,555	1,291,762
Net Position, End of year					\$ 348,234,385	\$ 72,326,277	\$ 420,560,662	\$ 929,659

See Notes to the Financial Statements.

Town of Breckenridge, Colorado
Balance Sheet
Governmental Funds
December 31, 2022

DRAFT

	General Fund	Affordable Housing Fund	Other Governmental Funds	Capital Projects Fund	Totals
Assets					
Cash and Investments	\$ 76,246,615	\$ 8,980,894	\$ 22,332,946	\$ -	\$ 107,560,455
Restricted Cash and Investments	2,928,571	-	-	22,129,013	25,057,584
Receivables					
Taxes Receivable	7,090,601	-	1,376,225	-	8,466,826
Accounts Receivable	389,239	240,104	-	21,018	650,361
Intergovernmental Receivables	15,092,597	-	-	-	15,092,597
Interest Receivable	-	-	37,287	-	37,287
Prepaid Items and Deposits	904	-	-	-	904
To From Other Funds	4,880,284	-	-	-	-
Notes Receivable	1,111,248	14,140,290	-	-	15,251,538
Assets Held for Resale	-	10,273,404	-	-	10,273,404
	<u>-</u>	<u>10,273,404</u>	<u>-</u>	<u>-</u>	<u>10,273,404</u>
Total Assets	\$ 107,740,059	\$ 33,634,692	\$ 23,746,458	\$ 22,150,031	\$ 182,390,956
Liabilities					
Accounts Payable	1,026,112	113,481	62,421	2,093,740	3,295,754
Accrued Liabilities	-	-	8,503	-	8,503
Accrued Salaries	632,539	20,308	13,902	-	666,749
Due to Other Funds	-	-	-	4,880,284	-
Funds Held for Others	95,289	-	-	-	95,289
Unearned Revenues	9,336	-	-	-	9,336
Total Liabilities	1,763,276	133,789	84,826	6,974,024	4,075,631
Deferred Inflows of Resources					
Property Taxes and Assessments	3,693,864	-	-	-	3,693,864
Total Deferred Inflows of Resources	3,693,864	-	-	-	3,693,864
Fund Balances					
Nonspendable					
Prepaid Items	904	-	-	-	904
Notes Receivable	1,111,248	-	-	-	1,111,248
Restricted					
Emergencies	3,345,000	-	-	-	3,345,000
Capital Projects	61,226,900	-	-	-	61,226,900
Affordable Housing	-	33,500,903	-	-	33,500,903
Open Space	-	-	10,235,090	18,111,229	28,346,319
Accommodation Unit Compliance	-	-	6,552,306	-	6,552,306
Marketing	-	-	556,213	-	556,213
Parks and Recreation	-	-	22,378	-	22,378
Committed					
Marketing	-	-	6,295,645	-	6,295,645
Nicotine Programs	414,350	-	-	-	414,350
Sustainability Programs	479,239	-	-	-	479,239
Assigned					
Capital Projects	-	-	-	737,492	737,492
Next Year's Budget	365,088	-	-	-	365,088
Unassigned	35,340,190	-	-	(3,672,714)	31,667,476
	<u>102,282,919</u>	<u>33,500,903</u>	<u>23,661,632</u>	<u>15,176,007</u>	<u>174,621,461</u>
Total Fund Balances	102,282,919	33,500,903	23,661,632	15,176,007	174,621,461
	<u>102,282,919</u>	<u>33,500,903</u>	<u>23,661,632</u>	<u>15,176,007</u>	<u>174,621,461</u>
Total Liabilities, Deferred Inflows of Resources, and Fund Balances	\$ 107,740,059	\$ 33,634,692	\$ 23,746,458	\$ 22,150,031	\$ 182,390,956

See Notes to the Financial Statements.

Town of Breckenridge, Colorado
Reconciliation of the Balance Sheet of Governmental Funds
to the Statement of Net Position
Governmental Funds
December 31, 2022

DRAFT

**Amounts Reported for Governmental Activities
in the Statement of Net Position are Different Because:**

Total Fund Balances of Governmental Funds	\$ 174,621,461
Capital assets used in governmental activities are not financial resources, and therefore, are not reported in governmental funds.	240,394,107
Long-term liabilities and related items are not due and payable in the current year, and therefore, are not reported in governmental funds.	
Certificates of Participation Payable	(73,465,000)
Debt Premiums	(10,530,336)
Capital Lease Liability	-
Accrued Interest Payable	(223,252)
Accrued Compensated Absences	(1,180,943)
Net OPEB Liability	(1,507,962)
OPEB-related Deferred Outflows of Resources	539,678
OPEB-related Deferred Inflows of Resources	(308,556)
Internal Service Funds are blended into Governmental Activities	
Garage Service Net Position	12,684,506
Information Services Net Position	1,194,784
Facilities Maintenance Net Position	4,974,945
Health Benefits Net Position	<u>1,040,953</u>
Total Net Position of Governmental Activities	<u>\$ 348,234,385</u>

Town of Breckenridge, Colorado
Statement of Revenues, Expenditures and Changes in Fund Balances
Governmental Funds
For the Year Ended December 31, 2022

DRAFT

	General Fund	Affordable Housing Fund	Other Governmental Funds	Capital Projects Fund	Totals
Revenues					
Taxes and Assessments	\$ 59,271,954	\$ 5,966,809	\$ 9,649,925	\$ -	\$ 74,888,688
Licenses and Permits	1,739,815	-	1,461,422	-	3,201,237
Intergovernmental	4,797,069	719,650	122,328	864,479	6,503,526
Charges for Services	10,208,544	436,967	10,259,029	136,400	21,040,940
Fines and Forfeitures	827,546	-	-	-	827,546
Investment Earnings	272,318	85,979	(785)	261,905	619,417
Other	419,421	187,860	-	3,747,085	4,354,366
Total Revenues	<u>77,536,667</u>	<u>7,397,265</u>	<u>21,491,919</u>	<u>5,009,869</u>	<u>111,435,720</u>
Expenditures					
Current					
General Government	5,026,754	-	4,804,168	-	9,830,922
Public Safety	6,124,808	-	-	-	6,124,808
Public Works	13,903,312	-	-	3,657,561	17,560,873
Community Development	6,198,866	13,694,315	3,612,399	(75)	23,505,505
Culture and Recreation	9,240,104	-	-	-	9,240,104
Open Space Acquisition	-	-	1,720,427	-	1,720,427
Grants to Other Agencies	1,288,349	-	-	-	1,288,349
Capital Outlay	2,303,634	-	1,555,378	25,195,097	29,054,109
Debt Service					
Principal	1,620,000	620,000	-	-	2,240,000
Interest	1,712,124	661,126	-	-	2,373,250
Debt Issuance Costs	3,000	150,845	-	-	153,845
Total Expenditures	<u>47,420,951</u>	<u>15,126,286</u>	<u>11,692,372</u>	<u>28,852,583</u>	<u>103,092,192</u>
Revenues Over (Under) Expenditures	<u>30,115,716</u>	<u>(7,729,021)</u>	<u>9,799,547</u>	<u>(23,842,714)</u>	<u>8,343,528</u>
Other Financing Sources (Uses)					
Issuance of Certificates of Participation	-	17,775,000	-	-	17,775,000
Original Issue Premium on Certificates of Participation	-	1,892,049	-	-	1,892,049
Transfers In	135,719	-	-	20,170,000	20,305,719
Transfers Out	(20,205,955)	(546,287)	(79,486)	-	(20,831,728)
Total Other Financing Sources (Uses)	<u>(20,070,236)</u>	<u>19,120,762</u>	<u>(79,486)</u>	<u>20,170,000</u>	<u>19,141,040</u>
Net Change in Fund Balances	10,045,480	11,391,741	9,720,061	(3,672,714)	27,484,568
Fund Balances, Beginning of Year	<u>92,237,439</u>	<u>22,109,162</u>	<u>13,941,571</u>	<u>18,848,721</u>	<u>147,136,893</u>
Fund Balances, End of Year	<u>\$ 102,282,919</u>	<u>\$ 33,500,903</u>	<u>\$ 23,661,632</u>	<u>\$ 15,176,007</u>	<u>\$ 174,621,461</u>

See Notes to the Financial Statements.

Town of Breckenridge, Colorado
Reconciliation of the Statement of Revenues, Expenditures, and Changes in
Fund Balances of Governmental Funds to the Statement of Activities
Governmental Funds
For the Year Ended December 31, 2022

DRAFT

**Amounts Reported for Governmental Activities
in the Statement of Activities are Different Because:**

Net Change in Fund Balances of Governmental Funds	\$ 27,484,568
Capital outlays to purchase or construct capital assets are reported in governmental funds as expenditures. However, for governmental activities those costs are capitalized in the statement of net position and are allocated over their estimated useful lives as annual depreciation expense in the statement of activities.	
Capital Outlay	27,816,885
Loss on Disposal of Assets	(1,399,445)
Depreciation Expense	(6,253,771)
Some expenses reported in the statement of activities do not require the use of current financial resources and, therefore, are not reported as expenditures in governmental funds.	
Payments on Long-Term Debt	2,744,367
Proceeds from Long-Term Debt	(19,667,049)
Change in Accrued Interest Payable	(28,396)
Change in Grants	-
Change in Accrued Compensated Absences	(176,074)
Change in Pension Asset	(49,600)
Change in Pension Related Deferred Outflows of Resources	20,184
Change in Pension Related Deferred Inflows of Resources	(117,733)
Internal Service Funds are blended into Governmental Activities:	
Change in Net Position:	
Garage Services	2,553,733
Information Technology	336,458
Facility Maintenance	321,340
Health Benefits	<u>1,046,538</u>
Change in Net Position of Governmental Activities	<u>\$ 34,632,005</u>

Town of Breckenridge, Colorado
Statement of Net Position
Proprietary Funds
December 31, 2022

DRAFT

	Business-Type Activities			Governmental Activities
	Utility Fund	Nonmajor Funds	Totals	Internal Service Funds
Assets				
Current Assets				
Cash and Investments	\$ 2,362,844	\$ 3,425,760	\$ 5,788,604	\$ 15,368,026
Accounts Receivables	1,650,837	(1,178)	1,649,659	3,382
Total Current Assets	<u>4,013,681</u>	<u>3,424,582</u>	<u>7,438,263</u>	<u>15,371,408</u>
Noncurrent Assets				
Restricted Cash and Investments	19,549,616	-	19,549,616	-
Capital Assets				
Not Being Depreciated	24,473,298	5,790,582	30,263,880	-
Being Depreciated,				
Net of Accumulated Depreciation	73,449,798	3,148,553	76,598,351	5,417,648
Total Noncurrent Assets	<u>117,472,712</u>	<u>8,939,135</u>	<u>126,411,847</u>	<u>5,417,648</u>
Total Assets	<u>121,486,393</u>	<u>12,363,717</u>	<u>133,850,110</u>	<u>20,789,056</u>
Liabilities				
Current Liabilities				
Accounts Payable	1,022,599	25,490	1,048,089	638,819
Accrued Liabilities	-	-	-	19,912
Accrued Salaries	39,252	22,170	61,422	35,766
Accrued Interest Payable	358,764	-	358,764	-
Funds Held by Other	6,209	-	6,209	-
Current Portion of Long-term Liabilities				
Accrued Compensated Absences	7,848	4,866	12,714	2,828
Capital Lease Obligations Payable	323,653	53,600	377,253	-
Total Current Liabilities	<u>1,758,325</u>	<u>106,126</u>	<u>1,864,451</u>	<u>697,325</u>
Noncurrent Liabilities				
Accrued Compensated Absences	70,630	43,794	114,424	25,452
Capital Lease Obligations Payable	59,465,042	79,916	59,544,958	171,091
Total Noncurrent Liabilities	<u>59,535,672</u>	<u>123,710</u>	<u>59,659,382</u>	<u>196,543</u>
Total Liabilities	<u>61,293,997</u>	<u>229,836</u>	<u>61,523,833</u>	<u>893,868</u>
Net Position				
Net Investment in Capital Assets	38,134,401	8,805,619	46,940,020	5,246,557
Unrestricted	22,057,995	3,328,262	25,386,257	14,648,631
Total Net Position	<u>\$ 60,192,396</u>	<u>\$ 12,133,881</u>	<u>\$ 72,326,277</u>	<u>\$ 19,895,188</u>

See Notes to the Financial Statements.

Town of Breckenridge, Colorado
Statement of Revenues, Expenses, and Changes in Net Position
Proprietary Funds
For the Year Ended December 31, 2022

DRAFT

	Business-Type Activities			Governmental Activities
	Utility Fund	Nonmajor Funds	Total	Internal Service Fund
Operating Revenues				
Charges for Services	\$ 5,496,953	\$ 4,011,589	\$ 9,508,542	\$ 3,465
Intergovernmental	-	-	-	3,382
Reimbursement of Expenses	579,753	77,940	657,693	1,904,618
Insurance Recoveries	-	-	-	26,139
Internal Service Revenue	-	-	-	10,962,384
Employee Paid Premiums	-	-	-	613,257
Other Operating Revenue	34,477	-	34,477	172,528
Total Operating Revenues	<u>6,111,183</u>	<u>4,089,529</u>	<u>10,200,712</u>	<u>13,685,773</u>
Operating Expenses				
Administration	5,571,730	201,028	5,772,758	-
Water Rights Maintenance	127,061	-	127,061	-
Depreciation	2,695,446	617,668	3,313,114	1,128,141
Motor Vehicle Maintenance	-	-	-	757,173
Facility Maintenance	-	-	-	604,046
Information Systems Maintenance	-	-	-	1,252,966
Health Program	-	-	-	4,944,612
Golf Course Maintenance	-	1,084,769	1,084,769	-
Golf Pro Shop	-	1,231,388	1,231,388	-
Total Operating Expenses	<u>8,394,237</u>	<u>3,134,853</u>	<u>11,529,090</u>	<u>8,686,938</u>
Operating Income	<u>(2,283,054)</u>	<u>954,676</u>	<u>(1,328,378)</u>	<u>4,998,835</u>
Nonoperating Revenues (Expenses)				
Interest Income	75,824	3,819	79,643	8,647
Interest Expense	(840,452)	(6,836)	(847,288)	(4,133)
Proceeds from Sale of Assets	(101,556)	-	(101,556)	(745,280)
Total Nonoperating Revenues (Expenses)	<u>(866,184)</u>	<u>(3,017)</u>	<u>(869,201)</u>	<u>(740,766)</u>
Income Before Capital Contributions & Transfers	<u>(3,149,238)</u>	<u>951,659</u>	<u>(2,197,579)</u>	<u>4,258,069</u>
Capital Contributions & Transfers				
Grant	7,543,802	-	7,543,802	-
Plant Investment Fees	594,870	-	594,870	-
Transfers In	564,198	97,530	661,728	-
Transfers Out	(102,166)	(33,553)	(135,719)	-
Total Capital Contributions & Transfers	<u>8,600,704</u>	<u>63,977</u>	<u>8,664,681</u>	<u>-</u>
Change in Net Position	<u>5,451,466</u>	<u>1,015,636</u>	<u>6,467,102</u>	<u>4,258,069</u>
Net Position, Beginning of Year	<u>54,740,930</u>	<u>11,118,245</u>	<u>65,859,175</u>	<u>15,637,119</u>
Net Position, End of Year	<u>\$ 60,192,396</u>	<u>\$ 12,133,881</u>	<u>\$ 72,326,277</u>	<u>\$ 19,895,188</u>

See Notes to the Financial Statements.

Town of Breckenridge, Colorado
Statement of Cash Flows
Proprietary Funds
For the Year Ended December 31, 2022

DRAFT

	Business-Type Activities			Governmental Activities
	Utility Fund	Nonmajor Funds	Total	Internal Service Fund
Cash Flows From Operating Activities				
Cash Received from Customers	\$ 5,686,329	\$ 4,091,303	\$ 9,777,632	\$ 13,683,832
Cash Payments to Employees	(859,376)	(1,065,509)	(1,924,885)	(686,835)
Cash Payments to Vendors and Suppliers	(5,871,978)	(1,495,130)	(7,367,108)	(7,049,490)
Net Cash Provided by Operating Activities	(1,045,025)	1,530,664	485,639	5,947,507
Cash Flows From Noncapital Financing Activities				
Repayment of Loans to Other Funds	7,543,802	-	7,543,802	-
Transfers from Other Funds	564,198	-	564,198	-
Transfers to Other Funds	(102,166)	12,594	(89,572)	-
Net Cash Used in Noncapital Financing Activities	8,005,834	12,594	8,018,428	-
Cash Flows From Capital and Related Financing Activities				
Acquisition and Construction of Capital Assets	(10,857,240)	(1,843,170)	(12,700,410)	(2,313,648)
Proceeds from Sale of Assets	(101,556)	28,262	(73,294)	68,226
Plant Investment Fees	594,870	-	594,870	-
Proceeds from Issuance of Debt	13,130,000	-	13,130,000	-
Principal Payments on Debt	(2,343,516)	-	(2,343,516)	(58,513)
Interest Payments on Debt	(888,183)	(7,224)	(895,407)	(5,654)
Net Cash Used in Capital and Related Financing Activities	(465,625)	(1,822,132)	(2,287,757)	(2,309,589)
Cash Flows from Investing Activities				
Interest Received	75,824	3,819	79,643	8,647
Net Increase (Decrease) in Cash and Cash Equivalents	6,571,008	(275,055)	6,295,953	3,646,565
Cash and Cash Equivalents, Beginning of Year	15,341,452	3,700,815	19,042,267	11,721,461
Cash and Cash Equivalents, End of Year	<u>\$ 21,912,460</u>	<u>\$ 3,425,760</u>	<u>\$ 25,338,220</u>	<u>\$ 15,368,026</u>
Reconciliation of Operating Income to Net Cash Provided by Operating Activities				
Operating Income	\$ (2,283,054)	\$ 954,676	\$ (1,328,378)	\$ 4,998,835
Adjustments to Reconcile Operating Income to Net Cash Provided by Operating Activities				
Depreciation	2,688,807	623,759	3,312,566	1,290,897
Changes in Asset and Liabilities				
Accounts Receivable	(424,854)	1,767	(423,087)	(1,941)
Accounts Payable and Accrued Liabilities	(1,005,299)	(17,021)	(1,022,320)	(300,024)
Accrued Salaries	9,406	5,381	14,787	10,126
Deposits	1,209	7	1,216	-
Accrued Compensated Absences	(31,240)	(37,905)	(69,145)	(50,386)
Net Cash Provided by Operating Activities	<u>\$ (1,045,025)</u>	<u>\$ 1,530,664</u>	<u>\$ 485,639</u>	<u>\$ 5,947,507</u>

See Notes to the Financial Statements.

Note 1: Summary of Significant Accounting Policies

The accounting policies of the Town conform to generally accepted accounting principles as applicable to government entities. The Governmental Accounting Standard Board (GASB) is the accepted standard-setting body for establishing governmental accounting and financial reporting principles. Following is a summary of the more significant policies.

Reporting Entity

The Town of Breckenridge became a home rule municipal corporation in 1980. The Town is governed by a mayor and six-member council elected by the residents.

In accordance with Governmental Accounting Standards, the Town has considered the possibility of inclusion of additional entities in its basic financial statements. The definition of the reporting entity is based primarily on financial accountability. The Town is financially accountable for organizations that make up its legal entity. It is also financially accountable for legally separate organizations if Town officials appoint a voting majority of the organization's governing body and either it is able to impose its will on that organization or there is a potential for the organization to provide specific financial benefits to, or to impose specific financial burdens on, the Town. The Town may also be financially accountable for governmental organizations that are fiscally dependent upon it. As such, the reporting entity is comprised of the primary government and its component units, entities for which the government is considered to be financially accountable.

Blended component units are, in substance, part of the Town's operations, even though they are legally separate entities. Thus, blended component units are appropriately presented as funds of the Town. Each discretely presented component unit is reported in a separate column in the government-wide financial statements to emphasize that it is legally separate from the Town.

Blended Component Units

The Town of Breckenridge Finance Authority (the Finance Authority) was established to allow for the issuance of certificates of participation with subsequent leasing of the underlying assets to the Town. The Finance Authority is fully controlled by the Town Council. The transactions of the Finance Authority have been eliminated as part of the financial presentation, but it is hereby incorporated by reference.

On January 13, 2015, the Town established the Breckenridge Housing Authority (BHA) and Pinewood 2, LLC (LLC) to facilitate the construction of a 47-unit affordable rental housing project, Pinewood 2 (PW2). The BHA has a three-member board; the Mayor as Chairperson, the Mayor Pro Tem as Vice Chairperson, and the Town Manager (or designee) as Secretary and Executive Director of the Finance Authority. As a result, the LLC is reflected in the accompanying financial statements as a blended component unit as its governing body is substantively the same as the Town, and the LLC provides services entirely to the government. The BHA does not issue separate financial statements and is a blended component unit. The BHA is the sole member of the LLC, which does not issue separate financial statements. The LLC is presented as a blended unit in the Affordable Housing Fund.

Note 1: Summary of Significant Accounting Policies (Continued)

Discretely Presented Component Unit

Pinewood 2, LLC is the general partner of Pinewood 2, LLLP (LLLP). The LLLP contains the project itself, and its financials are presented discretely as a component unit of the Town. This organizational structure was utilized in order to allow the Town to realize the benefits of low-income housing tax credits (LIHTEC). The LLLP has another partner, the Midwest Housing Equity Group (MHEG). MHEG's membership in the LLLP allows for the monetization of the LIHTEC. Pinewood 2 LLLP would not exist without its relationship with the Town for the purpose of providing an affordable housing option to the residents. Due to the nature and significance of this relationship, it is presented as a discretely presented component unit with the financial statements of the Town.

Separately issued financial statements for the Pinewood 2, LLLP can be obtained from Corum Real Estate at 600 S. Cherry Street Glendale, CO 80246.

Related Organizations

The Town's officials are also responsible for appointing four of nine members of the board of the Breckenridge Tourism Office (formerly known as GoBreck), a marketing organization that serves the Town's business community, but the Town's accountability for this organization does not extend beyond making the appointments. The BTO appoints the remainder of the board and submits a request to the Town each year for budget support. In 2020, the Town expended \$3,987,248 to the Breckenridge Tourism Office (BTO) out of its Marketing Fund.

The Breckenridge Historical Alliance (BHA) is another organization that works closely with the Town. The BHA is responsible for administering many of the Town's historical sites, such as the Barney Ford Victorian Home, Edwin Carter Discovery Center, and William H. Briggles House. They also provide walking tours of the Town's historic core. They also recommend and administer capital maintenance and improvements to our historic sites. The BHA maintains its own 7-member board. In 2020, the Town contributed \$470,058 to the BHA's efforts.

The Breckenridge Creative Arts (BCA) is an independent non-profit organization that works with the Town to maintain and program our Arts District campus. It has an eleven-member board, including one Town Council liaison (appointed by the Mayor) and the Town Manager as an *ex-officio* member. The remaining members are appointed by BCA. Town support for the BCA in 2020 was \$2,036,961. In addition, the BCA paid the Town \$173,174 for facility maintenance and \$38,327 for information technology.

The Town and Summit County cut the ribbon on Huron Landing, a 26-unit workforce housing rental development on County Road 450. The Huron Landing Authority is a 50-50 partnership between the Town and Summit County formed to operate the rental units. Each organization contributed funding, staff time and in-kind resources to the housing project. Summit County has owned the 1.7-acre property on CR 450 since the 1960s; the community identified it as a potential workforce housing site during the 2010 update of the Upper Blue Master Plan. Corum Real Estate Group will provide day-to-day property management services at Huron Landing. Four units are reserved for employees of the Town and Summit County government.

Note 1: Summary of Significant Accounting Policies (Continued)

Government-wide and Fund Financial Statements

The government-wide financial statements (i.e., the statement of net position and the statement of activities) report information on all nonfiduciary activities of the Town and its component unit.

The reporting information includes all of the non-fiduciary activities of the Town. These statements are to distinguish between the governmental and business-type activities of the Town. Governmental activities normally are supported by taxes and intergovernmental revenues, and are reported separately from business-type activities, which rely to a significant extent on fees and charges for support.

The statement of activities presents a comparison between direct expenses and program revenues for the different business-type activities of the Town and for each function of the Town's governmental activities. Direct expenses are those that are specifically associated with a program or function and, therefore, are clearly identifiable to a particular function. Program revenues include fees and charges paid by the recipients of goods or services offered by the programs, and grants and contributions that are restricted to meeting the operational or capital requirements of a particular program. Revenues that are not classified as program revenues are presented as general revenues. In general, the effects of interfund activity have been eliminated from the government-wide financial statements. For 2020, this included the offset of internal service activity in the governmental activities presentation.

The fund financial statements provide information about the Town's funds. Separate statements for each fund category, governmental and proprietary, are presented. The emphasis of fund financial statements is on major governmental and enterprise funds, each displayed in a separate column. All remaining governmental and enterprise funds would be aggregated and reported as non-major funds. The Town presently does not treat any of its governmental or enterprise funds as non-major.

Measurement Focus, Basis of Accounting, and Financial Statement Presentation

The government-wide financial statements are reported using the *economic resources measurement focus* and the *accrual basis of accounting*, as are the proprietary fund and trust fund financial statements. Revenues are recorded when earned and expenses are recorded when the liability is incurred, regardless of the timing of related cash flows. Property taxes are recognized as revenues in the year for which they are levied. Grants and similar items are recognized as revenue as soon as all eligibility requirements imposed by the provider have been met. The custodial fund utilizes the accrual basis of accounting.

Governmental fund financial statements are reported using the *current financial resources measurement focus* and the *modified accrual basis of accounting*. Revenues are recognized as soon as they are both measurable and available. Revenues are considered to be *available* when they are collected within the current year or soon enough thereafter to pay liabilities of the current year. For this purpose, the Town considers revenues to be available if they are collected within 60 days of the end of the current year.

Note 1: Summary of Significant Accounting Policies (Continued)

Measurement Focus, Basis of Accounting, and Financial Statement Presentation
(Continued)

Taxes, intergovernmental revenues, and interest associated with the current year are considered to be susceptible to accrual and so have been recognized as revenues of the current year. All other revenues are considered to be measurable and available only when cash is received by the Town.

Expenditures generally are recorded when a liability is incurred, as under accrual accounting. However, debt service expenditures, as well as expenditures related to compensated absences, are recorded only when payment is due. Proprietary funds distinguish operating revenues and expenses from nonoperating items. Operating revenues and expenses generally result from providing services and producing and delivering goods in connection with a proprietary fund's principal ongoing operations. Operating expenses for enterprise funds include the cost of sales and services, administrative expenses, and depreciation on capital assets. All revenues and expenses not meeting this definition are reported as nonoperating revenues and expenses.

When both restricted and unrestricted resources are available for a specific use, it is the Town's practice to use restricted resources first, then unrestricted resources as they are needed.

In the fund financial statements, the Town reports the following major governmental funds:

General Fund - The General Fund is the general operating fund of the Town. It is used to account for all financial resources except those required to be accounted for in another fund.

Special Revenue Funds - Special Revenue Funds are used to account for the collection and disbursement of specific revenue sources. The Town's major Special Revenue Fund is as follows:

Affordable Housing Fund - The Affordable Housing Program is intended to assure the provision of housing for employees who work in the Upper Blue basin. The program's major components include the development and implementation of policies and programs that assure housing. A down payment assistance program for Town employees is provided to assist employees in obtaining housing in the area. This loan program is designed to assist with recruitment and retention. In addition, the Town provides limited transitional housing for employees in units both leased and owned by the Town. Costs related to owned and leased units including homeowner's association dues and general maintenance are accounted for in this fund as well.

Capital Projects Fund - This fund accounts for major Town multi-year capital projects. The Town accounts for the capital expenditures in this fund to facilitate the monitoring of operations in the Town's General Fund departments.

Note 1: Summary of Significant Accounting Policies (Continued)

Measurement Focus, Basis of Accounting, and Financial Statement Presentation
(Continued)

In addition to the above, the Town reports the following nonmajor special revenue funds:

Open Space Acquisition Fund - A one half of one percent sales tax has been authorized by the voters for the purpose of an open space program. At times, implementing the goals of this program may require acquiring land for open space values. An open space master plan has been adopted which provides a framework for decisions on open space purchases. Revenues include a dedicated ½ of 1% sales tax, various grants, and annexation fees.

Marketing Fund - This fund accounts for the Town's participation in the Breckenridge Resort Chamber marketing program as well as community marketing grants through various non-profit organizations. The source of funding is a dedicated portion of the Town's sales and accommodations taxes as well as business license fees.

Conservation Trust Fund - This fund was established pursuant to Colorado State law to account for the receipt and disbursement of lottery funds. Each year the State distributes a percentage of the profits from the sale of lottery tickets to municipalities which may be used only to maintain, acquire, or construct recreation facilities, park facilities, or open space. As the Town funds its capital projects through the Capital Fund, the Town transfers their conservation trust proceeds to the Capital Fund as allowed projects are completed.

Accommodation Unit Compliance Fund - This fund accounts for the Town's accommodation unit fee charged to short-term rental units. Funds generated from this fee is used to assist the Town in provided workforce housing.

Proprietary Funds

Enterprise Funds - Enterprise Funds are used to account for operations that are financed and operated in a manner similar to private business enterprises, where the intent of the governing body is that costs (expenses, including depreciation) of providing goods or services to the general public on a continuing basis be financed or recovered primarily through user charges. The Town's enterprise funds are as follows:

Utility Fund - This fund accounts for the operations of the Town's water system.

Golf Course Fund (nonmajor) - This fund accounts for the operations of the Town's golf course.

Cemetery Fund (nonmajor) - This fund accounts for the operations of the Town's cemetery.

Note 1: Summary of Significant Accounting Policies (Continued)

Measurement Focus, Basis of Accounting, and Financial Statement Presentation
(Continued)

Internal Service Funds - Internal Service Funds are used to account for operations that provide services to other departments or agencies of the Town on a cost-reimbursement basis. The Town's Internal Service funds are as follows:

Garage Fund - This fund accounts for the administration and operating expenses associated with the repair and maintenance of Town vehicles and equipment. The Fund will also purchase new vehicles and equipment. Costs related to the fund are allocated to the Town's other operating funds based on budgeted usage. Business-type activities represent only 1.61% of Garage Fund activities; therefore, the fund is consolidated with the governmental activities in the government-wide financial statements.

Information Services Fund - This fund is responsible for all aspects of the Town's computerized information systems. Costs related to the fund are allocated to the Town's other operating funds based on budgeted usage. Business-type activities represent only 9.24% of Information Services Fund activities; therefore, the fund is consolidated with the governmental activities in the government-wide financial statements.

Facility Maintenance Fund - This fund is responsible for certain aspects of the Town's facilities maintenance. Costs related to the fund are allocated to the Town's other operating funds based on budgeted usage. Business-type activities represent only 2.21% of Facilities Maintenance Fund activities; therefore, the fund is consolidated with the governmental activities in the government-wide financial statements.

Health Benefits Fund - This fund was created in 2018 to better track and predict the cost of the Town's employee health plan. Costs related to the fund are allocated to the Town's other operating funds based on budgeted use. Business-type activities represent 9.00% of Health Benefits Fund activities, therefore, the fund is consolidated with the governmental activities in the government-wide financial statements.

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 1: Summary of Significant Accounting Policies (Continued)

Budgets

The Town follows these procedures in establishing the budgetary data reflected in the financial statements:

- The Town's charter contains the following budget language:
Adoption of the budget by council shall constitute appropriations of the amounts specified therein for expenditure from the funds indicated. The proceeds of any municipal borrowing authorized by Article XI of this Charter shall not be subject to any requirement of prior budgeting or appropriation as a condition to their expenditure. The amount necessary to repay any such municipal borrowing (including interest thereon) need not be budgeted or appropriated in full in the year in which the borrowing occurs; however, amounts necessary to pay debt service shall (except to the extent they may be payable from other legally available funds in the first year) be budgeted and appropriated on an annual basis, provided that no failure to budget and appropriate such annual debt service amounts shall affect the enforceability of any covenant of the town to make such payments. An appropriation for a capital expenditure shall continue in effect until the purpose for which the appropriation was made has been accomplished, or until the appropriation is abandoned or transferred. (Ord. 7, Series 2002, Election 4-2-2002)
- All appropriations lapse at year end except as noted previously. Colorado governments may not exceed budgeted appropriations at the fund level.
- By October 15th of each year the Town Administration submits to the Town Council a proposed operating budget for the fiscal year commencing the following January 1st. The operating budget includes proposed expenditures and the means of financing them.
- Public hearings are conducted to obtain taxpayer comments.
- The Town certifies the mill levies to the Board of County Commissioners by December 15th.
- Prior to December 31, the budget is legally enacted through passage of an ordinance.
- The Town Administration is authorized to transfer budgeted amounts between departments within any fund; however, any revisions that alter the total expenditures of any fund must be approved by the Town Council.
- Budgets are legally adopted for all funds of the Town. Budgets for the General, Special Revenue, and Capital Projects Funds are adopted on a basis consistent with generally accepted accounting principles (GAAP). Budgetary comparisons presented for the Enterprise and Internal Service Funds are presented on a non-GAAP budgetary basis. Tap fees, grant revenues and debt proceeds are recognized as revenue for budget purposes. Capital outlay is budgeted as an expenditure.

Assets, Liabilities and Net Position/Fund Balances

Cash Equivalents - Cash equivalents include investments with original maturities of three months or less. Investments in pooled cash are considered cash equivalents.

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 1: Summary of Significant Accounting Policies (Continued)

Assets, Liabilities and Net Position/Fund Balances (Continued)

Receivables - All receivables are reported at their gross value and, where appropriate, are reduced by the estimated portion that is expected to be uncollectible. As of December 31, 2022, town management determined that an allowance was not necessary.

Inventory - Inventories are valued at cost, using the first-in, first-out (FIFO) method. The costs of inventories are recorded as expenses when consumed rather than when purchased.

Prepaid Expenses - Certain payments to vendors reflect costs applicable to future years and are reported as prepaid expenses. Expenses are recorded when consumed rather than when purchased.

Capital Assets - Capital assets, which include land, buildings, equipment, and all infrastructure owned by the Town, are reported in the applicable governmental or business-type activities columns in the government-wide financial statements and in the proprietary funds in the fund financial statements. Capital assets are defined by the Town as assets with an initial, individual cost of \$5,000 or more and an estimated useful life in excess of one year. Such assets are recorded at historical cost or estimated historical cost if purchased or constructed. Donated capital assets are recorded at the acquisition value on the date of donation. The costs of normal maintenance and repairs that do not add to the value of the assets or materially extend asset lives are not capitalized.

Capital assets are depreciated using the straight-line method over the following estimated useful lives.

Buildings	5 - 100 years
Infrastructure	5 - 30 years
Collection and Distribution Systems	30 - 50 years
Machinery, Equipment and Vehicles	5 - 15 years

Compensated Absences - Employees of the Town are allowed to accumulate unused vacation time up to 240 hours and unused sick time up to 480 hours. One-third of sick leave will be paid out to any employee upon termination after three years of continuous service not to exceed 80 hours.

Accumulated unpaid vacation pay is accrued when earned. In the government-wide presentation, accumulated compensated absences not expected to be paid with current available resources are reported as long-term liabilities. Governmental Activity compensated absences have normally been liquidated by the General Fund. The Town has estimated that 10% of the outstanding compensated absence balances will be liquidated within the next twelve months.

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 1: Summary of Significant Accounting Policies (Continued)

Assets, Liabilities and Net Position/Fund Balances (Continued)

Long-Term Obligations – In the government-wide financial statements and the proprietary funds in the fund financial statements, long-term debt and other long-term obligations are reported as liabilities in the applicable governmental activities, business-type activities, or proprietary fund statement of net position. Debt premiums and discounts are deferred and amortized over the life of the debt using the straight-line method.

In the fund financial statements, governmental funds recognize the face amount of debt issued as other financing sources. Premiums received on debt issuances are reported as other financing sources while discounts on debt issuances are reported as other financing uses.

Debt issuance costs, whether or not withheld from the debt proceeds, are reported as current expenses or expenditures.

Bond Premiums - For the government-wide presentation as well as proprietary fund types, bond premiums are included with long-term debt and amortized over the life of the bonds using straight-line method. In the governmental fund financial statements, bond premiums are recognized as current period expenditures.

Deferred Outflows of Resources - In addition to assets, the statement of net position will sometimes report a separate section for deferred outflows of resources. A deferred outflow of resources is a consumption of net assets by the Town that is applicable to a future reporting period. The Town has one item that qualifies as a deferred outflow of resources related to its OPEB liability per GASB Statement No. 75. See Note 11 for additional information.

Deferred Inflows of Resources - In addition to liabilities, the statement of net position will sometimes report a separate section for deferred inflows of resources. This separate financial statement element, deferred inflows of resources, represents an acquisition of net assets that applies to a future period(s) and so will not be recognized as an inflow of resources (revenue) until that time. The government has only two types of deferred inflows of resources, which arises both under the full accrual and modified accrual basis of accounting that qualifies for reporting in this category. Accordingly, the item, unavailable revenue, is reported in both the governmental activities statement of net position and in the governmental funds balance sheet. The governmental funds report unavailable revenues from property taxes. These amounts are deferred and recognized as an inflow of resources in the period that the amounts become available. Since property tax revenues are collected in arrears during the succeeding year, a receivable and corresponding deferred inflow is recorded at December 31. As the tax is collected in the succeeding year, the deferred inflow is recognized as revenue and the receivable is reduced. In addition, the Town has deferred inflows of resources related to the OPEB liability per GASB Statement No. 75 has been recorded as of December 31, 2020. See Note 11 for additional information.

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 1: Summary of Significant Accounting Policies (Continued)

Assets, Liabilities and Net Position/Fund Balances (Continued)

Net Position/Fund Balances - In the government-wide financial statements and for the proprietary fund statements, net position is either shown as invested in capital assets net of related debt, with these assets essentially being nonexpendable; restricted when constraints placed on the net position are externally imposed; or unrestricted.

For the governmental fund presentation, fund balances that are classified as *non-spendable* include amounts that cannot be spent because they are either (a) not in spendable form or (b) legally or contractually required to be maintained intact. The *not in spendable form* criterion includes items that are not expected to be converted to cash, for example, inventories, prepaid amounts, and notes receivable.

Fund balance should be reported as *restricted* when constraints placed on the use of resources are either (a) externally imposed by creditors (such as through debt covenants), grantors, contributors, or laws or regulations of other governments; or (b) imposed by law through constitutional provisions or enabling legislation.

Amounts that can only be used for specific purposes pursuant to constraints imposed by formal action of the government's highest level of decision-making authority, the Town Council, should be reported as *committed* fund balance. Those committed amounts cannot be used for any other purpose unless the government removes or changes the specified use by taking the same type of action (for example, legislation, resolution, ordinance) it employed to previously commit those amounts.

Amounts that are constrained by the government's intent to be used for specific purposes, but are neither restricted nor committed, should be reported as *assigned* fund balance. Through resolution, the Town Council has authorized the Town's financial services director or designee to assign fund balances.

All remaining fund balance in the General Fund or deficits in the other governmental funds are presented as unassigned.

Property Taxes

Property taxes attach as an enforceable lien on January 1, are levied the following December, and are collected in the subsequent calendar year. Taxes are payable in full on April 30 or in two installments on February 28 and June 15. The County Treasurer's Office collects property taxes and remits to the Town on a monthly basis.

Since property tax revenues are collected in arrears during the succeeding year, receivables and corresponding deferred inflows of resources are reported at December 31.

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 1: Summary of Significant Accounting Policies (Continued)

Other Post-Employment Benefits (OPEB)

The Town provides a single-employer defined benefit post-employment (OPEB) health care plan that covers eligible retired employees of the Plan. No assets are accumulated in a trust that meets the criteria in paragraph 4 of Statement 75.

Subsequent Events

We have evaluated subsequent events through December 12, 2022, the date the financial statements were available to be issued.

Note 2: Cash and Investments

Cash Deposits

Cash and investments at December 31, 2022, consisted of the following:

Cash on Hand	\$ 5,085
Deposits	54,929,696
Investments	56,113,875
Local Government Investment Pool	62,275,629
Total	\$ 173,324,285

Cash and investments are reported in the financial statements as follows:

Cash and Investments	\$ 128,717,085
Restricted Cash and Investments	44,607,200
Total	\$ 173,324,285

The Colorado Public Deposit Protection Act (PDPA) requires all local government entities to deposit cash in eligible public depositories. Eligibility is determined by State regulations. Amounts on deposit in excess of federal insurance levels must be collateralized by eligible collateral as determined by the PDPA. The PDPA allows the financial institution to create a single collateral pool for all public funds held. The pool is to be maintained by another institution or held in trust for all uninsured public deposits as a group. The market value of the collateral must be at least equal to 102% of the uninsured deposits. At December 31, 2022, the Town had bank deposits of \$46,689,574 collateralized with securities held by the financial institution's agent but not in the Town's name.

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 2: Cash and Investments (Continued)

Cash Deposits (Continued)

The discretely presented component unit - Pinewood 2, LLLP has cash deposits of \$455,229, of which \$253,030 is unrestricted and \$202,199 is restricted. Cash in excess of \$250,000 is collateralized by PDPA.

Restricted Cash

The General Fund has restricted cash of \$2,928,571 representing \$322,720 in forfeitures of retirement contributions and \$2,605,851 held by UMB Trust. The cash will be held by UMB until requests to draw against these funds are paid by the Town as construction expenses for the parking structure as incurred.

The Utility Fund has a restricted cash balance of \$19,549,616 that was held by Colorado Water Resources & Power Development Authority (CWRPDA). The cash will be held by CWRPDA until requests to draw against these funds are paid by the Town as construction expenses are incurred. The Note Payable that relates to this cash is described in Note 6 - Long Term Debt.

The Capital Fund has cash of \$22,129,013 restricted for the construction of the fiber infrastructure. The cash will be held by UMB until requests to draw against these funds are paid by the Town as construction expenses as incurred.

Investments

State statutes and the Town's investment policy specify the investment instruments meeting defined rating, maturity, and concentration risk criteria in which the Town may invest, which include the following. State statutes do not address custodial risk.

- Obligations of the United States and certain U.S. Agency securities
- Certain international agency securities
- General obligation and revenue bonds of U.S. local government entities
- Bankers' acceptances of certain banks
- Commercial paper
- Local government investment pools
- Written repurchase agreements collateralized by certain authorized securities
- Certain money market funds
- Guaranteed investment contracts

The Town measures and records its investments using guidelines established by generally accepted accounting principles. These guidelines recognize a three-tiered hierarchy, as follows:

- Level 1: Quoted prices for identical investments in active markets;
- Level 2: Observable inputs other than quoted market prices; and,
- Level 3: Unobservable inputs

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 2: Cash and Investments (Continued)

Investments (Continued)

The Town had the following investments at December 31, 2022:

Investment	Maturity	Rating	Level 1	Level 2	Level 3	Total
ColoTrust Plus+	N/A	Aam	\$ 62,275,629	\$ -	\$ -	\$ 62,275,629
U.S. Treasuries	Less than 1 year	Aaa	-	24,825,557	-	24,825,557
U.S. Treasuries	1 to 5 years	Aaa	-	17,459,690	-	17,459,690
U.S. Instruments	Less than 1 year	Aaa	-	8,437,075	-	8,437,075
U.S. Instruments	1 to 5 years	Aaa	-	3,442,345	-	3,442,345
Corporate Fixed Income	Less than 1 year	N/A	-	1,949,208	-	1,949,208
Total						\$ 118,389,504

The Town's investments in U.S. Treasuries are valued using quoted prices in markets that are not considered to be active, dealer quotations or alternative pricing sources for similar assets or liabilities for which all significant inputs are observable, either directly or indirectly (Level 2 inputs).

Fair Value Measurements - The Town reports its investments using the fair value measurements established by generally accepted accounting principles. As such, a fair value hierarchy categorizes the inputs used to measure the fair value of the investments into three levels. Level 1) inputs are quoted prices in active markets for identical investments; Level 2) inputs include quoted prices in active markets for similar investments, or other observable inputs; and Level 3) inputs are unobservable inputs. At December 31, 2022, the Town's investments in U.S. Treasury and Agency securities were measured utilizing quoted prices in active markets for similar investments (Level 2 inputs). The Town's investments in the Invesco Treasury Money Market Fund and the local government investment pools were measured at the net asset value per share.

Interest Rate Risk - State statutes generally limit investment securities to an original maturity of five years unless the governing board authorizes the investment for a period in excess of five years.

Credit Risk - State statutes limit investments in money market funds to those that maintain a constant share price, with a maximum remaining maturity in accordance with the Securities and Exchange Commission's Rule 2a-7, and either assets of one billion dollars or the highest rating issued by one or more nationally recognized statistical rating organizations.

Local Government Investment Pools - At December 31, 2022, the Town had a total of \$62,275,629 invested in the Colorado Local Government Liquid Asset Trust (Colotrust). The pool are investment vehicles established for local government entities in Colorado to pool surplus funds. The Colorado Division of Securities administers and enforces the requirements of creating and operating the pools. The pools operate in conformity with the Securities and Exchange Commission's Rule 2a-7.

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 2: Cash and Investments (Continued)

Investments (Continued)

The pools are measured at the net asset value per share, with each share valued at \$1. The pools are rated AAAM by Standard and Poor's. Investments of the pools are limited to those allowed by State statutes. A designated custodial bank provides safekeeping and depository services in connection with the direct investment and withdrawal functions. The custodian's internal records identify the investments owned by the participating governments.

Custodial Credit Risk - At December 31, 2022, the Town's investments in U.S. Treasury and Agency securities were held by the counterparty (broker), but not in the Town's name.

Note 3: Note Receivable

A summary of the Changes in the Note Receivable is as follows:

Notes Receivable	Balance 12/31/21	Additions	Deletions	Balance 12/31/22
Breckenridge Nordic Center, LLC	\$ 1,147,899	\$ -	\$ (36,651)	\$ 1,111,248
Pinewood 2, LLLC	6,012,386	-	(100,000)	5,912,386
Alta Verda Affordable Housing	3,986,731	1,225,269	-	5,212,000
Alta Verda Affordable Housing	-	3,000,000	-	3,000,000
Employee Verde Affordable Housing	76,745	-	(60,841)	15,904
	<u>\$ 11,223,761</u>	<u>\$ 4,225,269</u>	<u>\$ (197,492)</u>	<u>\$ 15,251,538</u>

The Town has outstanding notes receivable totaling \$1,111,248 at December 31, 2022, due from the Breckenridge Nordic Center, LLC under a loan agreement dated June 15, 2011, for the construction of a new facility and storage building. The note is collateralized by a deed of trust/security interest in the new facility. The note is paid in monthly installments of principal and interest over 30 years beginning May 1, 2014, at an interest rate of 4% per annum.

The Town's 2015 contributions to Pinewood 2, LLLC, for construction of a new affordable rental housing project, Pinewood 2, are recognized as a note receivable in the Affordable Housing Fund. As of December 31, 2022, the amount of this note receivable was \$5,912,386. The project was completed in July of 2016. In 2017, the loan was converted from a construction loan to a permanent financing loan. The annual payments are to be made from the net income from the housing project. The first annual payment will be made in 2018 from the 2017 net income, and then annually thereafter. The term of the loan is an interest rate of 2.5% and a 40-year term.

In 2021 and in 2022, Town Council approved resolutions to enter into an agreement with Alta Verde, LLC in order to assist Alta Verde, LLC in securing interest in real property. The note was collateralized by a deed of trust and an assignment of leases and rents. The amount of the note outstanding as of December 31, 2022, was \$8,212,000. Under the agreement principal and interest is paid based upon surplus cash flow of the project. Any unpaid interest is capitalized into the principal on a monthly basis, with interest at a rate of 1.0% per annum.

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 3: Note Receivable (Continued)

In 2000, The Town instituted a housing down payment assistance program where regular (non-seasonal) Town employees can borrow money from the Town to purchase housing. The purpose of the program is to assist qualified Town of Breckenridge employees with the purchase of a home within a reasonable commuting distance of their jobs. Eligible activities are down payment assistance for a home purchase or new construction only. The Town's note is a second mortgage on the property with a fixed interest rate of 3% amortized over 20 years. The note is due in 10 years or upon sale or transfer of the home from the employee to another party. The default interest rate of Prime plus 3% is put into effect as the new fixed rate upon a payment past due 90 days or greater or 1 year after termination of employment from the Town. As of December 31, 2022, the amount of these notes outstanding totaled \$15,904.

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 4: Assets Held for Resale

The Town has a program whereas they acquire housing properties within the Town limits and resale the properties to employees of either the Town or Town employers. The Town holds 18 properties as of December 31, 2022. During 2022, the Town sold thirteen (13) properties for a total of \$9,726,842, resulting in a net loss of \$2,574,905.

A summary of the activity is as follows:

	Balance	Additions	Sales	Balance	Loss on Sale of Properties
Airport Rd, Unit 207	\$ 422,957	\$ -	\$ -	\$ 422,957	\$ -
Altanic Lode, 120	-	699,957	(699,957)	-	211,681
Berlin Placer #10	310,700	-	-	310,700	-
Berlin Placer #9	310,700	-	-	310,700	-
Blazing Saddles, Unit 116	-	520,373	-	520,373	-
Bucyrus 145	675,852	-	(675,852)	-	90,863
Edleweiss, Unit 4	-	365,384	(365,384)	-	131,644
Fairview, 671	-	1,318,561	(1,318,561)	-	408,970
Farivew, 841	1,135,867	-	(1,135,867)	-	275,453
Gold Camp, Unit A48	-	814,674	-	814,674	-
Gold Camp C66	651,418	-	-	651,418	-
Gold Camp E42	735,372	-	-	735,372	-
Gold Camp, E90	651,062	-	(651,062)	-	187,853
Gold Camp, I120	440,921	-	(440,921)	-	(22,967)
Grandview, Unit B9	-	536,151	-	536,151	-
Grandview, Unit C3	-	810,086	-	810,086	-
High Tor 163, Unit 8	613,870	-	(613,870)	-	174,382
High Tor 163, Unit 9	-	725,949	-	725,949	-
Highland Greens, Unit 213	-	596,985	(596,985)	-	197,045
Highlands Green 205	400,803	-	-	400,803	-
Highlands Green 309	402,353	-	-	402,353	-
Kenington, Unit 227	-	899,903	(899,903)	-	278,871
Kenington, Unit 261	-	784,687	(784,687)	-	295,743
Kingdom Park, 850	849,827	-	-	849,827	-
Magnum Bonum, Unit 58	-	817,760	-	817,760	-
Peak 8 Village, B6	659,473	-	(659,473)	-	100,000
Reiling, 66	-	884,320	(884,320)	-	245,367
Tannhauser 2, Unit 10	-	650,247	-	650,247	-
Val d Isere, Unit 111	336,768	-	-	336,768	-
Val d Isere, Unit 207	427,099	-	-	427,099	-
Wildflower, Unit A110	-	550,167	-	550,167	-
Assets Held for Resales	<u>\$ 9,025,042</u>	<u>\$ 10,975,204</u>	<u>\$ (9,726,842)</u>	<u>\$ 10,273,404</u>	<u>\$ 2,574,905</u>

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 5: Capital Assets

Governmental capital assets activity for the year ended December 31, 2022, is summarized below:

Governmental Activities	Balance 12/31/21	Additions	Transfers	Deletions	Balance 12/31/22
Capital Assets, Not Being Depreciated					
Land	\$ 54,557,935	\$ 312,122	\$ 1,409,642	\$ (10,883)	\$ 56,268,816
Art	117,914	-	-	-	117,914
Construction in Progress	60,622,495	26,073,857	(11,628,600)	-	75,067,752
Total Capital Assets, Not Being Depreciated	115,298,344	26,385,979	(10,218,958)	(10,883)	131,454,482
Capital Assets, Being Depreciated					
Buildings	102,681,761	1,223,634	-	(388,854)	103,516,541
Improvements	37,946,940	-	4,557,564	-	42,504,504
Infrastructure	23,846,041	-	4,890,196	(6,924,785)	21,811,452
Equipment	13,258,489	207,270	771,198	(8,787,796)	5,449,161
Internal Service Improvements	104,520	-	-	-	104,520
Equipment	16,345,795	2,965,389	-	(7,555,772)	11,755,412
Total Capital Assets, Being Depreciated	194,183,546	4,396,293	10,218,958	(23,657,207)	185,141,590
Less Accumulated Depreciation for					
Buildings	(37,044,211)	(3,149,651)	-	179,655	(40,014,207)
Improvements	(12,241,983)	(1,888,184)	-	-	(14,130,167)
Infrastructure	(10,956,565)	(796,258)	-	5,753,762	(5,999,061)
Equipment	(12,567,150)	(419,678)	-	8,787,796	(4,199,032)
Internal Service Improvements	(52,823)	(6,968)	-	-	(59,791)
Equipment	(11,832,058)	(1,283,929)	-	6,733,928	(6,382,059)
Total Accumulated Depreciation	(84,694,790)	(7,544,668)	-	21,455,141	(70,784,317)
Total Capital Assets, Being Depreciated, Net	109,488,756	(3,148,375)	10,218,958	(2,202,066)	114,357,273
Governmental Activities Capital Assets, Net	\$ 224,787,100	\$ 23,237,604	\$ -	\$ (2,212,949)	\$ 245,811,755

Depreciation is allocated to the Town's governmental activities as follows:

Governmental Activities	
General Government	\$ 1,204,985
Public Safety	761,476
Public Works	1,117,881
Community Development	2,210,339
Culture and Recreation	959,090
Internal Service Funds	1,290,897
Total	\$ 7,544,668

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 5: Capital Assets (Continued)

Business-type capital assets activity for the year ended December 31, 2022, is summarized below:

	Balance 12/31/21	Additions	Transfers	Deletions	Balance 12/31/22
Business-Type Activities					
Capital Assets, <i>Not Being Depreciated</i>					
Land	\$ 5,634,909	\$ -	\$ -	\$ -	\$ 5,634,909
Construction in Progress	9,426,743	12,011,255	-	-	21,437,998
Water and Water Storage Rights	3,190,973	-	-	-	3,190,973
Total Capital Assets, <i>Not Being Depreciated</i>	18,252,625	12,011,255	-	-	30,263,880
Capital Assets, <i>Being Depreciated</i>					
Buildings	69,026,356	-	-	-	69,026,356
Infrastructure	5,306,300	631,397	-	-	5,937,697
Improvements	15,757,187	5,536	-	(205,927)	15,556,796
Equipment	25,672,629	160,417	-	(203,681)	25,629,365
Total Capital Assets, <i>Being Depreciated</i>	115,762,472	797,350	-	(409,608)	116,150,214
<i>Less: Accumulated Depreciation for</i>					
Buildings	(10,365,172)	(1,652,025)	(102,833)	(102,833)	(12,222,863)
Infrastructure	(1,394,572)	(416,580)	-	-	(1,811,152)
Improvements	(10,263,762)	(740,369)	102,833	205,927	(10,695,371)
Equipment	(14,488,942)	(503,592)	-	170,057	(14,822,477)
Total Accumulated Depreciation	(36,512,448)	(3,312,566)	-	273,151	(39,551,863)
Total Capital Assets, Being Depreciated, <i>Net</i>	79,250,024	(2,515,216)	-	(136,457)	76,598,351
Business-Type Activities Capital Assets, <i>Net</i>	\$ 97,502,649	\$ 9,496,039	\$ -	\$ (136,457)	\$ 106,862,231

Depreciation expense was charged to function/programs of the Town as follows:

Business-type Activities	
Utility Fund	\$ 2,688,807
Golf Course Fund	623,759
Total	\$ 3,312,566

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 5: Capital Assets (Continued)

Component Unit capital assets activity for the year ended December 31, 2022, is summarized below:

	Balance 12/31/21	Additions	Transfers	Deletions	Balance 12/31/22
Discreetly Presented Component Unit					
Capital Assets, <i>Being Depreciated</i>					
Buildings and Improvements	\$ 9,035,023	\$ -	\$ -	\$ -	\$ 9,035,023
Equipment	787,735	-	-	-	787,735
Total Capital Assets, <i>Being Depreciated</i>	9,822,758	-	-	-	9,822,758
Less Accumulated Depreciation for					
Buildings and Improvements	(2,848,293)	(375,132)	-	-	(3,223,425)
Equipment	-	-	-	-	-
Total Accumulated Depreciation	(2,848,293)	(375,132)	-	-	(3,223,425)
Total Capital Assets, Being Depreciated, <i>Net</i>	6,974,465	(375,132)	-	-	6,599,333
Discreetly Presented Component Unit Capital Assets, <i>Net</i>	\$ 6,974,465	\$ (375,132)	\$ -	\$ -	\$ 6,599,333

Note 6: Long-Term Debt

Governmental Activities

Following is a summary of long-term transactions for the year ended December 31, 2022:

	Balance 12/31/21	Additions	Payments	Balance 12/31/22	Due Within One Year
Governmental Activities					
Certificate of Participation, 2016	\$ 6,965,000	\$ -	\$ (575,000)	\$ 6,390,000	\$ 590,000
Premium	729,445	-	(52,104)	677,341	-
Certificate of Participation, 2020	41,810,000	-	(1,380,000)	40,430,000	1,430,000
Premium	6,354,404	-	(276,278)	6,078,126	-
Certificate of Participation, 2021	9,155,000	-	(285,000)	8,870,000	300,000
Premium	2,058,805	-	(175,985)	1,882,820	-
Certificate of Participation, 2022	-	17,775,000	-	17,775,000	585,000
Premium	-	1,892,049	-	1,892,049	-
Capital Leases - Internal Services	229,604	-	(58,513)	171,091	61,507
Compensated Absences					
Governmental	1,004,869	276,561	(100,487)	1,180,943	118,094
Internal Services	78,666	36,146	(86,532)	28,280	2,828
Totals	\$ 68,385,793	\$ 19,979,756	\$ (2,989,899)	\$ 85,375,650	\$ 3,087,429

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 6: Long-Term Debt (Continued)

Governmental Activities (Continued)

Certificates of Participation

On March 10, 2016, the Town issued certificates of participation in the amount of \$10,060,000 (2016 COPs). \$2,325,000 was used for the refunding of the 2005 COP (related to the construction of the police department facility) and \$7,735,000 was available for the construction of the Huron Landing affordable housing project. The certificates require semi-annual interest and annual principal payments on June 1 and December 1 through December 2030. The Certificates bear interest at rates varying from 2-5%. Payments are allocated between the Housing Fund and the Excise Fund, which is combined with the General Fund for reporting purposes.

The annual debt service requirements for the 2016 COPs are as follows:

<u>Year Ended December 31,</u>	<u>Principal</u>	<u>Interest</u>	<u>Total</u>
2023	\$ 590,000	\$ 264,500	\$ 854,500
2024	605,000	246,800	851,800
2025	620,000	228,650	848,650
2026	380,000	203,850	583,850
2027	395,000	188,650	583,650
2028 - 2032	2,210,000	698,500	2,908,500
2033 - 2036	1,590,000	161,500	1,751,500
Total	\$ <u>6,390,000</u>	\$ <u>1,992,450</u>	\$ <u>8,382,450</u>

In May of 2020, the Town Council approved the issuance of certificates of participation (2020 COPs). After final pricing, the proceeds for the Town for the 2020 Certificates of Participation total \$50,716,961. The underlying assets securing these COPs are the Breckenridge Grand Vacation Community Center (BGVCC), Breckenridge Town Hall, Breckenridge Recreation Center & Kingdom Park, Riverwalk Center Theatre, and the Police Department Building. The COPs are payable over 25 years at an all-in true interest cost of 2.734% per annum for the 2020A taxable bonds and 1.131% per annum for the 2020B tax exempt bonds. Of this issue, \$2.4M was used to retire the principle of the 2007 COP debt issue (related to the construction of a childcare facility). The remaining amount is designated to fund the construction of a parking structure and expansion of the Fiber Infrastructure project. Construction began in June of 2020.

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 6: Long-Term Debt (Continued)

Governmental Activities (Continued)

Certificates of Participation

The annual debt service requirements for the 2020 COPs are as follows:

<u>Year Ended December 31,</u>	<u>Principal</u>	<u>Interest</u>	<u>Total</u>
2023	\$ 1,430,000	\$ 1,598,523	\$ 3,028,523
2024	1,490,000	1,539,075	3,029,075
2025	1,555,000	1,476,293	3,031,293
2026	1,575,000	1,452,845	3,027,845
2027	1,645,000	1,382,866	3,027,866
2028 - 2032	8,065,000	5,870,433	13,935,433
2033 - 2037	9,870,000	4,063,468	13,933,468
2038 - 2042	10,430,000	2,090,064	12,520,064
2043 - 2044	4,370,000	264,000	4,634,000
Total	\$ <u>40,430,000</u>	\$ <u>19,737,567</u>	\$ <u>60,167,567</u>

In December 2021, the Town Council approved the issuance of certificates of participation (2021 COPs). The proceeds of the 2021 COPs were used for the purpose of finance the acquisition, construction, installation, equipping of for rent workforce housing on the leased property. The lease term is 20 years, maturing on December 1, 2041 with annual principal and interest payments of approximately \$1,422,000. Interest accrues at 5% per year.

The annual debt service requirements for the 2021 COPs are as follows:

<u>Year Ended December 31,</u>	<u>Principal</u>	<u>Interest</u>	<u>Total</u>
2023	\$ 300,000	\$ 397,550	\$ 697,550
2024	315,000	382,550	697,550
2025	330,000	366,800	696,800
2026	350,000	350,300	700,300
2027	365,000	332,800	697,800
2028 - 2032	2,125,000	1,370,250	3,495,250
2033 - 2037	2,640,000	817,100	3,457,100
2038 - 2041	2,445,000	249,200	2,694,200
Total	\$ <u>8,870,000</u>	\$ <u>4,266,550</u>	\$ <u>13,136,550</u>

In December 2022, the Town Council approved the issuance of certificates of participation (2022 COPs). The proceeds of the 2022 COPs will be used for the purpose building 52 work force housing apartments. The lease term is 20 years, maturing on December 1, 2042 with annual principal and interest payments of increasing from \$285,000 to \$645,000. Interest accrues at 5% per year.

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 6: Long-Term Debt (Continued)

Governmental Activities (Continued)

The annual debt service requirements for the 2022 COPs are as follows:

<u>Year Ended December 31,</u>	<u>Principal</u>	<u>Interest</u>	<u>Total</u>
2023	\$ 585,000	\$ 836,906	\$ 1,421,906
2024	565,000	859,500	1,424,500
2025	590,000	831,250	1,421,250
2026	620,000	801,750	1,421,750
2027	650,000	770,750	1,420,750
2028 - 2032	3,780,000	3,331,250	7,111,250
2033 - 2037	4,825,000	2,287,000	7,112,000
2038 - 2041	6,160,000	954,000	7,114,000
Total	<u>\$ 17,775,000</u>	<u>\$ 10,672,406</u>	<u>\$ 28,447,406</u>

In 2019, the Town entered into a lease agreement for \$355,298 for the purchase of high voltage battery packs for the Town's buses. The lease term is six years, maturing on August 1, 2025, with monthly principal and interest payments of \$5,833. Interest accrues at 5% per year.

Following is a schedule of the future lease payments under this capital lease and the present value of the lease payments at December 31, 2022:

<u>Year Ended December 31,</u>	<u>Principal</u>	<u>Interest</u>	<u>Total</u>
2023	\$ 61,507	\$ 8,493	\$ 70,000
2024	64,654	5,346	70,000
2025	44,930	1,737	46,667
Total	<u>\$ 171,091</u>	<u>\$ 15,576</u>	<u>\$ 186,667</u>

Compensated absences of the governmental activities are expected to be liquidated primarily with revenues of the General Fund.

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 6: Long-Term Debt (Continued)

Business-Type Activities

Following is a summary of long-term debt transactions for the year ended December 31, 2022:

	Balance 12/31/21	Additions	Payments	Balance 12/31/22	Due Within One Year
Business-Type Activities					
CWR&PDA, Series 2017	\$ 48,048,413	\$ -	\$ (2,343,516)	\$ 45,704,897	\$ 2,343,516
Premium	1,009,904	-	(56,106)	953,798	-
CWR&PDA, Series 2022	-	13,130,000	-	13,130,000	323,653
Premium	-	-	-	-	-
Capital Lease	184,899	-	(51,382)	133,517	53,600
Compensated Absences					
Stormwater Fund	196,283	18,349	(87,495)	127,137	12,714
	<u>196,283</u>	<u>18,349</u>	<u>(87,495)</u>	<u>127,137</u>	<u>12,714</u>
Totals	\$ <u>49,439,499</u>	\$ <u>13,148,349</u>	\$ <u>(2,538,499)</u>	\$ <u>60,049,349</u>	\$ <u>2,733,483</u>

Notes Payable

In November 2017, the Town entered into a loan agreement with the Colorado Water Resources Power Development Authority (CWRPDA) for a principal amount of \$56,990,796, in order to construct a 2nd water plant to serve the Town's growing needs. The loan has a prime interest rate and is payable in bi-annual payments beginning on February 1, 2018, with a maturity date of August 1, 2039.

The annual debt service requirements for the 2017 CWRPDA are as follows:

<u>Year Ended December 31,</u>	<u>Principal</u>	<u>Interest</u>	<u>Total</u>
2023	\$ 2,365,634	\$ 861,033	\$ 3,226,667
2024	2,410,399	816,783	3,227,182
2025	2,454,376	774,033	3,228,409
2026	2,497,507	733,033	3,230,540
2027	2,534,683	694,033	3,228,716
2028 - 2032	13,015,185	3,133,063	16,148,248
2033 - 2037	14,194,559	1,956,706	16,151,265
2038 - 2039	6,232,554	225,446	6,458,000
	<u>6,232,554</u>	<u>225,446</u>	<u>6,458,000</u>
Total	\$ <u>45,704,897</u>	\$ <u>9,194,130</u>	\$ <u>54,899,027</u>

In August 2022, the Town entered into a loan agreement with the Colorado Water Resources Power Development Authority (CWRPDA) for a principal amount of \$13,130,000, in order to provide the matching funds required for the FEMA grant which involves reconstruction of the Tarn Dam for the purpose of flood control. The loan has a 2.0% interest rate and is payable in annual payments beginning on August 1, 2023, with a maturity date of August 1, 2053.

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 6: Long-Term Debt (Continued)

Business-Type Activities

Notes Payable

The annual debt service requirements for the 2022 CWRPDA are as follows:

<u>Year Ended December 31,</u>	<u>Principal</u>	<u>Interest</u>	<u>Total</u>
2023	\$ 323,653	\$ 262,600	\$ 586,253
2024	330,127	256,127	586,254
2025	336,729	249,524	586,253
2026	343,464	242,790	586,254
2027	350,333	235,921	586,254
2028 - 2032	1,859,610	1,071,658	2,931,268
2033 - 2037	2,053,159	878,108	2,931,267
2038 - 2042	2,266,854	664,414	2,931,268
2043 - 2047	2,502,790	428,478	2,931,268
2048 - 2052	2,763,281	167,984	2,931,265
Total	\$ <u>13,130,000</u>	\$ <u>4,457,604</u>	\$ <u>17,587,604</u>

Capital Lease

In June 2021, the Town entered into a lease agreement for \$213,885 for the purchase of golf carts for use at the Town's golf course. The lease term is 48 months, maturing in May 2025 with monthly principal and interest payments of \$4,852. Interest accrues at 4.23% per year.

Following is a schedule of the future lease payments under this capital lease and the present value of the lease payments at December 31, 2022:

<u>Year Ended December 31,</u>	<u>Principal</u>	<u>Interest</u>	<u>Total</u>
2023	\$ 53,600	\$ 4,619	\$ 58,219
2024	55,913	2,306	58,219
2025	24,004	255	24,259
Total	\$ <u>133,517</u>	\$ <u>7,180</u>	\$ <u>140,697</u>

Discretely Presented Component Unit

Pinewood 2 LLLP has a note payable to the Town of Breckenridge, related to an affordable housing project known as Pinewood 2. A bridge loan was issued in 2016 for \$3.37 million at 0.75% interest and retired with a payment in full through the refinancing process in 2017. The outstanding note payable was refinanced in 2017, converting the construction loan to a permanent financing loan, with interest only payments made from available cash flow at a rate of 2.50% annually, excess interest added to the principal balance, and the principal balance due at maturity, April 30, 2057. Loan balance as of December 31, 2022, was \$6,012,385 million at 2.5% interest. Payments are made annually from available cash flow.

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 7: Interfund Balances and Transfers

It is the Town's policy to report all sales, accommodations and real estate transfer taxes into the General Fund and then distribute these receipts to the other funds for operating purposes. As the Town funds its capital projects during the year, through the Capital Fund, the Town transfers the Conservation Trust proceeds to the Capital Fund as allowed projects are completed.

During the year ended December 31, 2022, the Town made the following transfers:

Transfers Out	Transfers In:				
	Special				Total
	Revenue Funds				
	General	Capital Projects	Marketing	Health Utility	
General Fund	\$ -	\$ 20,115,000	\$ -	\$ -	\$ 20,115,000
Affordable Housing	-	-	-	546,287	546,287
Open Space	-	-	-	17,911	17,911
Conservation Trust	-	55,000	-	-	55,000
Utility	102,166	-	-	-	102,166
Golf Course	33,553	-	-	-	33,553
Total	\$ 135,719	\$ 20,170,000	\$ -	\$ 564,198	\$ 20,869,917

Note 8: Retirement Commitments

Money Purchase Pension Plan

The Town provides pension benefits for its employees through a defined contribution money purchase plan. The plan is administered by the ICMA Retirement Corporation. Covered employees are required to participate in the plan from the date of employment and are fully vested after six years of continuous service. The plan provisions can be modified by the Town Council. The Town contributes an amount equal to 7% or 9% of the covered employee's salary each month, depending upon the employee's length of full-time regular employment with the Town. During the year ended December 31, 2022, contributions totaled \$1,000,794. The Town has no liability for this plan beyond its current annual contribution.

Deferred Compensation Plan

Pursuant to GASB Statement No. 32: *Accounting and Financial Reporting for Internal Revenue Code Section 457 Deferred Compensation Plans*, the Town established a trust to hold the assets of its Deferred Compensation Plan, and modified the plan document to state that the plan is *held in trust for the exclusive benefit of participants and their beneficiaries*. As such the plan's assets are no longer the property and rights of the Town and are not reflected in the financial statements of the Town.

Note 9: Commitments and Contingencies

Claims and Judgments

The Town participates in a number of federal and state programs that are fully or partially funded by grants received from other governmental entities. Expenditures financed by grants are subject to audit by the appropriate grantor government. If expenditures are disallowed due to noncompliance with grant program regulations, the Town may be required to reimburse the grantor government. At December 31, 2022, significant amounts of grant expenditures have not been audited but management believes that disallowed expenditures, if any, based on subsequent audits will not have a material effect on the overall financial position of the Town.

TABOR Amendment

Colorado voters passed an amendment to the State Constitution, Article X, Section 20, which has several limitations, including revenue raising, spending abilities, and other specific requirements of state and local governments. On April 5, 1994, voters within the Town approved the collection, retention and expenditure of the full revenues generated by the Town in 1994 and subsequent years, notwithstanding the provisions of the Amendment. The Amendment is complex and subject to judicial interpretation. The Town believes it is in substantial compliance with the requirements of the Amendment. However, the Town has made certain interpretations to determine compliance with the Amendment. The Town has established an emergency reserve, representing 3% of qualifying expenditures, as required by the Amendment.

Litigation

The Town is involved in various pending or threatened litigation. The outcome of the litigation cannot be predicted at this time. However, management does not believe the outcome will have a significant effect on the Town's financial position.

Subsequent Year Commitments

As of December 31, 2022, the Town had unexpended commitments that were rolled over into the 2023 budget in the amount of \$_____ in the General Fund.

Note 10: Risk Management

Colorado Intergovernmental Risk Sharing Agency

The Town is exposed to various risks of loss related to torts; theft of, damage to, and destruction of assets; errors and omissions; and natural disasters. For these risks of loss, the Town is involved with the Colorado Intergovernmental Risk Sharing Agency (CIRSA), a separate and independent governmental and legal entity formed by intergovernmental agreement by member municipalities pursuant to the provision of 24-10-115.5, Colorado Revised Statutes (1982 Replacement Volume) and Colorado Constitution, Article XIV, Section 18(2).

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 10: Risk Management (Continued)

The purposes of CIRSA are to provide members defined liability, property, and workers compensation coverage and to assist members in preventing and reducing losses and injuries to municipal property and to persons or property which might result in claims being made against members of CIRSA, their employees and officers.

It is the intent of the members of CIRSA to create an entity in perpetuity which will administer and use funds contributed by the members to defend and indemnify, in accordance with the bylaws, any member of CIRSA against stated liability of loss, to the limit of the financial resources of CIRSA. It is also the intent of the members to have CIRSA provide continuing stability and availability of needed coverage at reasonable costs. All income and assets of CIRSA shall be at all times dedicated to the exclusive benefit of its members. CIRSA is a separate legal entity, and the Town does not approve budgets, nor does it have the ability to significantly affect the operations of the unit.

The amounts of settlements have not exceeded insurance coverage the past three years, nor were there any significant changes in insurance coverage. The Town carries commercial insurance for workers compensation coverage.

Self-Insurance

The Town partially self-insures its medical and dental insurance claims. The Town provides coverage up to \$80,000 per employee and a total stop loss of \$2,243,005 or 125% of the prior year claims. The Town carries commercial insurance for all claims in excess of that amount.

A summary of the Town's self-insured claims and liability is as follows:

Claims Payable, December 31, 2020	\$ 428,208
Claims Incurred and Adjustments	4,867,381
Claims Paid	<u>(5,166,240)</u>
Claims Payable, December 31, 2021	129,349
Claims Incurred and Adjustments	4,944,612
Claims Paid	<u>(5,054,049)</u>
Claims Payable, December 31, 2021	<u>\$ 19,912</u>

Note 11: Other Post -Employment Benefits

Plan Description

The Town of Breckenridge provides a single employer defined benefit post-employment health care plan that covers eligible retired employees of the Town. An employee is eligible for retiree coverage when he or she has reached a minimum age of 55 years and satisfies one of the following:

Note 11: Other Post -Employment Benefits (Continued)

Plan Description (Continued)

- For continuous employment, the employee has been employed by the Town for a minimum of 15 years on a regular full-time basis; or
- For non-continuous employment, the employees have been employed by the Town in aggregate a minimum of 15 years on a regular full-time basis. Any period of unemployment with the Town shall not exceed five years at any one time.

The Town of Breckenridge follows the Rule of 70 which enables an employee to retire as early as age 55, and with a minimum of 15 years of regular full-time employment, without a benefit reduction, provided the combined credited service and age at termination equals or exceeds the sum of 70. If an employee would have qualified for the Rule of 70 prior to July 1, 2016, they will be permitted to participate in the employer's retiree coverage.

The spouse of a covered employee is eligible for retiree coverage on the same date the covered employee qualifies for retiree coverage only if the following two criteria are met:

- The spouse was covered under the Town's medical plan immediately prior to the employee becoming eligible for retiree coverage (regardless of whether the employee is enrolled in Medicare at the time of retirement); and
- He/she has been the employee's spouse (including common law or domestic partner if appropriate documents and affidavits are provided) for at least two years.

In the event the employee and spouse meet the retiree medical plan benefit eligibility criteria, but the employee dies before retiring, the surviving spouse will maintain his/her eligibility rights to retiree coverage, if timely elected. All other retiree medical plan provisions will apply.

The General Fund typically have been used in prior years to liquidate the OPEB liabilities.

Benefits Provided

Retirees are eligible for medical and dental benefits. Health care coverage is provided through one of two self-insured medical plans, a Health Reimbursement Arrange Plan (HRA) or a Health Savings Account (HSA).

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 11: Other Post -Employment Benefits (Continued)

Contributions

Retiree premiums for the medical and dental program in 2022 are shown below. The rates are the same for the HRA and HSA plans. Retirees pay the same rates as actives.

<u>Coverage Category</u>	<u>Medical</u>	<u>Dental</u>
Retire Only	\$ 110.00	\$ 22.88
Retire + Spouse	\$ 235.00	\$ 43.12
Retire + Child(ren)	\$ 220.00	\$ 58.12
Retire + Family	\$ 345.00	\$ 73.47

Employees Covered by Benefit Terms

As of December 31, 2022, the number of active and inactive employees covered by the plan was as follows. The count of retirees does not include spouses unless covered as spouse only. The count of active employees does not include COBRA continues or employees who waived medical coverage.

Retired Employees Currently Receiving Benefit Payments	7
Active Employees	<u>176</u>
Total	\$ <u>183</u>

Total OPEB Liability

The Town's total OPEB liability is \$1,507,962 as of December 31, 2022 and was determined by an actuarial valuation as of that date.

Actuarial Methods and Assumptions

The total OPEB liability in the December 31, 2022, actuarial valuation was determined using the following actuarial assumptions and other inputs, applied to all periods included in the measurement, unless otherwise specified:

Inflation	3.0% per year
Salary Increases	5.0%
Discount Rate	2.25%
Healthcare Cost Trend Rates	6.4 percent for 2022, decreasing 0.1 percent per year to an ultimate rate of 5.7 percent for 2027 and future years
Retirees' share of benefit-Related Costs	15.0 percent of projected health insurance premiums for retirees

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 11: Other Post -Employment Benefits (Continued)

Actuarial Methods and Assumptions (Continued)

The discount rate was based on S&P Municipal Bond 20-year High Grade Rate Index as of December 31, 2021.

Mortality rates were based on the RP-2000 Healthy Annuitant Mortality Table for Males or Females, as appropriate, with adjustments for mortality improvements based on Scale BB.

The actuarial assumptions used in the December 31, 2021 valuation were based on the results of an actuarial experience study for the period January 1, 2021 - December 31, 2022.

Changes in the Total OPEB Liability

Changes in the Total OPEB Liability

Balance at December 31, 2021	\$ 1,458,362
Changes During the Year:	
Service Cost	108,145
Interest	62,855
Difference Between Expected and Actual Experience	112,202
Change of Assumption or Other Inputs	(168,778)
Employer Contributions	(64,824)
Net Changes	<u>49,600</u>
Balance at December 31, 2022	<u>\$ 1,507,962</u>

Changes of assumptions and other inputs reflect a change in the discount rate, participation rate, retirement and termination rates, medical and dental trend, payroll trend and excise tax, as further presented below:

<u>Assumption</u>	<u>Description of Change</u>	<u>Impact on Liability</u>
Discount Rate	Increased from 2.25% to 4.31%	\$ (37,201)
Participation Rate	Updated assumptions based on recent experience:	
	Retire participation increased from 45% to 51.0%	73,770
	Spouse participation reduced from 52% to 49%	
Medical and Dental Trend	Updated assumptions based on historical claims and industry trend study	(69,060)
Total Impact		<u>\$ (32,491)</u>

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 11: Other Post -Employment Benefits (Continued)

Sensitivity of the Total OPEB Liability to Changes in the Discount Rate

The following presents the total OPEB liability of the Town, as well as what the Town's total OPEB liability would be if it were calculated using a discount rate that is 1-percentage-point lower (0.93%) or 1-percentage-point higher (2.93%) than the current discount rate:

	1% Decrease (3.31%)	Current Discount Rate (4.31%)	1% Increase (5.31%)
Total OPEB Liability	\$ <u>1,610,010</u>	\$ <u>1,507,962</u>	\$ <u>1,413,283</u>

Sensitivity of the Total OPEB Liability to Changes in the Healthcare Cost Trend Rates

The following presents the total OPEB liability of the Town, as well as what the Town's total OPEB liability would be if it were calculated using healthcare cost trend rates that is 1-percentage-point lower (5.4%) or 1-percentage-point higher (7.4%) than the current healthcare cost trend rates:

	1% Decrease (4.9%)	Current Trend Rate (5.9%)	1% Increase (6.9%)
Total OPEB Liability	\$ <u>1,384,692</u>	\$ <u>1,507,962</u>	\$ <u>1,650,239</u>

OPEB Expense, Deferred Outflows of Resources and Deferred Inflows of Resources Related to OPEB

For the year ended December 31, 2021, the Town recognized negative OPEB expense of \$180,162. At December 31, 2021, the Town reported deferred outflows of resources and deferred inflows of resources related to OPEB from the following sources:

	Deferred Outflows of Resources	Deferred Inflows of Resources
Differences between expected and actual experience	\$ 590,426	\$ 32,064
Changes in assumptions and other inputs	(50,748)	276,492
Total	\$ <u>539,678</u>	\$ <u>308,556</u>

Town of Breckenridge, Colorado
Notes to Financial Statements
December 31, 2022

DRAFT

Note 11: Other Post -Employment Benefits (Continued)

OPEB Expense, Deferred Outflows of Resources and Deferred Inflows of Resources Related to OPEB (Continued)

Amounts reported as deferred outflows of resources and deferred inflows of resources relate to OPEB will be recognized in OPEB expense as follows:

<u>Year Ended December 31,</u>	
2023	\$ 36,887
2024	36,887
2025	36,887
2026	36,887
2027	36,887
Thereafter	<u>46,687</u>
Total	\$ <u>231,122</u>

Required Supplementary Information

Town of Breckenridge, Colorado
 Budgetary Comparison Schedule
 General Fund
 For the Year Ended December 31, 2022

DRAFT

	Original Budget	Final Budget	Actual	Variance Positive (Negative)
Revenues				
Taxes:				
Property Taxes	\$ 4,256,565	\$ 4,256,565	\$ 3,785,874	\$ (470,691)
Specific Ownership Taxes	165,000	165,000	178,543	13,543
Sales Taxes	29,805,800	29,805,800	35,873,815	6,068,015
Accommodations Taxes	5,118,200	5,118,200	6,830,813	1,712,613
Marijuana Taxes	728,500	728,500	658,274	(70,226)
Franchise Taxes	832,300	832,300	998,167	165,867
Real Estate Transfer Taxes	6,000,000	6,000,000	6,872,481	872,481
Lift Ticket Taxes	-	-	3,993,836	3,993,836
Payments in Lieu of Tax	3,906,206	3,906,206	-	(3,906,206)
Other Taxes	52,700	52,700	49,771	(2,929)
Interest on Taxes	91,065	91,065	7,060	(84,005)
Total Taxes	<u>50,956,336</u>	<u>50,956,336</u>	<u>59,248,634</u>	<u>8,292,298</u>
Licenses and Permits				
Liquor Licenses and Fees	30,000	30,000	25,843	(4,157)
Animal Licenses	750	750	680	(70)
Street Cut Permits	19,000	19,000	35,997	16,997
Building Inspection Permits	450,000	450,000	396,519	(53,481)
Electrical Inspection Permits	40,000	40,000	52,554	12,554
Plumbing and Mechanical Permits	64,537	64,537	109,442	44,905
Parking Permits	-	-	207,917	207,917
Miscellaneous Licenses and Permits	14,000	14,000	906,472	892,472
Total Licenses and Permits	<u>618,287</u>	<u>618,287</u>	<u>1,735,424</u>	<u>1,117,137</u>
Intergovernmental				
Motor Vehicle Fees	27,999	27,999	21,905	(6,094)
Highway Users	214,862	214,862	218,568	3,706
Road and Bridge Levy	236,999	236,999	332,318	95,319
Grants	12,000	860,105	3,693,832	2,833,727
Other	702,459	702,459	538,092	(164,367)
Total Intergovernmental	<u>1,194,319</u>	<u>2,042,424</u>	<u>4,804,715</u>	<u>2,762,291</u>
Charges for Services				
Building Plan Review	350,000	350,000	315,919	(34,081)
Class A, B, C and D Fees	178,752	178,752	188,378	9,626
Recreation Fees and Contributions	3,563,014	3,563,014	5,954,726	2,391,712
Sales of Publication	-	-	1,346	1,346
Other Planning Fees	-	-	2,850	2,850
Parking Fees	5,983,960	5,983,960	2,741,892	(3,242,068)
Administration Fees	-	-	7,184	7,184
Rental Income	869,365	869,365	206,258	(663,107)
Other Charges	395,900	395,900	809,921	414,021
Total Charges for Services	<u>11,340,991</u>	<u>11,340,991</u>	<u>10,228,474</u>	<u>(1,112,517)</u>

(Continued)

See Accompanying Independent Auditor's Report.

Town of Breckenridge, Colorado
 Budgetary Comparison Schedule
 General Fund
 For the Year Ended December 31, 2022
 (Continued)

DRAFT

	Original Budget	Final Budget	Actual	Variance Positive (Negative)
Revenues (Continued)				
Fines and Forfeitures				
Court Costs	20,000	20,000	9,170	(10,830)
Dog Fines	1,000	1,000	560	(440)
Parking Citations	-	-	751,675	751,675
Traffic Citations	75,000	75,000	21,565	(53,435)
Penal Fines	41,300	41,300	40,070	(1,230)
Municipal Forfeits	-	-	(690)	(690)
Other Fines	-	-	5,196	5,196
Total Fines and Forfeits	<u>137,300</u>	<u>137,300</u>	<u>827,546</u>	<u>690,246</u>
Investment Earnings	<u>224,997</u>	<u>224,997</u>	<u>272,318</u>	<u>47,321</u>
Other Revenue				
Reimbursement of Expenditures	22,900	22,900	125,628	102,728
Insurance Recoveries	35,000	35,000	93,858	58,858
Pension Forfeitures	55,000	55,000	108,702	53,702
Contributions and Donations	-	-	50,000	50,000
Other	213,258	213,258	41,368	(171,890)
Total Other Revenue	<u>326,158</u>	<u>326,158</u>	<u>419,556</u>	<u>93,398</u>
Total Revenue	<u>64,798,388</u>	<u>65,646,493</u>	<u>77,536,667</u>	<u>11,890,174</u>
Expenditures				
Current				
General Government				
Legislative	293,636	293,636	326,184	(32,548)
Committees	72,600	72,600	89,105	(16,505)
Judicial	189,607	189,607	167,306	22,301
Legal	312,480	312,480	378,286	(65,806)
Executive and Management	4,435,017	4,435,017	1,671,602	2,763,415
Town Clerk	591,967	591,967	583,693	8,274
Finance	1,519,521	1,519,521	1,393,441	126,080
Other Expenditures	191,454	191,638	417,137	(225,499)
Total General Government	<u>7,606,282</u>	<u>7,606,466</u>	<u>5,026,754</u>	<u>2,579,712</u>
Public Safety				
Police Services	<u>5,445,236</u>	<u>5,445,236</u>	<u>6,124,808</u>	<u>(679,572)</u>

(Continued)

Town of Breckenridge, Colorado
 Budgetary Comparison Schedule
 General Fund
 For the Year Ended December 31, 2022
 (Continued)

DRAFT

	Original Budget	Final Budget	Actual	Variance <i>Positive (Negative)</i>
Expenditures (Continued)				
Public Works				
General Services	1,099,217	1,099,217	641,833	457,384
Street and Parks	5,763,825	5,763,825	5,832,450	(68,625)
Facilities Maintenance	2,388,202	2,388,202	2,108,232	279,970
Engineering and Construction	820,867	820,867	832,374	(11,507)
Public Transportation	6,085,770	6,085,770	4,488,423	1,597,347
Total Public Works	<u>16,157,881</u>	<u>16,157,881</u>	<u>13,903,312</u>	<u>2,254,569</u>
Community Development				
Planning Services	1,295,765	1,295,765	1,305,886	(10,121)
Building Services	763,846	763,846	629,491	134,355
Other Community Development	185,795	185,795	3,164,328	(2,978,533)
Special Projects	650,000	650,000	856,395	(206,395)
Child Care	245,499	245,499	242,766	2,733
Total Community Development	<u>3,140,905</u>	<u>3,140,905</u>	<u>6,198,866</u>	<u>(3,057,961)</u>
Culture and Recreation				
Recreation Programs	<u>8,717,715</u>	<u>8,717,715</u>	<u>9,240,104</u>	<u>(522,389)</u>
Grants to Other Agencies	<u>993,000</u>	<u>993,000</u>	<u>1,288,349</u>	<u>(295,349)</u>
Capital Outlay	<u>8,568,675</u>	<u>8,852,827</u>	<u>2,303,634</u>	<u>6,549,193</u>
Debt Service				
Principal	885,000	885,000	1,620,000	(735,000)
Interest	1,975,190	1,975,190	1,712,124	263,066
Debt Issuance Cost	-	-	3,000	(3,000)
	<u>2,860,190</u>	<u>2,860,190</u>	<u>3,335,124</u>	<u>(474,934)</u>
Total Expenditures	<u>53,489,884</u>	<u>53,774,220</u>	<u>47,420,951</u>	<u>6,353,269</u>
Excess Revenues Over (Under)				
Expenditures	<u>11,308,504</u>	<u>11,872,273</u>	<u>30,115,716</u>	<u>18,243,443</u>
Other Financing Sources (Uses)				
Transfers In	17,817,643	19,087,643	14,484,719	(4,602,924)
Transfers Out	(20,121,510)	(20,121,510)	(34,554,955)	(14,433,445)
Total Other Financing Sources (Uses)	<u>(2,303,867)</u>	<u>(1,033,867)</u>	<u>(20,070,236)</u>	<u>(19,036,369)</u>
Change in Fund Balance	9,004,637	10,838,406	10,045,480	(792,926)
Fund Balance, Beginning of Year	<u>70,591,420</u>	<u>70,591,420</u>	<u>92,237,439</u>	<u>21,646,019</u>
Fund Balance, End of Year	<u>\$ 79,596,057</u>	<u>\$ 81,429,826</u>	<u>\$ 102,282,919</u>	<u>\$ 20,853,093</u>

See Accompanying Independent Auditor's Report.

Town of Breckenridge, Colorado
 Budgetary Comparison Schedule
 Affordable Housing Fund
 For the Year Ended December 31, 2022

DRAFT

	Original Budget	Final Budget	Actual	Variance Positive (Negative)
Revenues				
Taxes	\$ 4,928,500	\$ 4,928,500	\$ 5,966,809	\$ 1,038,309
Intergovernmental	292,250	292,250	719,650	427,400
Charges for Services	584,000	584,000	436,967	(147,033)
Investment Earnings	50,000	50,000	85,979	35,979
Other Revenue	16,000,000	16,000,000	187,860	(15,812,140)
Total Revenues	21,854,750	21,854,750	7,397,265	(14,457,485)
Expenditures				
Current				
Culture and Recreation	2,800,569	2,750,042	13,694,315	10,944,273
Debt Service				
Principal Payments	285,000	285,000	620,000	335,000
Interest Payments	411,080	411,000	661,126	250,126
Debt Issuance Cost	-	-	150,845	150,845
Capital Outlays	3,150,000	-	-	-
	6,646,649	3,446,042	15,126,286	11,680,244
Excess Revenues Over (Under) Expenditures	15,208,101	18,408,708	(7,729,021)	(26,137,729)
Other Financing Sources (Uses)				
Proceeds from Issuance of Debt	-	-	19,667,049	19,667,049
Proceeds from Sale of Assets	3,400,000	3,400,000	-	(3,400,000)
Payments Received on Notes Receivable	151,487	116,551	-	(116,551)
Transfers Out	(22,516,389)	(6,835,000)	(546,287)	6,288,713
Total Other Financing Sources (Uses)	(18,964,902)	(3,318,449)	19,120,762	22,439,211
Net Change in Fund Balance	(3,756,801)	15,090,259	11,391,741	(3,698,518)
Fund Balance, Beginning of Year	20,240,983	20,240,983	22,109,162	1,868,179
Fund Balance, End of Year	\$ 16,484,182	\$ 35,331,242	\$ 33,500,903	\$ (1,830,339)

Town of Breckenridge, Colorado
Required Supplementary Information
Schedule of Changes in the Total OPEB Liability and Related Ratios
For the Year Ended December 31, 2022

DRAFT

	2022	2021	2020	2019	2018
Total OPEB Liability					
Service Cost	\$ 108,145	\$ 117,494	\$ 126,782	\$ 68,527	\$ 71,686
Interest on Total OPEB Liability	62,855	34,076	17,451	30,163	40,237
Difference between Expected and Actual Experience	112,202	(41,564)	366,468	59,687	50,006
Change in Assumptions or Other Inputs	(168,778)	(37,201)	220,756	(20,641)	(192,711)
Employer Contribution	(64,824)	(128,922)	(121,167)	(158,791)	(149,380)
Net Change in OPEB Liability	49,600	(56,117)	610,290	(21,055)	(180,162)
Total OPEB Liability - Beginning of Year	1,458,362	1,514,479	904,189	925,244	1,105,406
Total OPEB Liability - End of Year	<u>\$ 1,507,962</u>	<u>\$ 1,458,362</u>	<u>\$ 1,514,479</u>	<u>\$ 904,189</u>	<u>\$ 925,244</u>

City's Covered-employee Payroll	\$ 15,827,560	\$ 12,219,719	\$ 11,637,828	\$ 11,668,453	\$ 11,668,453

Total OPEB Liability as a Percentage of Covered Payroll	9.5%	11.9%	13.0%	7.7%	7.9%

Note: There are no assets accumulated in a trust to pay related benefits for the OPEB plan.

This schedule is presented to show information for 10 years. Until information for the full 10-year period is available, information will be presented for the years information is available.

Note 1: Stewardship, Compliance and Accountability

Budgetary Accounting

Budgets are adopted for all funds of the Town in accordance with State statutes. Fiduciary fund budgets are not required and have not been presented in the financial statements. Budgets for the governmental funds are adopted on a basis consistent with generally accepted accounting principles (GAAP). Budgetary comparisons for the enterprise funds are presented on a non-GAAP budgetary basis. Capital outlay and debt principle are budgeted as expenditures, but depreciation and amortization are not budgeted.

The Town follows these procedures to establish the budgetary information reflected in the financial statements:

- In October, management submits to the Town Council a proposed operating budget for the fiscal year commencing the following January 1. The operating budget includes proposed expenditures and the means of financing them.
- Public hearings are conducted to obtain taxpayer comments.
- Prior to December 31, the budget is legally adopted through passage of an ordinance.
- Management is authorized to transfer budgeted amounts between departments within any fund. However, any revisions that alter the total expenditures of any fund must be approved by the Town Council.
- All appropriations lapse at year end.

Supplementary Information

Town of Breckenridge, Colorado
Combining Balance Sheet
Nonmajor Governmental Funds
December 31, 2022

DRAFT

	Special Revenue Funds				
	Open Space Acquisition Fund	Marketing Fund	Conservation Trust Fund	Accommodation Unit Compliance Fund	Totals
Assets					
Cash	\$ 9,597,003	\$ 6,124,540	\$ 22,378	\$ 6,589,025	\$ 22,332,946
Receivables					
Taxes	641,159	735,066	-	-	1,376,225
Accounts Receivable	37,287	-	-	-	37,287
Total Assets	<u>\$ 10,275,449</u>	<u>\$ 6,859,606</u>	<u>\$ 22,378</u>	<u>\$ 6,589,025</u>	<u>\$ 23,746,458</u>
Liabilities					
Accounts Payable	\$ 26,457	\$ 7,748	\$ -	\$ 28,216	\$ 62,421
Accrued Liabilities	-	-	-	8,503	8,503
Accrued Salaries	13,902	-	-	-	13,902
Total Liabilities	<u>40,359</u>	<u>7,748</u>	<u>-</u>	<u>36,719</u>	<u>84,826</u>
Fund Balances					
Restricted for					
Parks and Recreation	-	-	22,378	-	22,378
Marketing	-	556,213	-	-	556,213
Accommodation Unit Compliance	-	-	-	6,552,306	6,552,306
Open Space	10,235,090	-	-	-	10,235,090
Committed to					
Marketing	-	6,295,645	-	-	6,295,645
Total Fund Balances	<u>10,235,090</u>	<u>6,851,858</u>	<u>22,378</u>	<u>6,552,306</u>	<u>23,661,632</u>
Total Liabilities, Deferred Inflows of Resources, and Fund Balances	<u>\$ 10,275,449</u>	<u>\$ 6,859,606</u>	<u>\$ 22,378</u>	<u>\$ 6,589,025</u>	<u>\$ 23,746,458</u>

Town of Breckenridge, Colorado
Combining Statement of Revenues, Expenditures and Changes in Fund Balances
Nonmajor Governmental Funds
For the Year Ended December 31, 2022

DRAFT

	Special Revenue Funds				
	Open Space Acquisition Fund	Marketing Fund	Conservation Trust Fund	Accommodation Unit Compliance Trust Fund	Totals
Revenues					
Taxes	\$ 4,741,297	\$ 4,908,628	\$ -	\$ -	\$ 9,649,925
Licenses and Permits	-	1,461,422	-	-	1,461,422
Intergovernmental	57,600	-	64,728	-	122,328
Charges for Services	221,716	-	-	10,037,313	10,259,029
Investment Earnings	(5,506)	(2,331)	38	7,014	(785)
Total Revenues	5,015,107	6,367,719	64,766	10,044,327	21,491,919
Expenditures					
Current					
General Government	-	4,438,668	-	365,500	4,804,168
Community Development	-	-	-	3,612,399	3,612,399
Open Space Acquisition	1,720,427	-	-	-	1,720,427
Capital Outlay	1,555,378	-	-	-	1,555,378
Total Expenditures	3,275,805	4,438,668	-	3,977,899	11,692,372
Excess of Revenues Over (Under) Expenditures	1,739,302	1,929,051	64,766	6,066,428	9,799,547
Other Financing Sources (Uses)					
Transfers Out	(24,486)	-	(55,000)	-	(79,486)
Total Other Financing Sources (Uses)	(24,486)	-	(55,000)	-	(79,486)
Net Change in Fund Balances	1,714,816	1,929,051	9,766	6,066,428	9,720,061
Fund Balances, Beginning of year	8,520,274	4,922,807	12,612	485,878	13,941,571
Fund Balances, End of year	\$ 10,235,090	\$ 6,851,858	\$ 22,378	\$ 6,552,306	\$ 23,661,632

Town of Breckenridge, Colorado
 Budgetary Comparison Schedule
 Open Space Acquisition Fund
 Nonmajor Governmental Funds
 For the Year Ended December 31, 2022

DRAFT

	Original and Final Budget	Actual	Variance <i>Positive</i> <i>(Negative)</i>
Revenues			
Taxes	\$ 4,000,800	\$ 4,497,841	\$ 497,041
Intergovernmental	40,000	57,600	17,600
Charges for Services	132,911	465,172	332,261
Investment Earnings	39,000	(5,506)	(44,506)
Other	35,604	-	(35,604)
	<u>4,248,315</u>	<u>5,015,107</u>	<u>766,792</u>
Total Revenues			
	<u>4,248,315</u>	<u>5,015,107</u>	<u>766,792</u>
Expenditures			
Current			
Open Space Acquisition	1,993,785	1,720,427	273,358
Capital Outlay	-	1,555,378	(1,555,378)
	<u>1,993,785</u>	<u>3,275,805</u>	<u>(1,282,020)</u>
Total Expenditures			
	<u>1,993,785</u>	<u>3,275,805</u>	<u>(1,282,020)</u>
Excess of Revenues Over (Under) Expenditures	<u>2,254,530</u>	<u>1,739,302</u>	<u>(515,228)</u>
Other Financing Sources (Uses)			
Transfers Out	(693,996)	(24,486)	669,510
Total Other Financing Sources (Uses)	<u>(693,996)</u>	<u>(24,486)</u>	<u>669,510</u>
Net Change in Fund Balance	1,560,534	1,714,816	154,282
Fund Balance, Beginning of Year	<u>5,368,108</u>	<u>8,520,274</u>	<u>3,152,166</u>
Fund Balance, End of Year	<u>\$ 6,928,642</u>	<u>\$ 10,235,090</u>	<u>\$ 3,306,448</u>

Town of Breckenridge, Colorado
 Budgetary Comparison Schedule
 Marketing Fund
 Nonmajor Governmental Funds
 For the Year Ended December 31, 2022

DRAFT

	Original Budget	Final Budget	Actual	Variance Positive (Negative)
Revenues				
Taxes	\$ 4,140,930	\$ 4,140,930	\$ 4,908,628	\$ 767,698
Licenses and Permits	951,547	951,547	1,461,422	509,875
Investment Income	6,320	6,320	(2,331)	(8,651)
 Total Revenues	 <u>5,098,797</u>	 <u>5,098,797</u>	 <u>6,367,719</u>	 <u>1,268,922</u>
Expenditures				
Current				
General Government	4,447,840	4,447,840	4,438,668	9,172
 Total Expenditures	 <u>4,447,840</u>	 <u>4,447,840</u>	 <u>4,438,668</u>	 <u>9,172</u>
 Net Change in Fund Balance	 650,957	 650,957	 1,929,051	 1,278,094
 Fund Balance, Beginning of Year	 <u>1,546,057</u>	 <u>1,546,057</u>	 <u>4,922,807</u>	 <u>3,376,750</u>
 Fund Balance, End of Year	 <u><u>\$ 2,197,014</u></u>	 <u><u>\$ 2,197,014</u></u>	 <u><u>\$ 6,851,858</u></u>	 <u><u>\$ 4,654,844</u></u>

Town of Breckenridge, Colorado
 Budgetary Comparison Schedule
 Conservation Trust Fund
 Nonmajor Governmental Funds
 For the Year Ended December 31, 2022

DRAFT

	Original and Final Budget	Actual	Variance Positive (Negative)
Revenues			
Intergovernmental	\$ 55,000	\$ 64,728	\$ 9,728
Investment Earnings	-	38	38
	<u>55,000</u>	<u>64,766</u>	<u>9,766</u>
Total Revenues			
	<u>55,000</u>	<u>64,766</u>	<u>9,766</u>
Excess of Revenues Over (Under) Expenditures			
	<u>55,000</u>	<u>64,766</u>	<u>9,766</u>
Other Financing Sources (Uses)			
Transfers Out	(55,000)	(55,000)	-
	<u>(55,000)</u>	<u>(55,000)</u>	<u>-</u>
Net Change in Fund Balance	-	9,766	9,766
Fund Balance, Beginning of Year	<u>6,106</u>	<u>12,612</u>	<u>6,506</u>
Fund Balance, End of Year	<u><u>\$ 6,106</u></u>	<u><u>\$ 22,378</u></u>	<u><u>\$ 16,272</u></u>

Town of Breckenridge, Colorado
 Budgetary Comparison Schedule
 Accommodation Unit Compliance Fund
 Nonmajor Governmental Funds
 For the Year Ended December 31, 2022

DRAFT

	Original and Final Budget	Actual	Variance Positive (Negative)
Revenues			
Charges for Services	\$ 8,700,900	\$ 10,037,313	\$ 1,336,413
Investment Earnings	-	7,014	7,014
	<u>8,700,900</u>	<u>10,044,327</u>	<u>1,343,427</u>
Total Revenues			
	<u>8,700,900</u>	<u>10,044,327</u>	<u>1,343,427</u>
Expenditures			
Current			
General Government	420,243	365,500	54,743
Community Development	4,999,000	3,612,399	1,386,601
	<u>5,419,243</u>	<u>3,977,899</u>	<u>1,441,344</u>
Net Change in Fund Balance	3,281,657	6,066,428	2,784,771
Fund Balance, Beginning of Year	<u>6,106</u>	<u>485,878</u>	<u>479,772</u>
Fund Balance, End of Year	<u><u>\$ 3,287,763</u></u>	<u><u>\$ 6,552,306</u></u>	<u><u>\$ 3,264,543</u></u>

Town of Breckenridge, Colorado
 Budgetary Comparison Schedule
 Capital Projects Fund
 For the Year Ended December 31, 2022

DRAFT

	Original Budget	Final Budget	Actual	Variance Positive (Negative)
Revenues				
Charges for Services	\$ 205,000	\$ 205,000	\$ 136,400	\$ (68,600)
Intergovernmental	-	-	864,479	864,479
Investment Earnings	1,000	1,000	261,905	260,905
Other	-	-	3,747,085	3,747,085
Total Revenues	<u>206,000</u>	<u>206,000</u>	<u>5,009,869</u>	<u>4,803,869</u>
Expenditures				
Current				
Public Works	1,745,000	-	3,657,486	(3,657,486)
Capital Outlay	35,475,000	49,265,000	25,195,097	24,069,903
Debt Service				
Principal Payments	310,000	310,000	-	310,000
Interest Payments	157,917	161,157	-	161,157
Total Expenditures	<u>37,687,917</u>	<u>49,736,157</u>	<u>28,852,583</u>	<u>20,883,574</u>
Excess of Revenues Over (Under) Expenditures	<u>(37,481,917)</u>	<u>(49,530,157)</u>	<u>(23,842,714)</u>	<u>25,687,443</u>
Other Financing Sources (Uses)				
Transfers In	44,212,474	-	20,170,000	20,170,000
Total Other Financing Sources (Uses)	<u>44,212,474</u>	<u>-</u>	<u>20,170,000</u>	<u>20,170,000</u>
Net Change in Fund Balance	6,730,557	(49,530,157)	(3,672,714)	45,857,443
Fund Balance, Beginning of Year	<u>9,107,391</u>	<u>9,107,391</u>	<u>18,848,721</u>	<u>9,741,330</u>
Fund Balance, End of Year	<u>\$ 15,837,948</u>	<u>\$ (40,422,766)</u>	<u>\$ 15,176,007</u>	<u>\$ 55,598,773</u>

Town of Breckenridge, Colorado
Statement of Net Position
Nonmajor Proprietary Funds
December 31, 2022

DRAFT

	Golf Course Fund	Cemetery Fund	Totals
Assets			
Current Assets			
Cash and Investments	\$ 3,167,764	\$ 257,996	\$ 3,425,760
Accounts Receivables	(1,178)	-	(1,178)
Total Current Assets	<u>3,166,586</u>	<u>257,996</u>	<u>3,424,582</u>
Noncurrent Assets			
Capital Assets			
Not Being Depreciated	5,790,582	-	5,790,582
Being Depreciated,			
Net of Accumulated Depreciation	<u>3,148,553</u>	<u>-</u>	<u>3,148,553</u>
Total Noncurrent Assets	<u>8,939,135</u>	<u>-</u>	<u>8,939,135</u>
Total Assets	<u>12,105,721</u>	<u>257,996</u>	<u>12,363,717</u>
Liabilities			
Current Liabilities			
Accounts Payable	25,490	-	25,490
Accrued Salaries	22,170	-	22,170
Current Portion of Long-term Liabilities			
Accrued Compensated Absences	4,866	-	4,866
Capital Lease Obligations Payable	<u>53,600</u>	<u>-</u>	<u>53,600</u>
Total Current Liabilities	<u>106,126</u>	<u>-</u>	<u>106,126</u>
Noncurrent Liabilities			
Accrued Compensated Absences	43,794	-	43,794
Capital Lease Obligations Payable	<u>79,916</u>	<u>-</u>	<u>79,916</u>
Total Noncurrent Liabilities	<u>123,710</u>	<u>-</u>	<u>123,710</u>
Total Liabilities	<u>229,836</u>	<u>-</u>	<u>229,836</u>
Net Position			
Net Investment in Capital Assets	8,805,619	-	8,805,619
Unrestricted	<u>3,070,266</u>	<u>257,996</u>	<u>3,328,262</u>
Total Net Position	<u>\$ 11,875,885</u>	<u>\$ 257,996</u>	<u>\$ 12,133,881</u>

Town of Breckenridge, Colorado
Statement of Revenues, Expenses, and Changes in Net Position
Nonmajor Proprietary Funds
For the Year Ended December 31, 2022

DRAFT

	Golf Course Fund	Cemetery Fund	Total
Operating Revenues			
Charges for Services	\$ 3,969,439	\$ 42,150	\$ 4,011,589
Reimbursement of Expenses	77,940	-	77,940
Total Operating Revenues	<u>4,047,379</u>	<u>42,150</u>	<u>4,089,529</u>
Operating Expenses			
Administration	181,530	19,498	201,028
Depreciation	617,668	-	617,668
Golf Course Maintenance	1,084,769	-	1,084,769
Golf Pro Shop	1,231,388	-	1,231,388
Total Operating Expenses	<u>3,115,355</u>	<u>19,498</u>	<u>3,134,853</u>
Operating Income	<u>932,024</u>	<u>22,652</u>	<u>954,676</u>
Nonoperating Revenues (Expenses)			
Interest Income	3,773	46	3,819
Interest Expense	(6,836)	-	(6,836)
Total Nonoperating Revenues (Expenses)	<u>(3,063)</u>	<u>46</u>	<u>(3,017)</u>
Income Before Capital Contributions & Transfers	928,961	22,698	951,659
Capital Contributions & Transfers			
Transfers In	97,530	-	97,530
Transfers Out	(33,553)	-	(33,553)
Total Capital Contributions & Transfers	<u>63,977</u>	<u>-</u>	<u>63,977</u>
Change in Net Position	992,938	22,698	1,015,636
Net Position, Beginning of Year	<u>10,882,947</u>	<u>235,298</u>	<u>11,118,245</u>
Net Position, End of Year	<u>\$ 11,875,885</u>	<u>\$ 257,996</u>	<u>\$ 12,133,881</u>

See Notes to the Financial Statements.

Town of Breckenridge, Colorado
Statement of Cash Flows
Nonmajor Proprietary Funds
For the Year Ended December 31, 2022

DRAFT

	Golf Course Fund	Cemetery Fund	Total
Cash Flows From Operating Activities			
Cash Received from Customers	\$ 4,049,153	\$ 42,150	\$ 4,091,303
Cash Payments to Employees	(1,065,509)	-	(1,065,509)
Cash Payments to Vendors and Suppliers	(1,475,632)	(19,498)	(1,495,130)
Net Cash Provided by Operating Activities	<u>1,508,012</u>	<u>22,652</u>	<u>1,530,664</u>
Cash Flows From Noncapital Financing Activities			
Transfers to Other Funds	<u>12,594</u>	-	<u>12,594</u>
Net Cash Used in Noncapital Financing Activities	<u>12,594</u>	-	<u>12,594</u>
Cash Flows From Capital and Related Financing Activities			
Acquisition and Construction of Capital Assets	(1,843,170)	-	(1,843,170)
Proceeds from Sale of Assets	28,262	-	28,262
Interest Payments on Debt	(7,224)	-	(7,224)
Net Cash Used in Capital and Related Financing Activities	<u>(1,822,132)</u>	-	<u>(1,822,132)</u>
Cash Flows from Investing Activities			
Interest Received	<u>3,773</u>	<u>46</u>	<u>3,819</u>
Net Increase (Decrease) in Cash and Cash Equivalents	(297,753)	22,698	(275,055)
Cash and Cash Equivalents, <i>Beginning of Year</i>	<u>3,465,517</u>	<u>235,298</u>	<u>3,700,815</u>
Cash and Cash Equivalents, <i>End of Year</i>	<u>\$ 3,167,764</u>	<u>\$ 257,996</u>	<u>\$ 3,425,760</u>
Reconciliation of Operating Income to Net Cash Provided by Operating Activities			
Operating Income	\$ 932,024	\$ 22,652	\$ 954,676
Adjustments to Reconcile Operating Income to Net Cash Provided by Operating Activities			
Depreciation	623,759	-	623,759
Changes in Asset and Liabilities			
Accounts Receivable	1,767	-	1,767
Accounts Payable and Accrued Liabilities	(17,021)	-	(17,021)
Accrued Salaries	5,381	-	5,381
Deposits	7	-	7
Accrued Compensated Absences	(37,905)	-	(37,905)
Net Cash Provided by Operating Activities	<u>\$ 1,508,012</u>	<u>\$ 22,652</u>	<u>\$ 1,530,664</u>

See Notes to the Financial Statements.

Town of Breckenridge, Colorado
 Budgetary Comparison Schedule
 Utility Fund
 Enterprise Funds
 For the Year Ended December 31, 2022

DRAFT

	Original Budget	Final Budget	Actual	Variance Positive (Negative)
Revenues				
Charges for Services	\$ 5,107,203	\$ 5,107,203	\$ 5,496,953	\$ 389,750
Grant Revenue	-	-	7,543,802	7,543,802
Investment Income	54,400	54,400	75,824	21,424
Plant Investment Fees	925,000	925,000	594,870	(330,130)
Other	799,500	799,500	512,674	(286,826)
Total Revenues	<u>6,886,103</u>	<u>6,886,103</u>	<u>14,224,123</u>	<u>7,338,020</u>
Expenditures				
Administration	2,658,104	2,658,104	5,571,730	(2,913,626)
Water Rights Maintenance	364,265	364,265	127,061	237,204
Debt Service				
Principal Payments	2,343,516	2,343,516	2,295,776	47,740
Interest Payments	888,183	888,183	840,452	47,731
Capital Outlays	15,868,750	15,868,750	6,870,300	8,998,450
Total Expenditures	<u>22,122,818</u>	<u>22,122,818</u>	<u>15,705,319</u>	<u>6,417,499</u>
Revenues Over (Under) Expenditures	(15,236,715)	(15,236,715)	(1,481,196)	13,755,519
Other Financing Sources and Uses and Transfers				
Transfers In	167,911	167,911	564,198	396,287
Transfers Out	<u>(102,166)</u>	<u>(102,166)</u>	<u>(102,166)</u>	<u>-</u>
Change in Net Position - Budgetary Basis	<u>\$ (15,170,970)</u>	<u>\$ (15,170,970)</u>	(1,019,164)	<u>\$ 14,151,806</u>
Adjustments to GAAP Basis				
Capital Outlay			6,870,300	
Debt Principal Payments			2,295,776	
Depreciation			<u>(2,695,446)</u>	
Change in Net Position, GAAP Basis			<u>\$ 5,451,466</u>	

Town of Breckenridge, Colorado
 Budgetary Comparison Schedule
 Golf Course Fund
 Enterprise Funds
 For the Year Ended December 31, 2022

DRAFT

	Original Budget	Final Budget	Actual	Variance Positive (Negative)
Revenues				
Charges for Services	\$ 3,212,506	\$ 3,212,506	\$ 3,969,439	\$ 756,933
Interest Income	10,065	10,065	3,773	(6,292)
Other	-	-	77,940	77,940
Total Revenues	<u>3,222,571</u>	<u>3,222,571</u>	<u>4,051,152</u>	<u>828,581</u>
Expenditures				
Administration	199,582	199,582	181,530	18,052
Gold Course Maintenance	1,038,723	1,038,723	1,084,769	(46,046)
Golf Pro Shop	1,078,499	1,078,499	1,231,388	(152,889)
Debt Service				
Principal Payments	-	-	28,986	(28,986)
Interest Payments	-	-	6,836	(6,836)
Capital Outlay	<u>2,291,969</u>	<u>2,291,969</u>	<u>151,419</u>	<u>2,140,550</u>
Total Expenditures	<u>4,608,773</u>	<u>4,608,773</u>	<u>2,684,928</u>	<u>1,923,845</u>
Revenues Over (Under) Expenditures	(1,386,202)	(1,386,202)	1,366,224	2,752,426
Other Financing Sources and Uses and Transfers				
Transfers In	-	-	97,530	97,530
Transfers Out	<u>-</u>	<u>(33,553)</u>	<u>(33,553)</u>	<u>-</u>
Change in Net Position - Budgetary Basis	<u>\$ (1,386,202)</u>	<u>\$ (1,419,755)</u>	1,430,201	<u>\$ 2,849,956</u>
Adjustments to GAAP Basis				
Capital Outlay			151,419	
Debt Service Principal			28,986	
Depreciation			<u>(617,668)</u>	
Change in Net Position, GAAP Basis			<u>\$ 992,938</u>	

Town of Breckenridge, Colorado
 Budgetary Comparison Schedule
 Cemetery Fund
 Enterprise Funds
 For the Year Ended December 31, 2022

DRAFT

	Original and Final Budget	Actual	Variance <i>Positive</i> <i>(Negative)</i>
Revenues			
Charges for Services	\$ 16,405	\$ 42,150	\$ 25,745
Investment Income	-	46	46
Total Revenues	<u>16,405</u>	<u>42,196</u>	<u>25,791</u>
Expenditures			
Administration	<u>18,500</u>	<u>19,498</u>	<u>(998)</u>
Total Expenditures	<u>18,500</u>	<u>19,498</u>	<u>(998)</u>
Change in Net Position - Budgetary Basis	<u><u>\$ (2,095)</u></u>	22,698	<u><u>\$ 24,793</u></u>
Adjustments to GAAP Basis			
None		<u>-</u>	
Change in Net Position, GAAP Basis		<u><u>\$ 22,698</u></u>	

Town of Breckenridge, Colorado
Combining Statement of Net Position
Internal Service Funds
December 31, 2022

DRAFT

	Garage Services Fund	Information Technology Fund	Facility Maintenance Fund	Health Benefit Fund	Totals
Assets					
Current Assets					
Cash	\$ 8,117,866	\$ 1,243,251	\$ 4,946,044	\$ 1,060,865	\$ 15,368,026
Accounts Receivable	3,382	-	-	-	3,382
Total Current Assets	<u>8,121,248</u>	<u>1,243,251</u>	<u>4,946,044</u>	<u>1,060,865</u>	<u>15,371,408</u>
Noncurrent Assets					
Capital Assets					
Being Depreciated, Net of Accumulated Depreciation	5,372,919	-	44,729	-	5,417,648
Total Noncurrent Assets	<u>5,372,919</u>	<u>-</u>	<u>44,729</u>	<u>-</u>	<u>5,417,648</u>
Total Assets	<u>\$ 13,494,167</u>	<u>\$ 1,243,251</u>	<u>\$ 4,990,773</u>	<u>\$ 1,060,865</u>	<u>\$ 20,789,056</u>
Liabilities					
Current Liabilities					
Accounts Payable	\$ 599,860	\$ 23,131	\$ 15,828	\$ -	\$ 638,819
Accrued Liabilities	-	-	-	19,912	19,912
Accrued Salaries	23,154	12,612	-	-	35,766
Accrued Interest	-	-	-	-	-
Accrued Compensated Absences, Current Portion	1,556	1,272	-	-	2,828
Capital Lease Obligations, Current Portion	-	-	-	-	-
Total Current Liabilities	<u>624,570</u>	<u>37,015</u>	<u>15,828</u>	<u>19,912</u>	<u>697,325</u>
Noncurrent Liabilities					
Accrued Compensated Absences	14,000	11,452	-	-	25,452
Capital Lease Obligations	171,091	-	-	-	171,091
Total Noncurrent Liabilities	<u>185,091</u>	<u>11,452</u>	<u>-</u>	<u>-</u>	<u>196,543</u>
Total Liabilities	<u>809,661</u>	<u>48,467</u>	<u>15,828</u>	<u>19,912</u>	<u>893,868</u>
Fund Balances					
Net Investment in Capital Assets	5,201,828	-	44,729	-	5,246,557
Unrestricted	7,482,678	1,194,784	4,930,216	1,040,953	14,648,631
Total Fund Balances	<u>12,684,506</u>	<u>1,194,784</u>	<u>4,974,945</u>	<u>1,040,953</u>	<u>19,895,188</u>
Total Liabilities, Deferred Inflows of Resources, and Fund Balances	<u>\$ 13,494,167</u>	<u>\$ 1,243,251</u>	<u>\$ 4,990,773</u>	<u>\$ 1,060,865</u>	<u>\$ 20,789,056</u>

See Accompanying Independent Auditor's Report.

Town of Breckenridge, Colorado
Combining Statement of Revenues, Expenditures and Changes in Fund Net Position
Internal Service Funds
For the Year Ended December 31, 2022

DRAFT

	Garage Services Fund	Information Technology Fund	Facility Maintenance Fund	Health Benefit Fund	Totals
Revenues					
Internal Service Revenue	\$ 5,055,065	\$ 1,589,963	\$ 759,342	\$ 3,558,014	\$ 10,962,384
Charges for Services	3,465	-	-	-	3,465
Intergovernmental	3,382	-	-	-	3,382
Insurance Recoveries	26,139	-	-	-	26,139
Reimbursement of Expenses	82,743	-	-	1,821,875	1,904,618
Employee Paid Premiums	-	-	-	613,257	613,257
Other Revenue	-	-	172,528	-	172,528
Total Operating Revenues	<u>5,170,794</u>	<u>1,589,963</u>	<u>931,870</u>	<u>5,993,146</u>	<u>13,685,773</u>
Expenditures					
Depreciation	1,121,173	-	6,968	-	1,128,141
Health Program	-	-	-	4,944,612	4,944,612
Motor Vehicle Maintenance	757,173	-	-	-	757,173
Information Systems Maintenance	-	1,252,966	-	-	1,252,966
Facility Maintenance	-	-	604,046	-	604,046
Total Operating Expenditures	<u>1,878,346</u>	<u>1,252,966</u>	<u>611,014</u>	<u>4,944,612</u>	<u>8,686,938</u>
Operating Income	<u>3,292,448</u>	<u>336,997</u>	<u>320,856</u>	<u>1,048,534</u>	<u>4,998,835</u>
Non-Operating Revenue (Expense)					
Investments Earnings	10,698	(539)	484	(1,996)	8,647
Gain of Sale of Assets	(745,280)	-	-	-	(745,280)
Interest Expense	(4,133)	-	-	-	(4,133)
Total Non-Operating Revenue (Expense)	<u>(738,715)</u>	<u>(539)</u>	<u>484</u>	<u>(1,996)</u>	<u>(740,766)</u>
Change in Net Position	<u>2,553,733</u>	<u>336,458</u>	<u>321,340</u>	<u>1,046,538</u>	<u>4,258,069</u>
Net Position, Beginning of year	<u>10,130,773</u>	<u>858,326</u>	<u>4,653,605</u>	<u>(5,585)</u>	<u>15,637,119</u>
Net Position, End of year	<u>\$ 12,684,506</u>	<u>\$ 1,194,784</u>	<u>\$ 4,974,945</u>	<u>\$ 1,040,953</u>	<u>\$ 19,895,188</u>

Town of Breckenridge, Colorado
Combining Statement of Cash Flows
Internal Service Funds
For the Year Ended December 31, 2022

DRAFT

	Garage Services Fund	Information Technology Fund	Facility Maintenance Fund	Health Benefit Fund	Totals
Cash Flows From Operating Activities					
Cash Received from Customers	\$ 5,168,853	\$ 1,589,963	\$ 931,870	\$ 5,993,146	\$ 13,683,832
Cash Payments to Employees	(383,068)	(303,767)	-	-	(686,835)
Cash Payments to Vendors and Suppliers	(361,438)	(1,037,726)	(593,464)	(5,056,862)	(7,049,490)
Net Cash Provided by Operating Activities	<u>4,424,347</u>	<u>248,470</u>	<u>338,406</u>	<u>936,284</u>	<u>5,947,507</u>
Cash Flows From Capital and Related Financing Activities					
Acquisition and Construction of Capital Assets	(2,313,648)	-	-	-	(2,313,648)
Proceeds from Sale of Assets	68,226	-	-	-	68,226
Principal Payments on Debt	(58,513)	-	-	-	(58,513)
Interest Payments on Debt	(5,654)	-	-	-	(5,654)
Net Cash Used in Capital and Related Financing Activities	<u>(2,309,589)</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>(2,309,589)</u>
Cash Flows from Investing Activities					
Interest Received	<u>10,698</u>	<u>(539)</u>	<u>484</u>	<u>(1,996)</u>	<u>8,647</u>
Net Increase (Decrease) in Cash and Cash Equivalents	2,125,456	247,931	338,890	934,288	3,646,565
Cash and Cash Equivalents, Beginning of Year	<u>5,992,410</u>	<u>995,320</u>	<u>4,607,154</u>	<u>126,577</u>	<u>11,721,461</u>
Cash and Cash Equivalents, End of Year	<u>\$ 8,117,866</u>	<u>\$ 1,243,251</u>	<u>\$ 4,946,044</u>	<u>\$ 1,060,865</u>	<u>\$ 15,368,026</u>
Reconciliation of Operating Income to Net Cash Provided by Operating Activities					
Operating Income	\$ 3,292,448	\$ 336,997	\$ 320,856	\$ 1,048,534	\$ 4,998,835
Adjustments to Reconcile Operating Income to Net Cash Provided by Operating Activities					
Depreciation	1,283,929	-	6,968	-	1,290,897
Changes in Asset and Liabilities					
Accounts Receivable	(1,941)	-	-	-	(1,941)
Accounts Payable and Accrued liabilities	(136,760)	(61,596)	10,582	(112,250)	(300,024)
Accrued Salaries	8,390	1,736	-	-	10,126
Accrued Compensated Absences	(21,719)	(28,667)	-	-	(50,386)
Net Cash Provided by Operating Activities	<u>\$ 4,424,347</u>	<u>\$ 248,470</u>	<u>\$ 338,406</u>	<u>\$ 936,284</u>	<u>\$ 5,947,507</u>

See Notes to the Financial Statements.

Town of Breckenridge, Colorado
 Budgetary Comparison Schedule
 Garage Services Fund
 Internal Service Funds
 For the Year Ended December 31, 2022

DRAFT

	Original and Final Budget	Actual	Variance <i>Positive</i> <i>(Negative)</i>
Operating Revenues			
Internal Service Revenue	\$ 5,099,915	\$ 5,055,065	\$ (44,850)
Charges for Services	-	3,465	3,465
Intergovernmental	2,015,775	3,382	(2,012,393)
Other Revenue	186,868	108,882	(77,986)
	<u>7,302,558</u>	<u>5,170,794</u>	<u>(2,131,764)</u>
Operating Expenses			
General Government	-	17,149	(17,149)
Motor Vehicle Maintenance	2,069,552	740,024	1,329,528
Capital Outlay	4,704,698	230,267	4,474,431
	<u>6,774,250</u>	<u>987,440</u>	<u>5,786,810</u>
Operating Income	528,308	4,183,354	3,655,046
Non-Operating Revenues (Expenses)			
Investments Earnings	-	10,698	10,698
Gain (Loss) on Sale of Assets	95,500	(745,280)	(840,780)
Interest Expense	-	(4,133)	(4,133)
Total Non-Operating Revenue (Expenses)	<u>95,500</u>	<u>(738,715)</u>	<u>(834,215)</u>
Change in Net Position - Budget Basis	<u>\$ 623,808</u>	<u>3,444,639</u>	<u>\$ 2,820,831</u>
GAAP Basis Adjustments			
Capital Outlay		230,267	
Depreciation		(1,121,173)	
Total GAAP Basis Adjustments		<u>(890,906)</u>	
Change in Net Position - GAAP Basis		2,553,733	
Fund Balance, Beginning of Year		<u>10,130,773</u>	
Fund Balance, End of Year		<u>\$ 12,684,506</u>	

Town of Breckenridge, Colorado
 Budgetary Comparison Schedule
 Information Technology Fund
 Internal Service Funds
 For the Year Ended December 31, 2022

DRAFT

	Original Budget	Final Budget	Actual	Variance Positive (Negative)
Operating Revenues				
Internal Service Revenue	\$ 1,486,646	\$ 1,486,646	\$ 1,589,963	\$ 103,317
Other Revenue	<u>11,170</u>	<u>5,585</u>	<u>-</u>	<u>(11,170)</u>
Total Operating Revenues	<u>1,497,816</u>	<u>1,492,231</u>	<u>1,589,963</u>	<u>92,147</u>
Operating Expenses				
Information Systems Maintenance	<u>1,536,125</u>	<u>1,536,125</u>	<u>1,252,966</u>	<u>283,159</u>
Total Operating Expenses	<u>1,536,125</u>	<u>1,536,125</u>	<u>1,252,966</u>	<u>283,159</u>
Operating Income	(38,309)	(43,894)	336,997	375,306
Non-Operating Revenues (Expenses)				
Investments Earnings	<u>(5,585)</u>	<u>(7,260)</u>	<u>(539)</u>	<u>5,046</u>
Total Non-Operating Revenue (Expenses)	<u>(5,585)</u>	<u>(7,260)</u>	<u>(539)</u>	<u>5,046</u>
Change in Net Position - Budget Basis	<u>\$ (43,894)</u>	<u>\$ (51,154)</u>	<u>336,458</u>	<u>\$ 380,352</u>
GAAP Basis Adjustments				
None			<u>-</u>	
Total GAAP Basis Adjustments			<u>-</u>	
Change in Net Position - GAAP Basis			336,458	
Fund Balance, Beginning of Year			<u>858,326</u>	
Fund Balance, End of Year			<u>\$ 1,194,784</u>	

Town of Breckenridge, Colorado
 Budgetary Comparison Schedule
 Facility Maintenance Fund
 Internal Service Funds
 For the Year Ended December 31, 2022

DRAFT

	Original and Final Budget	Actual	Variance <i>Positive</i> <i>(Negative)</i>
Operating Revenues			
Internal Service Revenue	\$ 953,802	\$ 759,342	\$ (194,460)
Other Revenue	<u>-</u>	<u>172,528</u>	<u>172,528</u>
Total Operating Revenues	<u>953,802</u>	<u>931,870</u>	<u>(21,932)</u>
Operating Expenses			
Facility Maintenance	<u>689,417</u>	<u>604,046</u>	<u>85,371</u>
Total Operating Expenses	<u>689,417</u>	<u>604,046</u>	<u>85,371</u>
Operating Income	264,385	327,824	63,439
Non-Operating Revenues (Expenses)			
Investments Earnings	<u>-</u>	<u>484</u>	<u>484</u>
Total Non-Operating Revenue (Expenses)	<u>-</u>	<u>484</u>	<u>484</u>
Change in Net Position - Budget Basis	<u>\$ 264,385</u>	<u>328,308</u>	<u>\$ 63,923</u>
GAAP Basis Adjustments			
Depreciation		<u>(6,968)</u>	
Total GAAP Basis Adjustments		<u>(6,968)</u>	
Change in Net Position - GAAP Basis		321,340	
Fund Balance, Beginning of Year		<u>4,653,605</u>	
Fund Balance, End of Year		<u>\$ 4,974,945</u>	

Town of Breckenridge, Colorado
 Budgetary Comparison Schedule
 Health Benefits Fund
 Internal Service Funds
 For the Year Ended December 31, 2022

DRAFT

	Original and Final Budget	Actual	Variance <i>Positive</i> <i>(Negative)</i>
Operating Revenues			
Internal Service Revenue	\$ 3,314,406	\$ 3,558,014	\$ 243,608
Employee Paid Premiums	431,800	1,821,875	1,390,075
Reimbursement of Expenditures	300,000	613,257	313,257
	<u>4,046,206</u>	<u>5,993,146</u>	<u>1,946,940</u>
Operating Expenses			
Health Program	3,933,627	4,944,612	(1,010,985)
	<u>3,933,627</u>	<u>4,944,612</u>	<u>(1,010,985)</u>
Operating Income	112,579	1,048,534	935,955
Non-Operating Revenue (Expense)			
Investment Earnings	6,240	(1,996)	(8,236)
Net Change in Fund Balance	118,819	1,046,538	927,719
Fund Balance, Beginning of Year	271,000	(5,585)	(276,585)
Fund Balance, End of Year	<u>\$ 389,819</u>	<u>\$ 1,040,953</u>	<u>\$ 651,134</u>

Statistical Section

Town of Breckenridge, Colorado
Statistical Section
Table of Contents
December 31, 2022

DRAFT

Financial Trends

These schedules contain trend information to help the reader understand how the Town's financial performance and position have changed over time. 98

Revenue Capacity

These schedules contain information to help the reader assess the Town's most significant revenue sources. 103

Debt Capacity

These schedules present information to help the reader assess the Town's ability to service current levels of outstanding debt and the Town's ability to issue additional debt in the future. 109

Demographic and Economic Information

This schedule offers demographic and economic indicators to help the reader understand the environment within which the Town's financial activities take place. 114

Operating Information

These schedules contain service and infrastructure data to help the reader understand how the information in the Town's financial report relates to the services the Town provides and the activities it performs. 117

Town of Breckenridge, Colorado
Net Position By Component
Fiscal Years 2013 - 2022
 (accrual basis of accounting)

DRAFT

	2013	2014	2015	(RESTATED) 2016	2017	2018	2019	2020	2021	2022
Governmental activities										
Net investment in capital assets	\$ 93,917,065	\$ 108,410,278	\$ 116,435,026	\$ 129,188,337	\$ 152,282,331	\$ 150,790,936	\$ 169,947,960	\$ 189,023,735	\$ 200,212,421	\$ 186,702,912
Restricted	1,807,154	1,961,175	8,822,838	20,728,773	25,595,213	25,188,466	34,458,694	33,628,759	49,081,979	65,192,222
Unrestricted	56,397,826	55,165,357	57,664,412	49,883,058	44,651,645	57,313,543	52,091,100	50,711,700	64,307,980	96,339,251
Total governmental activities net assets	152,122,045	165,536,810	182,922,276	199,800,168	222,529,188	233,292,945	256,497,754	273,364,194	313,602,380	348,234,385
Business type activities										
Net investment in capital assets	30,580,331	30,394,504	31,843,641	35,176,269	38,447,810	48,951,205	49,578,352	48,601,735	54,679,049	66,489,635
Restricted	-	-	-	-	-	-	-	-	-	-
Unrestricted	11,321,054	12,557,694	12,376,386	12,042,644	12,294,438	4,883,072	8,411,656	14,227,516	11,180,126	5,836,642
Total business-type activities net assets	41,901,385	42,952,198	44,220,027	47,218,913	50,742,248	53,834,277	57,990,008	62,829,251	65,859,175	72,326,277
Primary government										
Net investment in capital assets	124,497,396	138,804,782	148,278,667	164,364,606	190,730,140	199,742,141	219,526,312	237,625,470	254,891,470	253,192,547
Restricted	1,807,154	1,961,175	8,822,838	20,728,773	25,595,213	25,188,466	34,458,694	33,628,759	49,081,979	65,192,222
Unrestricted	67,718,880	67,723,051	70,040,798	61,925,702	56,946,083	62,196,615	60,502,756	64,939,216	75,488,106	102,175,893
Total primary government	<u>\$ 194,023,430</u>	<u>\$ 208,489,008</u>	<u>\$ 227,142,303</u>	<u>\$ 247,019,081</u>	<u>\$ 273,271,436</u>	<u>\$ 287,127,222</u>	<u>\$ 314,487,762</u>	<u>\$ 336,193,445</u>	<u>\$ 379,461,555</u>	<u>\$ 420,560,662</u>

Source: Town of Breckenridge Financial Statements.

Town of Breckenridge, Colorado

Changes in Net Position Fiscal Years 2013 - 2022 (accrual basis of accounting)

DRAFT

	2013	2014	2015	(RESTATED) 2016	2017	2018	2019	2020	2021	2022
Expenses										
Governmental activities:										
General government	\$ 6,501,386	\$ 7,671,566	\$ 8,057,598	\$ 7,930,256	\$ 8,638,950	\$ 9,480,565	\$ 10,065,011	\$ 8,806,877	\$ 12,171,546	\$ 16,973,930
Public safety	3,461,033	3,434,058	3,562,030	3,805,509	4,402,722	4,848,018	4,520,414	5,477,252	7,230,812	8,013,471
Community development	2,457,789	2,262,734	2,529,819	4,259,530	4,475,804	6,242,802	4,497,618	4,992,313	5,077,048	22,536,647
Public works	8,364,315	8,397,377	8,803,963	9,898,260	12,157,779	14,208,520	17,669,597	15,534,891	13,257,302	14,425,719
Culture and recreation	5,818,049	6,377,076	6,750,015	7,011,762	7,369,924	8,270,000	8,734,929	7,725,406	8,060,391	9,948,687
Open Space acquisition	1,012,550	979,969	839,227	1,302,756	1,089,770	1,052,080	1,269,812	1,123,966	1,479,997	1,572,929
Grants to Other Agencies	-	-	-	-	-	-	1,186,319	3,392,349	2,052,920	1,490,585
Debt service	404,947	325,463	1,120,737	-	-	-	-	-	-	-
Debt issuance cost	-	-	-	-	-	-	-	380,012	106,916	153,845
Interest expense not allocated	722,530	791,514	172,535	583,287	440,543	374,681	383,726	878,860	1,803,419	1,865,769
Total governmental activities expenses	28,742,599	30,239,757	31,835,924	34,791,360	38,575,492	44,476,666	48,327,426	48,311,926	51,240,351	76,981,582
Business-type activities expenses										
Utility operations	3,067,347	2,744,499	2,773,743	1,717,478	2,943,666	2,893,540	2,835,088	3,170,087	5,619,712	8,995,467
Golf operations	1,951,860	1,993,984	1,985,393	2,222,408	2,243,872	2,409,354	2,697,169	2,869,185	2,920,361	2,923,207
Cemetery	-	1,575	4,290	6,750	-	14,068	-	8,405	37	19,498
Total business-type activities expenses	5,019,207	4,740,058	4,763,426	3,946,636	5,187,538	5,316,962	5,532,257	6,047,677	8,540,110	11,938,172
Total primary government expenses	33,761,806	34,979,815	36,599,350	38,737,996	43,763,030	49,793,628	53,859,683	54,359,603	59,780,461	88,919,754
Program Revenues										
Governmental activities:										
Charges for services:										
General government	915,310	1,181,252	937,631	972,222	1,097,231	1,244,710	1,063,027	1,791,657	3,586,082	14,663,863
Public safety	831,339	902,115	989,953	1,163,870	1,810,163	2,369,723	2,526,085	1,049,490	2,431,006	2,950,489
Community development	1,223,159	1,840,740	1,450,391	1,486,115	1,982,306	1,673,799	1,791,496	2,909,934	743,143	815,046
Public works	633,388	531,400	602,886	681,918	677,130	693,063	629,170	186,508	1,434,658	1,065,662
Culture and recreation	3,491,885	3,593,584	3,246,217	3,246,192	3,123,114	3,541,801	3,725,008	1,838,174	3,378,481	5,954,726
Open space acquisition	87,231	113,495	733,199	138,369	671,860	155,028	190,657	174,311	173,776	465,172
Motor vehicle maintenance	-	-	-	-	-	-	-	-	-	-
Information systems maintenance	-	-	-	-	-	-	-	-	-	-
Facility Maintenance	-	-	-	-	-	-	-	-	-	-
Operating grants and contributions	506,429	1,029,614	707,507	987,617	1,248,648	1,518,366	1,209,389	2,451,808	3,105,621	5,894,535
Capital grants	1,134,053	2,304,075	3,242,886	1,529,878	1,837,174	643,734	774,877	349,842	1,622,813	97,228
Total governmental activities program revenues	8,822,794	11,496,275	11,910,670	10,206,181	12,447,626	11,840,224	11,909,709	10,751,724	16,475,580	31,906,721
Business-type activities:										
Charges for services:										
Water operations	2,947,712	2,938,797	3,447,348	3,700,688	3,859,127	4,395,081	5,566,562	5,365,132	6,035,785	6,915,606
Golf operations	2,076,702	2,123,389	2,224,527	2,629,037	2,648,169	2,888,193	3,047,900	2,853,602	3,634,238	4,047,379
Cemetery	-	26,025	21,863	15,725	12,249	10,426	32,075	16,600	116,200	42,150
Capital grants and contributions	495,388	1,111,609	798,995	1,894,843	2,180,080	896,378	1,051,652	923,897	2,191,713	7,334,250
Total business-type activities program revenues	5,519,802	6,199,820	6,492,733	8,240,293	8,699,625	8,190,078	9,698,189	9,159,231	11,977,936	18,339,385
Total primary government program revenues	14,342,596	17,696,095	18,403,403	18,446,474	21,147,251	20,030,302	21,607,898	19,910,955	28,453,516	50,246,106
Net (Expense)/Revenue										
Government activities	(19,919,805)	(18,743,482)	(19,925,254)	(24,585,179)	(26,127,866)	(32,636,442)	(36,417,717)	(37,560,202)	(34,764,771)	(45,074,861)
Business-type activities	500,595	1,459,762	1,729,307	4,293,657	3,512,087	2,873,116	4,165,932	3,111,554	3,437,826	6,401,213
Total primary government net expense	\$ (19,419,210)	\$ (17,283,720)	\$ (18,195,947)	\$ (20,291,522)	\$ (22,615,779)	\$ (29,763,326)	\$ (32,251,785)	\$ (34,448,648)	\$ (31,326,945)	\$ (38,673,648)

Town of Breckenridge, Colorado

Changes in Net Position Fiscal Years 2013 - 2022 (accrual basis of accounting)

DRAFT

	2013	2014	2015	(RESTATED) 2016	2017	2018	2019	2020	2021	2022
General Revenues and Other Changes in Net Position										
Governmental activities:										
Taxes										
Property taxes	\$ 3,294,668	\$ 2,286,592	\$ 2,364,153	\$ 2,558,773	\$ 2,603,320	\$ 2,797,563	\$ 2,866,154	\$ 3,388,704	\$ 3,498,737	\$ 3,792,934
Specific ownership taxes	159,170	123,104	129,276	124,910	157,594	165,951	181,376	158,861	173,079	178,543
Sales taxes	17,513,609	19,197,964	21,410,354	24,409,261	28,256,524	30,858,272	34,077,087	31,434,053	38,621,267	47,018,348
Accommodations taxes	3,411,171	3,900,582	4,443,509	5,071,813	5,216,501	5,905,499	6,633,176	6,607,864	10,049,182	11,109,329
Marijuana taxes	-	474,066	483,532	561,510	604,058	593,742	634,024	720,353	693,539	658,274
Franchise taxes	743,857	543,199	888,469	744,256	763,972	744,710	815,317	814,759	704,509	998,167
Real estate transfer taxes	4,462,232	4,604,914	5,468,732	5,240,098	6,239,221	6,156,677	7,166,614	7,838,100	11,038,657	6,872,481
Lift Ticket taxes	-	-	-	586,418	3,504,004	3,718,145	3,591,637	2,111,885	3,768,084	3,993,836
Other taxes	135,743	49,067	49,441	55,140	52,578	53,159	52,750	1,224,155	-	-
Unrestricted grants and contributions	11,403	17,222	13,705	9,846	7,071	7,902	11,130	61,527	-	-
Unrestricted investment earnings	97,098	122,424	121,788	359,992	518,195	849,419	1,732,050	432,304	54,642	628,064
Gain on Sale of Assets	383,224	117,592	1,121,283	11,923	142,869	(8,293,853)	-	7,308	4,323,488	(2,144,588)
Other general revenues	485,141	298,893	412,405	1,183,909	680,708	720,619	1,746,189	1,110,288	1,716,475	6,587,725
Transfers	205,342	422,628	472,152	477,024	110,271	113,592	115,023	(1,483,516)	361,298	13,753
Special Item-Valley Brook Reimbursement	-	-	-	-	-	-	-	-	-	-
Prior Period Restatement	-	-	-	-	-	-	-	-	-	-
Total governmental activities	<u>30,902,658</u>	<u>32,158,247</u>	<u>37,378,799</u>	<u>41,394,873</u>	<u>48,856,886</u>	<u>44,391,397</u>	<u>59,622,527</u>	<u>54,426,645</u>	<u>75,002,957</u>	<u>79,706,866</u>
Business-type activities:										
Unrestricted investment earnings	22,806	12,705	-	74,275	118,278	324,505	96,288	244,172	25,410	79,642
Other general revenues	1,600	974	-	-	-	-	-	-	530	-
Gain on Sale of Assets	-	-	-	5,337	3,241	8,000	8,535	-	(72,544)	-
Transfers	(205,342)	(422,628)	(422,628)	(477,024)	(110,271)	(113,592)	(115,023)	1,483,516	(361,298)	(13,753)
Prior Period Restatement	-	-	-	-	-	-	-	-	-	-
Total business-type activities	<u>(180,936)</u>	<u>(408,949)</u>	<u>(422,628)</u>	<u>(397,412)</u>	<u>11,248</u>	<u>218,913</u>	<u>(10,200)</u>	<u>1,727,688</u>	<u>(407,902)</u>	<u>65,889</u>
Total primary government	<u>30,721,722</u>	<u>31,749,298</u>	<u>36,956,171</u>	<u>40,997,461</u>	<u>48,868,134</u>	<u>44,610,310</u>	<u>59,612,327</u>	<u>56,154,333</u>	<u>74,595,055</u>	<u>79,772,755</u>
Change in Net Position										
Governmental activities	#REF!	13,414,765	17,385,585	16,655,668	22,729,020	11,754,955	23,204,810	16,866,443	40,238,186	34,632,005
Business-type activities	#REF!	1,050,813	1,267,829	2,998,886	3,523,335	3,092,029	4,155,732	4,839,242	3,029,924	6,467,102
Total primary government	<u>\$ #REF!</u>	<u>\$ 14,465,578</u>	<u>\$ 18,653,414</u>	<u>\$ 19,654,554</u>	<u>\$ 26,252,355</u>	<u>\$ 14,846,984</u>	<u>\$ 27,360,542</u>	<u>\$ 21,705,685</u>	<u>\$ 43,268,110</u>	<u>\$ 41,099,107</u>

Source: Town of Breckenridge Financial Statements.

Town of Breckenridge, Colorado
Fund Balances, Governmental Funds
Fiscal Years 2013 - 2022
(modified accrual basis of accounting)

DRAFT

	2013	2014	2015	(RESTATED) 2016	2017	2018	2019	2020	2021	2022
General Fund										
Nonspendable	\$ 1,011,791	\$ 1,385,689	\$ -	\$ 1,274,719	\$ 1,255,501	\$ 1,351,783	\$ 1,261,002	\$ 1,185,469	\$ 1,149,899	\$ 1,112,152
Restricted	1,763,154	1,917,175	2,261,415	3,134,604	3,117,109	4,099,842	7,106,607	45,302,323	56,827,607	64,571,900
Committed	-	-	-	-	-	-	-	824,688	777,944	893,589
Assigned	-	798,534	3,055,523	4,488,920	290,000	-	210,900	210,900	365,088	365,088
Unassigned	26,872,177	25,514,108	32,405,219	31,548,493	27,716,111	35,727,738	35,604,841	38,501,740	33,116,901	35,340,190
Total General Fund	<u>29,647,122</u>	<u>29,615,506</u>	<u>37,722,157</u>	<u>40,446,736</u>	<u>32,378,721</u>	<u>41,179,363</u>	<u>44,183,350</u>	<u>86,025,120</u>	<u>92,237,439</u>	<u>102,282,919</u>
All Other Governmental Funds										
Nonspendable		1,662,239	7,534,513	-	-	-	-	-	-	-
Restricted, reported in:										
Special Revenue Funds	7,795,013	2,685,959	6,561,423	12,962,517	22,478,104	21,088,624	27,352,087	37,022,737	49,790,368	68,978,119
Capital Projects Fund	-	-	-	142,732	-	-	-	-	-	-
Committed, reported in:										
Special Revenue Funds	-	-	-	448,833	317,455	323,544	580,145	1,494,693	4,366,594	6,295,645
Assigned, reported in:										
Special Revenue Funds	6,261,121	11,723,945	155,243	-	-	-	-	-	-	-
Capital Projects Fund	7,207,468	3,507,274	5,955,575	8,483,801	11,142,479	15,040,628	9,186,384	737,492	737,492	727,492
Unassigned, reported in:										
Special Revenue Funds	-	-	-	-	-	-	-	-	-	-
Total all other governmental funds	<u>21,263,602</u>	<u>19,579,417</u>	<u>20,206,754</u>	<u>22,037,883</u>	<u>33,938,038</u>	<u>36,452,796</u>	<u>37,118,616</u>	<u>39,254,922</u>	<u>54,894,454</u>	<u>76,001,256</u>
Total Governmental Funds Balance	<u>\$ 50,910,724</u>	<u>\$ 49,194,923</u>	<u>\$ 57,928,911</u>	<u>\$ 62,484,619</u>	<u>\$ 66,316,759</u>	<u>\$ 77,632,159</u>	<u>\$ 81,301,966</u>	<u>\$ 125,280,042</u>	<u>\$ 147,131,893</u>	<u>\$ 178,284,175</u>

Source: Town of Breckenridge Financial Statements.

2011: Excise Fund rolled into General Fund for implementation of GASB 54

Town of Breckenridge, Colorado
Changes in Fund Balances, Governmental Funds
Fiscal Years 2013 - 2022
(modified accrual basis of accounting)

DRAFT

	2013	2014	2015	(RESTATED) 2016	2017	2018	2019	2020	2021	2022
Revenues										
Taxes	\$ 29,720,450	\$ 31,179,488	\$ 35,237,467	\$ 39,352,179	\$ 47,397,773	\$ 50,993,718	\$ 56,018,135	\$ 54,298,734	\$ 68,547,054	\$ 74,888,688
Licenses and permits	1,278,245	1,827,110	1,590,838	1,794,597	1,992,995	1,698,476	1,819,382	2,114,542	2,803,400	3,201,237
Intergovernmental	1,829,872	3,461,620	3,878,175	2,456,413	3,129,849	2,185,013	1,867,089	2,926,177	4,677,237	6,503,526
Charges for services	5,247,675	5,663,973	5,987,120	5,581,231	6,961,064	7,582,979	8,682,126	5,529,977	8,736,094	21,040,940
Fines and forfeits	421,840	403,033	429,761	471,234	312,188	291,072	255,340	348,845	343,621	827,546
Interest	97,098	122,424	121,838	329,553	468,800	736,287	1,487,445	432,304	34,311	619,417
Miscellaneous	597,554	456,655	1,834,541	1,164,541	739,309	746,205	1,043,091	938,519	5,112,370	4,354,366
Total revenues	<u>39,192,734</u>	<u>43,114,303</u>	<u>49,079,740</u>	<u>51,149,748</u>	<u>61,001,978</u>	<u>64,233,750</u>	<u>71,172,608</u>	<u>66,589,098</u>	<u>90,254,087</u>	<u>111,435,720</u>
Expenditures										
General government	5,722,593	6,798,567	7,334,615	7,143,089	7,636,618	8,498,479	9,106,931	7,960,145	8,270,211	9,830,922
Public safety	3,127,265	3,115,845	3,274,868	3,564,679	4,073,393	4,420,323	4,070,443	5,035,834	5,141,647	6,124,808
Community development	2,151,835	2,065,749	2,284,598	2,523,265	2,771,157	4,362,599	3,879,126	4,359,850	4,329,358	17,560,873
Public works	7,557,708	7,766,689	8,294,233	9,599,073	11,477,330	13,272,015	15,962,117	13,947,626	14,845,842	23,505,505
Culture and recreation	5,261,768	5,769,724	6,157,336	6,459,033	6,792,019	7,441,773	7,785,028	6,750,268	6,997,211	9,240,104
Open Space Acquisition	722,530	793,429	844,410	1,309,989	1,108,694	1,069,615	1,284,113	1,152,471	1,572,685	1,720,427
Grants to Other Agencies	1,012,550	956,431	1,035,191	1,372,447	1,288,705	1,238,574	1,186,319	3,392,349	1,824,837	1,288,349
Capital outlay	10,334,373	17,111,630	9,280,717	22,521,726	24,541,342	17,303,800	23,363,040	24,477,291	32,449,734	29,054,109
Debt service										
Principal	849,453	535,000	3,115,002	605,000	675,000	695,000	715,000	3,020,000	1,980,000	2,240,000
Interest and charges	369,302	339,668	323,487	571,089	490,267	458,949	425,249	1,118,620	2,081,305	2,373,250
Debt issuance costs	-	-	-	-	-	-	-	380,012	106,916	153,845
Total expenditures	<u>37,109,377</u>	<u>45,252,732</u>	<u>41,944,457</u>	<u>55,669,390</u>	<u>60,854,525</u>	<u>58,761,127</u>	<u>67,777,366</u>	<u>71,594,466</u>	<u>79,599,746</u>	<u>103,092,192</u>
Excess of revenues over (under) expenditures	<u>2,083,357</u>	<u>(2,138,429)</u>	<u>7,135,283</u>	<u>(4,519,642)</u>	<u>147,453</u>	<u>5,472,623</u>	<u>3,395,242</u>	<u>(5,005,368)</u>	<u>10,654,341</u>	<u>8,343,528</u>
Other Financing Sources (Uses)										
Proceeds from Debt Issuances	-	-	-	10,600,000	-	-	-	43,810,000	-	-
Issuance of COP Premium	-	-	-	1,042,063	-	-	-	6,906,961	11,320,191	19,667,049
Payment to Refunding COP Escrow Agent	-	-	-	(2,435,658)	-	-	-	-	-	-
Sale of Capital Assets	493,289	-	1,058,475	-	-	6,329,185	159,542	-	-	-
Operating transfers in	14,936,623	13,439,705	12,027,316	11,676,765	28,941,537	19,956,460	14,490,735	17,988,177	13,857,128	20,305,719
Operating transfers out	(14,731,281)	(13,017,077)	(11,555,164)	(11,199,741)	(25,256,850)	(20,442,868)	(14,375,712)	(19,721,693)	(13,974,809)	(20,831,728)
Total other financing sources (uses)	<u>698,631</u>	<u>422,628</u>	<u>1,530,627</u>	<u>9,683,429</u>	<u>3,684,687</u>	<u>5,842,777</u>	<u>274,565</u>	<u>48,983,445</u>	<u>11,202,510</u>	<u>19,141,040</u>
Special Item-Valley Brook Reimbursement										
Net changes in fund balances	<u>\$ 2,781,988</u>	<u>\$ (1,715,801)</u>	<u>\$ 8,665,910</u>	<u>\$ 5,163,787</u>	<u>\$ 3,832,140</u>	<u>\$ 11,315,400</u>	<u>\$ 3,669,807</u>	<u>\$ 43,978,077</u>	<u>\$ 21,856,851</u>	<u>\$ 27,484,568</u>
Capitalized Capital Outlay	<u>\$ 9,662,522</u>	<u>\$ 17,144,215</u>	<u>\$ 9,280,717</u>	<u>\$ 22,521,725</u>	<u>\$ 24,541,342</u>	<u>\$ 17,303,800</u>	<u>\$ 23,363,040</u>	<u>\$ 24,477,291</u>	<u>\$ 32,775,318</u>	<u>\$ 27,816,885</u>
Noncapital Expenditures	<u>\$ 27,446,855</u>	<u>\$ 28,108,517</u>	<u>\$ 32,663,740</u>	<u>\$ 33,147,665</u>	<u>\$ 36,313,183</u>	<u>\$ 41,457,327</u>	<u>\$ 44,414,326</u>	<u>\$ 47,117,175</u>	<u>\$ 46,824,428</u>	<u>\$ 75,275,307</u>
Debt services as a percentage of noncapital expenditures	4.4%	3.1%	10.5%	3.5%	3.2%	2.8%	2.6%	8.8%	8.7%	6.1%

Source: Town of Breckenridge Financial Statements.

Town of Breckenridge, Colorado
Assessed Value and Actual Value of Taxable Property
Last Ten Fiscal Years

DRAFT

Fiscal Year Ended December 31	Residential Property	Commercial & Industrial Property	Vacant & Agricultural Property	State Assessed	Tax-Exempt Property	Total Taxable Assessed Value	Total Direct Tax Rate	Estimated Actual Taxable Value	Assessed Value as a Percentage of Actual Value
2013	\$ 312,524,160	\$ 93,070,550	\$ 48,571,900	\$ 6,583,520	\$ 16,310,030	\$ 460,750,130	5.07	\$ 4,437,377,520	10%
2014	319,923,220	93,166,870	47,313,330	6,727,020	16,921,060	467,130,440	5.07	4,526,813,340	10%
2015	359,661,730	102,857,550	47,919,560	6,813,460	17,488,410	517,252,300	5.07	5,061,778,400	10%
2016	371,301,310	104,198,650	40,060,590	7,080,640	21,982,900	522,641,190	5.07	5,186,450,130	10%
2017	401,810,440	115,291,110	40,692,430	7,359,180	22,875,060	565,153,160	5.07	6,143,950,390	9%
2018	414,591,880	119,641,750	33,788,530	7,038,610	24,491,890	575,060,770	5.07	6,396,015,040	9%
2019	497,338,880	135,391,830	43,618,350	8,524,820	24,689,250	684,873,880	5.07	7,687,628,800	9%
2020	509,393,360	138,574,060	33,249,250	9,090,520	25,540,430	690,307,190	5.07	7,836,291,970	9%
2021	562,458,910	138,729,700	35,476,160	9,621,750	26,473,640	772,760,160	5.07	8,591,731,290	9%
2022	\$ 553,095,465	\$ 138,162,789	\$ 29,259,161	\$ 8,055,337	\$ 32,433,666	\$ 728,572,752	5.07	\$ 8,681,125,587	8%

Source: Summit County Assessor's Office.

Town of Breckenridge, Colorado
Property Tax Rates
All Direct and Overlapping Governments
Last Ten Fiscal Years

DRAFT

Fiscal Year	DIRECT			OVERLAPPING						Total	Alpine Metro Dist	Breck Mtn Metro Dist
	Town of Breckenridge			Summit County	Summit School District	Colorado Moutain College	Red, White & Blue Fire District	Colorado River Water Con.	Middle Park Water Con.			
	General Operating	GO Debt	Total Town									
2011	5.070	1.875	6.945	12.796	20.202	3.997	9.000	0.228	0.056	53.224	-	25.000
2012	5.070	1.875	6.945	12.824	20.031	3.997	9.098	0.242	0.056	53.193	-	25.000
2013	5.070	-	5.070	12.789	20.275	3.997	9.013	0.254	0.056	51.454	-	25.000
2014	5.070	-	5.070	15.173	20.135	3.997	9.018	0.253	0.056	53.702	-	25.000
2015	5.070	-	5.070	15.072	19.618	3.997	9.004	0.243	0.055	53.059	-	25.000
2016	5.070	-	5.070	15.072	19.618	3.997	9.004	0.243	0.055	53.059	-	25.000
2017	5.070	-	5.070	15.086	20.417	3.997	9.015	0.256	0.055	53.896	-	25.000
2018	5.070	-	5.070	19.643	20.417	3.997	9.015	0.256	0.055	58.453	-	25.000
2019	5.070	-	5.070	19.280	19.092	4.013	9.053	0.235	0.048	56.791	-	25.000
2020	5.070	-	5.070	19.603	19.183	4.013	9.118	0.502	0.048	57.537	-	25.000
2021	5.070	-	5.070	19,530	18.835	4.013	9.110	0.501	0.046	57.105	-	25.000
2021	5.070	-	5.070	19.809	18.871	4.085	9.250	0.501	0.046	57.632	-	25.000

Note: All numbers shown are Mill Levies (amounts assessed per \$1,000 in valuation).

Source: Summit County Assessor's Office.

Town of Breckenridge, Colorado
Top Ten Principal Property Tax Payers
Current Year and Nine Years Ago

DRAFT

Taxpayer	Type of Business	2022			2013		
		Taxable Assessed Value	Rank	Percentage of Total Taxable Assessed Value	Taxable Assessed Value	Rank	Percentage of Total Taxable Assessed Value
Vail Summit Resorts, Inc	Ski Area Owner, Developer	12,623,110	1	1.733%	11,472,114	1	2.490%
Gold Point Lodging & Realty, Inc.	Hotel/Retail Condo Resort & Management	10,277,770	3	1.411%	8,433,671	2	1.830%
One Ski Hill Place LLC	Developer			0.000%	4,932,393	5	1.071%
Peak 8 Properties LLC	Developer	10,360,533	2	1.422%			
Grand Lodge on Peak 7 Intrvl Owner Assoc.	Timeshare Organization	7,678,210	4	1.054%	6,048,822	4	1.313%
Public Service Co. of Colorado	Public Utility	6,292,547	5	0.864%	4,558,434	6	0.989%
Beaver Run Interim Center Acquisition LLC	Developer	6,081,387	6	0.835%	6,755,555	3	1.466%
Welk Resorts Breckenridge LLC				0.000%			
Ofpers Partners, LLC	Commercial Real Estate			0.000%	2,691,424	8	0.584%
Marriott Ownership Resorts, Inc.	Developer	3,096,005	10	0.425%			
Village at Breckenridge Acquisition Corp.	Hotel/Retail Condo Resort & Management				3,158,756	7	0.686%
Valdoro Mtn Lodge Interval Owner Assoc.	Hotel/Retail Condo Resort & Management	\$ 3,145,354	9	0.432%	2,430,891	10	0.528%
Main Street Station Shopping Center	Hotel/Retail Condo Resort & Management				2,537,546	9	0.551%
Shock Hill Partners LLC	Developer						
Riva RE Holdings		\$ 5,495,094	7	0.754%			
BD 550 Village LLC		\$ 5,416,765	8	0.743%			
Total		<u>\$ 70,466,775</u>		<u>9.672%</u>	<u>\$ 53,019,606</u>		<u>11.507%</u>

Source: Summit County Assessor's Office.

Town of Breckenridge, Colorado

Taxable Sales and Sales Tax Collections By Category

Last Ten Years

DRAFT

	2018		2019		2020		2021		2022	
	Amount	Percent of Total	Amount	Percent of Total	Amount	Percent of Total	Amount	Percent of Total	Amount	Percent of Total
Taxable Sales										
Retail	\$ 168,252,098	25%	\$ 166,200,876	27%	\$ 156,718,184	19%	\$ 221,707,598	24%	\$ 239,982,824	26%
Marijuana	9,976,918	2%	10,254,704	2%	11,582,448	1%	12,148,814	1%	10,332,606	1%
Restaurants/Bars	140,080,648	21%	149,387,100	24%	113,138,431	13%	157,535,075	17%	185,637,284	20%
Short-Term Lodging	167,408,538	25%	188,625,802	31%	191,579,948	23%	294,052,704	32%	323,260,950	35%
Grocery/Liquor Stores	67,779,218	10%	69,250,236	11%	71,505,483	9%	77,785,415	8%	85,549,534	9%
Construction	32,212,484	5%	47,480,013	8%	35,010,912	4%	40,615,154	4%	45,844,558	5%
Utilities	25,776,614	4%	28,130,222	5%	31,905,330	4%	32,093,270	3%	37,058,024	4%
Undefined	2,565,274	0%	4,616,737	1%	3,083,184	0%	3,320,302	0%	3,657,345	0%
Total	\$ 614,051,792	92%	\$ 663,945,690	108%	\$ 614,523,920	73%	\$ 839,258,332	90%	\$ 931,323,125	100%

Sales Tax Collected

Retail	\$ 7,748,124	25%	\$ 7,633,381	27%	\$ 6,694,226	19%	\$ 9,671,496	24%	\$ 10,468,826	26%
Marijuana	459,444	2%	470,985	2%	494,745	1%	529,965	1%	450,305	1%
Restaurants/Bars	6,450,809	21%	6,861,147	24%	4,832,715	13%	6,872,114	17%	8,098,097	20%
Short-Term Lodging	7,709,277	25%	8,663,328	31%	8,183,349	23%	12,827,389	32%	14,101,685	35%
Grocery/Liquor Stores	3,121,279	10%	3,180,570	11%	3,054,361	9%	3,393,214	8%	3,731,946	9%
Construction	1,483,407	5%	2,180,693	8%	1,495,493	4%	1,771,745	4%	1,999,887	5%
Utilities	1,187,031	4%	1,291,983	5%	1,362,838	4%	1,399,997	3%	1,616,590	4%
Undefined	118,133	0%	212,040	1%	131,698	0%	144,841	0%	159,545	0%
Total	\$ 27,737,678	100%	\$ 30,575,151	100%	\$ 28,224,252	100%	\$ 35,848,969	100%	\$ 40,626,881	100%

	2013		2014		2015		2016		2017	
	Amount	Percent of Total	Amount	Percent of Total	Amount	Percent of Total	Amount	Percent of Total	Amount	Percent of Total
Taxable Sales										
Retail	\$ 113,042,463	28%	\$ 115,950,573	23%	\$ 131,135,835	24%	\$ 141,987,227	25%	\$ 152,200,147	0%
Marijuana	2,393,937	1%	8,351,852	2%	7,791,474	1%	9,192,345	2%	9,714,804	0%
Restaurants/Bars	87,874,565	22%	97,472,880	22%	107,664,478	20%	117,125,970	21%	126,504,293	#DIV/0!
Short-Term Lodging	99,161,964	25%	114,537,058	26%	130,677,280	24%	148,960,209	26%	148,927,636	#DIV/0!
Grocery/Liquor Stores	53,564,231	13%	55,544,066	13%	59,327,490	11%	62,692,608	11%	64,306,218	#DIV/0!
Construction	19,588,910	5%	22,045,591	5%	29,765,442	6%	32,236,255	6%	37,328,216	#DIV/0!
Utilities	25,755,299	6%	26,866,047	6%	26,624,825	5%	25,836,403	5%	27,068,676	#DIV/0!
Undefined	1,796,980	0%	1,606,347	0%	1,503,290	0%	2,355,541	0%	2,053,401	#DIV/0!
Total	\$ 403,178,349	100%	\$ 442,374,414	97%	\$ 494,490,114	92%	\$ 540,386,559	95%	\$ 568,103,391	#DIV/0!

Sales Tax Collected

Retail	\$ 5,382,614	28%	\$ 5,020,409	23%	\$ 5,923,423	24%	\$ 6,362,334	25%	\$ -	0%
Marijuana	113,989	1%	361,617	2%	351,942	1%	411,902	2%	-	0%
Restaurants/Bars	4,184,223	22%	4,717,562	22%	4,863,219	20%	5,248,321	21%	#DIV/0!	#DIV/0!
Short-Term Lodging	4,721,682	25%	5,543,447	26%	5,902,710	24%	6,674,788	26%	#DIV/0!	#DIV/0!
Grocery/Liquor Stores	2,550,507	13%	2,688,262	13%	2,679,831	11%	2,809,206	11%	#DIV/0!	#DIV/0!
Construction	932,743	5%	1,066,978	5%	1,344,509	6%	1,444,481	6%	#DIV/0!	#DIV/0!
Utilities	1,226,361	6%	1,300,282	6%	1,202,647	5%	1,157,709	5%	#DIV/0!	#DIV/0!
Undefined	85,565	0%	77,745	0%	67,904	0%	105,550	0%	#DIV/0!	#DIV/0!
Total	\$ 17,513,607	100%	\$ 19,197,683	100%	\$ 21,410,354	100%	\$ 24,409,332	100%	\$ 25,456,259	100%

Revenues and sales taxes are reported by category. Publication of revenues and sales taxes paid by specific individual business is prohibited (Breckenridge Town Code Section 3-1-17).

Town of Breckenridge, Colorado
Direct and Overlapping Sales Tax Rates
Last Ten Years

DRAFT

Fiscal Year	TOB Direct Rate	Summit Combined Housing Authority	Summit County	State of Colorado	Total
2013	2.50%	0.125%	2.750%	2.90%	8.275%
2014	2.50%	0.125%	2.750%	2.90%	8.275%
2015	2.50%	0.125%	2.750%	2.90%	8.275%
2016	2.50%	0.125%	2.750%	2.90%	8.275%
2017	2.50%	0.725%	2.750%	2.90%	8.875%
2018	2.50%	0.725%	2.750%	2.90%	8.875%
2019	2.50%	0.725%	2.750%	2.90%	8.875%
2020	2.50%	0.725%	2.750%	2.90%	8.875%
2021	2.50%	0.725%	2.750%	2.90%	8.875%
2022	2.50%	0.725%	2.750%	2.90%	8.875%

Source: State of Colorado, Town of Breckenridge

Town of Breckenridge, Colorado
Property Tax Levies and Collections
Last Ten Years

DRAFT

Fiscal Year Ended Dec 31	Taxes Levied for the Fiscal Year		Collected within the Fiscal Year of the Levy		Collections in Subsequent Years	Total Collections to Date	
			Amount	Percentage of Levy		Amount	Percentage of Levy
2013	\$	3,361,496	\$ 3,357,942	99.89%	\$ (287)	\$ 3,357,655	99.89%
2014	*	2,333,257	2,332,328	99.96%	89	2,332,417	99.96%
2015		2,368,351	2,366,820	99.94%	5,566	2,372,386	100.17%
2016		2,622,469	2,610,997	99.56%	-	2,610,997	99.56%
2017		2,649,791	2,874,541	108.48%	-	2,874,541	108.48%
2018		2,865,327	2,792,028	97.44%	1,878	2,793,906	97.51%
2019		2,915,558	2,860,052	98.10%	1,714	2,861,766	98.15%
2020		3,472,311	3,388,916	97.60%	-	3,388,916	97.60%
2021		3,499,857	3,491,458	99.76%	-	3,491,458	99.76%
2022	\$	3,783,673	\$ 3,785,874	100.06%	\$ -	\$ 3,785,874	100.06%

Sources: Town of Breckenridge Financial Statements
Summit County Assessor's and Treasurer's Offices

Property taxes are levied in year x1 and are paid the following year x2.

*Mill levy for GO Debt no longer in place as of 2014

Town of Breckenridge, Colorado
Ratios of Outstanding Debt By Type
Last Ten Years

DRAFT

Fiscal Year	Governmental Activities					Business-Type Activities					Total Primary Government	Percentage of Personal Income	Outstanding Debt Per Capita
	General Obligation	Certificates of Participation	Notes Payable	Capital Leases	Debt Premium Net of Accum Amort	Revenue Bonds	Capital Leases	Notes Payable	Debt Premium Net of Accum Amort				
2013	\$ -	\$ 5,600,000	\$ 2,960,000	\$ -	\$ 133,098	\$ -	\$ -	\$ 450,769	\$ -	\$ 9,143,867	8.39%	\$ 1,931	
2014	-	5,260,000	2,765,000	-	10,150	-	-	408,178	-	8,443,328	7.79%	1,769	
2015	-	4,910,000	-	-	13,798	-	-	363,879	-	5,287,677	5.07%	1,097	
2016	-	1,002,608	-	-	1,002,608	-	-	68,756	-	2,073,972	2.08%	424	
2017	-	11,290,000	-	-	949,355	-	133,122	56,990,796	1,234,328	70,597,601	65.03%	14,405	
2018	-	10,595,000	-	-	896,102	-	93,198	54,804,129	1,178,222	67,566,651	59.99%	13,587	
2019	-	9,880,000	-	338,225	842,849	-	44,712	52,592,710	1,122,116	64,820,612	58.82%	13,103	
2020	-	51,230,000	-	285,269	7,412,176	-	-	50,344,189	1,066,010	110,337,644	91.40%	21,914	
2021	-	57,930,000	-	229,604	9,142,654	-	184,899	48,048,413	1,009,904	116,545,474	129.81%	29,628	
2022	\$ -	\$ 73,465,000	\$ -	\$ 171,090	\$ 10,530,336	\$ -	\$ 133,516	\$ 58,834,897	\$ 953,798	\$ 144,088,637	121.38%	\$ 28,375	

Source: Details regarding the Town's outstanding debt can be found in the Town's financial statements.
Personal Income and Per Capita information is found in the demographic and economic schedule.

Town of Breckenridge, Colorado
Ratios of General Bonded Debt Outstanding
Last Ten Fiscal Years

DRAFT

Fiscal Year	Gen. Oblig. Bonded Debt Outstanding	Population	G.O Debt Per Capita	Assessed Valuation	Ratio of Debt to Assessed Valuation
2013	\$ -	4,735	- \$	460,750,130	N/A
2014	-	4,772	-	467,130,440	N/A
2015	-	4,820	-	517,252,300	N/A
2016	-	4,896	-	522,641,190	N/A
2017	-	4,901	-	565,153,160	N/A
2018	-	4,973	-	575,060,770	N/A
2019	-	4,947	-	684,873,880	N/A
2020	-	5,035	-	690,307,190	N/A
2021	-	5,024	-	746,286,520	N/A
2022	\$ -	5,078	- \$	728,572,750	N/A

Source: Summit County Assessor's Office,
Town of Breckenridge Financial Statements

Town of Breckenridge, Colorado
Computation of Direct and Overlapping General Obligation Debt
December 31, 2022

DRAFT

Jurisdiction	Assessed Value					Debt Outstanding	Percentage Applicable to Town	Amount Applicable to Town
	2018	2019	2020	2021	2022			
Direct Debt:								
Town of Breckenridge	\$ 575,060,770	\$ 684,873,880	\$ 690,307,190	\$ 746,286,520	\$ 728,572,750	\$ 84,166,427	100%	\$ 84,166,427
Summit County	1,897,719,190	2,257,439,910	2,271,614,210	2,477,541,750	2,458,966,100	-	30%	-
Summit School District	1,883,475,430	2,247,566,630	2,249,526,050	2,441,567,490	2,449,685,940	61,415,000	30%	18,265,727
Colorado Mountain College	1,883,475,430	2,247,566,630	2,249,526,050	2,468,313,700	2,449,685,940	-	30%	-
Red, White & Blue Fire Protection District	869,706,140	1,033,309,600	1,038,514,420	1,116,425,400	1,283,365,050	-	57%	-
Colorado River Water Conservation District	1,891,679,220	2,247,521,320	2,259,159,280	2,477,541,750	2,458,966,100	-	30%	-
Middle Park Water Conservancy District	1,891,679,220	2,247,521,320	2,259,159,280	2,477,541,750	2,458,966,100	-	30%	-
Upper Blue Sanitation District	730,370,010	873,408,690	883,454,180	956,620,720	937,726,180	-	78%	-
Alpine Metropolitan District	15,910	79,040	13,410	7,600	5,710	-	100%	-
Breckenridge Mountain Metropolitan District	\$ 49,168,010	\$ 54,531,290	\$ 56,329,430	\$ 59,324,240	\$ 59,544,810	21,940,000	100%	-
Overlapping Debt:						83,355,000		18,265,727
Direct Debt:						84,166,427		84,166,427
Total Debt:						<u>\$ 167,521,427</u>		<u>\$ 102,432,154</u>

The percent applicable to the Town is based upon the percent of valuation the Town makes up of the Jurisdiction's total valuation.

Source: Individual Entities

Town of Breckenridge, Colorado
Legal Debt Margin Information
Last Ten Years

DRAFT

Legal Debt Margin Computation	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Maximum Debt Allowed:										
Actual value	4,437,377,520	4,526,813,340	5,061,778,400	5,186,450,130	6,143,950,390	6,396,015,040	7,687,628,800	7,836,291,970	8,591,731,290	8,681,125,587
Debt limit (3% of valuation)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Legal debt limit	\$ 133,121,326	\$ 135,804,400	\$ 151,853,352	\$ 155,593,504	\$ 184,318,512	\$ 191,880,451	\$ 230,628,864	\$ 235,088,759	\$ 257,751,939	260,433,768
Debt Applicable to Limit:										
Total bonds outstanding	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	-
Less: Sales Tax Revenue Bonds	-	-	-	-	-	-	-	-	-	-
Debt subject to limitation	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>	<u>-</u>
Debt limit	\$ 133,121,326	\$ 135,804,400	\$ 151,853,352	\$ 155,593,504	\$ 184,318,512	\$ 191,880,451	\$ 230,628,864	\$ 235,088,759	\$ 257,751,939	260,433,768
Total net debt applicable to limit	-	-	-	-	-	-	-	-	-	-
Legal debt margin	<u>\$ 133,121,326</u>	<u>\$ 135,804,400</u>	<u>\$ 151,853,352</u>	<u>\$ 155,593,504</u>	<u>\$ 184,318,512</u>	<u>\$ 191,880,451</u>	<u>\$ 230,628,864</u>	<u>\$ 235,088,759</u>	<u>\$ 257,751,939</u>	<u>260,433,768</u>
Total net debt applicable to the limit as a percentage of debt limit	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Note: Colorado statutes limit legal debt margin to 3% of valuation, excepting general obligation debt serviced by enterprise funds and revenue bonds.

Source: Summit County Assessor's Office and Town of Breckenridge Financial Statements.

Town of Breckenridge, Colorado
Pledged Revenue Coverage
Last Ten Years

DRAFT

Colorado Water Resources & Power Development Authority					
Fiscal Year	Net Pledged Revenues	Debt Service		Coverage	
		Principal	Interest		
2013	\$ 377,900	\$ 185,000	146,488	1.1	
2014	377,900	195,000	137,238	1.1	
2015	377,900	2,765,000	104,964	0.1	
2016	377,900	3,005,000	57,197	0.1	
2017	-	-	-	0.0	
2018	3,521,504	2,186,667	835,751	1.2	
2019	4,663,684	2,211,419	1,019,883	1.4	
2020	4,120,212	2,248,521	981,683	1.3	
2021	4,356,931	2,295,776	934,433	1.3	
2021	\$ 4,345,479	\$ 2,689,287	\$ 1,123,633	1.1	

Source: Town of Breckenridge Financial Statements

Note: Details regarding the Town's outstanding debt can be found in the notes to the financial statements.

Town of Breckenridge, Colorado
Demographic and Economic Statistics
Last Ten Fiscal Years

DRAFT

Fiscal Year	Breckenridge Population (1)	Summit County Population (2)	Median Family Income (2)(3)	School Enrollment (4)	Unemployment Rate (3)
2013	4,735	31,895	\$ 92,100	509	6.1%
2014	4,772	29,404	90,800	535	4.2%
2015	4,820	29,399	86,600	535	2.8%
2016	4,896	30,299	81,500	530	1.4%
2017	4,901	30,622	88,600	508	2.1%
2018	4,973	31,007	90,600	485	2.2%
2019	4,947	31,011	89,100	471	1.3%
2020	5,035	31,205	95,900	403	5.1%
2021	5,024	30,941	91,299	418	2.3%
2022	5,078	31,055	\$ 93,505	437	1.6%

Sources: Town of Breckenridge Planning Department, Summit County, and Colorado Department of Education (CDE).

(1) Town of Breckenridge Planning Department

(2) Area Median Income for a family of four-Annual Government Census

(3) Statistics only available for Summit County

(4) CDE: RE-1 School District enrollment for Breckenridge Elementary & Upper Blue Elementary combined

Town of Breckenridge, Colorado

Principal Employers

Fiscal Years 2020 - 2022

DRAFT

Fiscal Year 2021

Employer	Employees	Rank	Percentage of Total Town Employment
Vail Resorts Inc. ¹	1,643	1	25%
Breckenridge Grand Vacations	609	2	9%
Beaver Run Resort And Conference Center ²	211	3	3%
Town of Breckenridge	203	4	3%
City Market #30	137	5	2%
Barbu Group	120	6	2%
Flame Group	108	7	2%
Breckenridge BBQ (Kenosha Steakhouse and Rita's)	80	8	1%
Gravity Haus	70	9	1%
Vacasa LLC	65	10	1%
Total	3,246		49%

Total Employees within the Town of Breckenridge: 6,152

Fiscal Year 2021

Employer	Employees	Rank	Percentage of Total Town Employment
Vail Resorts Inc. ¹	1,539	1	24%
Breckenridge Grand Vacations	735	2	11%
Town of Breckenridge	263	3	4%
Beaver Run Resort And Conference Center ²	205	4	3%
City Market #30	128	5	2%
Mi Casa Mexican Restaurant & Cantina	105	6	2%
Breckenridge BBQ (Kenosha Steakhouse and Rita's)	80	7	1%
Vacasa LLC	65	8	1%
Christy Sports	55	9	1%
Breckenridge Building Center	47	10	1%
Total	3,222		50%

Total Employees within the Town of Breckenridge: 6,435

Fiscal Year 2020

Employer	Employees	Rank	Percentage of Total Town Employment
Vail Resorts Inc. ¹	2,157	1	34%
Breckenridge Grand Vacations	583	2	9%
Town of Breckenridge	279	3	4%
Beaver Run Resort And Conference Center ²	212	4	3%
City Market #30	137	5	2%
Mi Casa Mexican Restaurant & Cantina	115	6	2%
Resort Quest	60	7	1%
Breckenridge BBQ (Kenosha Steakhouse and Rita's)	80	8	1%
Christy Sports	55	9	1%
Breckenridge Building Center	47	10	1%
Total	3,725		58%

Total Employees within the Town of Breckenridge: 6,580

¹ Vail Resorts Inc. includes Keystone Food & Beverage

² Beaver Run Resort & Conference Center includes Bridge Hospitality

Town of Breckenridge, Colorado
Town Government Employees by Department
Last Ten Years

DRAFT

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Administration (Includes Gen Govt, Executive Mgmt, HR & MS)	12	14	14	14	13	13	13	13	13	15
Finance & IT	14	9	9	9	10	11	11	11	12	13
Community Development (including Aff. Housing & Child Care)	15	14	13	14	15	16	16	16	16	17
Police	30	30	31	32	26	28	28	28	28	30
Public Works (includes Garage, Utility)	60	60	58	62	83	90	90	91	85	94
Recreation (includes Open Space)	26	24	24	24	26	26	27	28	29	29
Golf Course	4	4	3	5	5	5	5	5	5	5
Total	161	155	152	160	177.85	189	190	192	188	203

Source: Town of Breckenridge Payroll

Note: Full time equivalents assigned, as of December 31st.

Town of Breckenridge, Colorado
Operating Indicators by Function/Program
Last Ten Years

DRAFT

Function/Program	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Public Safety										
Physical arrests	750	687	558	625	690	657	723	753	369	407
Traffic violations	1,203	886	932	693	1,179	987	941	506	1,384	440
Municipal Water										
Number of customers	4,410	4,488	4,565	4,627	4,750	4,857	4,951	5,014	5,097	5,369
Residential	4,090	4,139	4,213	4,273	4,380	4,501	4,588	4,644	4,730	4,970
Commercial	320	349	352	354	370	356	363	370	367	399
Water gallons billed to customers	562,722,000	517,736,000	515,679,000	513,790,000	535,967,000	570,670,000	552,747,000	554,484,000	559,053,000	535,576,000
Residential	424,594,000	398,178,000	398,416,000	397,385,000	413,914,000	441,684,000	426,989,000	445,579,000	440,989,000	415,477,000
Commercial	138,128,000	119,558,000	117,263,000	116,405,000	122,053,000	128,986,000	125,758,000	109,005,000	118,064,000	120,099,000
Average residential daily consumption in gallons per customer per day	284	264	259	255	259	269	255	263		229
Public Works										
Street resurfacing (miles)	1.9	0.6	1.4	2.5	4.533	4.533	4.533	4.533	3.5	3.8
Resurfacing as a percentage of total street miles	3.3%	1.0%	2.4%	4.4%	8.0%	8.0%	8.0%	8.0%	5.4%	5.8%
Transit										
Total route miles	244,828	238,873	276,726	355,060	504,820	498,839	496,353	248,137	346,228	319,790
Passengers	614,425	660,369	748,806	885,508	1,009,179	1,174,127	1,310,282	668,409	681,671	862,602
Administration										
Business licenses	5,466	6,065	6,208	6,277	6,561	6,901	7,412	7,651	7,656	7,596
In Town	573	567	575	571	574	575	587	587	577	563
Lodges	12	11	10	11	10	11	10	10	8	9
Nonprofits	69	73	78	78	77	79	88	88	86	86
In-Home	130	143	154	151	158	150	158	158	170	170
Vendor	1,008	1,078	1,118	1,164	1,214	1,282	1,483	1,483	1,584	1,550
Seasonal Vendor	732	760	762	736	757	845	975	975	1,088	1,256
Short Term Rental	2,911	3,321	3,365	3,388	3,572	3,737	3,783	3,762	3,870	3,713
Chalet Homes	2	2	2	2	2	-	-	-	1	-
Administrative Licenses*	29	110	144	176	197	233	254	254	272	249

Source: Town of Breckenridge Departmental Statistics.

*Administrative licenses are a new type of license in 2013 provided to companies who are only performing services for the Town.

Town of Breckenridge, Colorado
Capital Asset Indicators by Function/Program
Last Ten Years

DRAFT

Function/Program	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Police										
Stations	1	1	1	1	1	1	1	1	1	1
Patrol units	11	11	11							
Public Works										
Street miles	57.51	57.51	57.51	56.73	56.73	56.73	56.73	56.73	65	65
Street lights	1,075	1,075	1,075	1,100	1,100	1,100	1,112	1,112	1,590	1,590
Traffic signals	2	2	2	2	2	2	2	2	2	2
Total Town area (mi)	5.88	5.88	5.88	6.01	6.01	6.01	6.01	6.01	6.02	6.02
Culture and Recreation										
Golf (number of holes)	27	27	27	27	27	27	27	27	27	27
Recreation Centers	1	1	1	1	1	1	1	1	1	1
Parks	2	2	6	6	6	7	7	7	7	7
Baseball, soccer and multipurpose fields	4	4	4	4	4	4	4	4	4	4
Swimming Pools	2	2	2	2	2	2	2	2	2	2
Skateboard parks	1	1	1	1	1	1	1	1	1	1
Tennis courts	14	14	14	14	12	12	12	12	12	1
Trails in miles	42	47	55	55	58.2	60.75	61.73	63	63	68
Nordic ski trails in miles	14	14	14	14	26.7**	26.7**	26.7**	28.50**	28.50**	25
Indoor ice rinks	1	1	1	1	1	1	1	1	1	1
Outdoor ice rinks	1	1	1	1	1	1	1	1	1	1
Performing Arts Theaters	2	2	2	2	2	2	2	2	2	2
Municipal Water										
Water mains in miles *	103	104	104	104	104	104	104	104	104	104

Source: Town of Breckenridge Departmental Statistics.

*Prior to 2013, water main miles were measured manually with a wheel. The Town now has mapping software which provides a more accurate measurement.

**Nordic ski trails in miles including groomed nordic ski, snowshoe and fat bike trails.

State Compliance

LOCAL HIGHWAY FINANCE REPORT		STATE: COLORADO
This Information From The Records Of: BRECKENRIDGE		YEAR ENDING (mm/yy): 12/31/2022
Prepared By: TRACEY LAMBERT		

I. DISPOSITION OF HIGHWAY-USER REVENUES AVAILABLE FOR LOCAL GOVERNMENT EXPENDITURE

ITEM	A. Local Motor-Fuel Taxes	B. Local Motor-Vehicle Taxes	C. Receipts from State Highway-User Taxes	D. Receipts from Federal Highway Administration
1. Total receipts available				
2. Minus amount used for collection expenses				
3. Minus amount used for nonhighway purposes				
4. Minus amount used for mass transit				
5. Remainder used for highway purposes				

II. RECEIPTS FOR ROAD AND STREET PURPOSES**III. EXPENDITURES FOR ROAD AND STREET PURPOSES**

ITEM	AMOUNT	ITEM	AMOUNT
A. Receipts from local sources:		A. Local highway expenditures:	
1. Local highway-user taxes		1. Capital outlay (from page 2)	\$ 8,836,209.02
a. Motor Fuel (from Item I.A.5.)		2. Maintenance:	\$ 489,172
b. Motor Vehicle (from Item I.B.5.)		3. Road and street services:	
c. Total (a.+b.)		a. Traffic control operations	\$ 733,758
2. General fund appropriations	11,769,236	b. Snow and ice removal	\$ 1,406,370
3. Other local imposts (from page 2)	\$ 510,861	c. Other	
4. Miscellaneous local receipts (from page 2)	\$ -	d. Total (a. through c.)	\$ 2,140,128
5. Transfers from toll facilities		4. General administration & miscellaneous	\$ 428,026
6. Proceeds of sale of bonds and notes:		5. Highway law enforcement and safety	\$ 627,035
a. Bonds - Original Issues		6. Total (1 through 5)	\$ 12,520,570
b. Bonds - Refunding Issues		B. Debt service on local obligations:	
c. Notes		1. Bonds:	
d. Total (a. + b. + c.)	\$ -	a. Interest	
7. Total (1 through 6)	\$ 12,280,097	b. Redemption	
B. Private Contributions		c. Total (a. + b.)	\$ -
C. Receipts from State government		2. Notes:	
(from page 2)	\$ 240,473	a. Interest	
D. Receipts from Federal Government		b. Redemption	
(from page 2)	\$ -	c. Total (a. + b.)	\$ -
E. Total receipts (A.7 + B + C + D)	\$ 12,520,570.02	3. Total (1.c + 2.c)	\$ -
		C. Payments to State for highways	
		D. Payments to toll facilities	
		E. Total expenditures (A.6 + B.3 + C + D)	\$ 12,520,570.02

IV. LOCAL HIGHWAY DEBT STATUS

(Show all entries at par)

	Opening Debt	Amount Issued	Redemptions	Closing Debt
A. Bonds (Total)				\$ -
1. Bonds (Refunding Portion)				\$ -
B. Notes (Total)				\$ -

V. LOCAL ROAD AND STREET FUND BALANCE (RECEIPTS AND DISBURSEMENTS ONLY)

	A. Beginning Balance	B. Total Receipts	C. Total Disbursements	D. Ending Balance	E. Reconciliation
		\$ 12,520,570.02	\$ 12,520,570.02		\$ -

Notes and Comments:

LOCAL HIGHWAY FINANCE REPORT		STATE: COLORADO YEAR ENDING (mm/yy): 12/31/2022	

DRAFT

II. RECEIPTS FOR ROAD AND STREET PURPOSES - DETAIL			
ITEM	AMOUNT	ITEM	AMOUNT
A.3. Other local imposts:		A.4. Miscellaneous local receipts:	
a. Property Taxes and Assesments	\$ 332,318	a. Interest on investments	
b. Other local imposts:		b. Traffic Fines & Penalties	
1. Sales Taxes		c. Parking Garage Fees	
2. Infrastructure & Impact Fees		d. Parking Meter Fees	
3. Liens		e. Sale of Surplus Property	
4. Licenses		f. Charges for Services	
5. Specific Ownership &/or Other	\$ 178,543	g. Other Misc. Receipts	
6. Total (1. through 5.)	\$ 178,543	h. Other	
c. Total (a. + b.)	\$ 510,861	i. Total (a. through h.)	\$ -
(Carry forward to page 1)		(Carry forward to page 1)	
ITEM	AMOUNT	ITEM	AMOUNT
C. Receipts from State Government		D. Receipts from Federal Government	
1. Highway-user taxes (from Item I.C.5.)	\$ 218,568	1. FHWA (from Item I.D.5.)	
2. State general funds		2. Other Federal agencies:	
3. Other State funds:		a. Forest Service	
a. State bond proceeds		b. FEMA	
b. Project Match		c. HUD	
c. Motor Vehicle Registrations	\$ 21,905	d. Federal Transit Administration	
d. DOLA Grant		e. U.S. Corps of Engineers	
e. Other		f. Other Federal	
f. Total (a. through e.)	\$ 21,905	g. Total (a. through f.)	\$ -
4. Total (1. + 2. + 3.f)	\$ 240,473	3. Total (1. + 2.g)	\$ -
(Carry forward to page 1)		(Carry forward to page 1)	

III. EXPENDITURES FOR ROAD AND STREET PURPOSES - DETAIL			
	ON NATIONAL HIGHWAY SYSTEM (a)	OFF NATIONAL HIGHWAY SYSTEM (b)	TOTAL (c)
A.1. Capital outlay:			
a. Right-Of-Way Costs			\$ -
b. Engineering Costs			\$ -
c. Construction:			
(1). New Facilities			\$ -
(2). Capacity Improvements			\$ -
(3). System Preservation		\$ 2,558,565	\$ 2,558,564.99
(4). System Enhancement And Operation		\$ 6,277,644	\$ 6,277,644.03
(5). Total Construction (1)+(2)+(3)+(4)	\$ -	\$ 8,836,209.02	\$ 8,836,209.02
d. Total Capital Outlay (Lines 1.a. + 1.b. + 1.c.4)	\$ -	\$ 8,836,209.02	\$ 8,836,209.02
(Carry forward to page 1)			

Notes and Comments:

Memo

To: Breckenridge Town Council Members
From: Town Staff
Date: 7/20/2023
Subject: Public Projects Update



Goose Pasture Dam Rehabilitation

The dam rehabilitation project remains on track to be completed in November. Over the past two weeks the reservoir was filled to evaluate the embankment and water flowed over the new spillway.

This project began in 2021 and will be constructed over three seasons with completion in November 2023. There is no recreational access to the Tarn during the construction. Public outreach for the project is ongoing through the project website: <https://www.townofbreckenridgegptd.com>.

Asphalt Overlay and Concrete Replacement

Remaining work for the asphalt and concrete project is limited to Ski Hill Road with the concrete work under way. Ski Hill Road will be paved in late summer/early fall (tentatively planned for September) after the completion of the fiberoptic work. No detours are planned for the remaining work, but short traffic delays are expected. Updated information on traffic impacts can be found at www.BreckRoads.com.

Project Funding	
2023 Capital Fund (Overlay & Concrete)	\$3,800,000
2021/2022 Remaining Balance	\$ 170,647
French Street Intersection Improvements	\$ 100,000
TOTAL:	\$4,070,647

Fiber 9600

Fiber construction began at the Peak 7 fire station and is continuing down Ski Hill Road to Park Avenue. This construction is expected to last until mid-August. Peak has traffic control in place and is only closing the necessary lane length for the day's construction.

We are reaching out to residents, businesses, and HOA's along Ski Hill Road to see if there is interest in connecting to fiber while the contractor is in the area. After the Ski Hill Road construction is complete, we plan to extend the existing fiber to the east across HWY 9 at Tiger Road so that we can connect to the workforce housing at the Wayside. We are also planning to bring fiber from Carter Park to the Ice Rink along Powder Ridge Drive and Deep Powder Circle. Workforce housing continues to be a priority for the fiber program, and we plan on having this infrastructure available to Alta Verde II, Justice Center, and Stables Village. We plan to wire the Ski Hill Road fire station next week, in anticipation of the fiber

connection later this summer. The Allo sales team has been reaching out to MDU's in town to garner more interest in fiber. We plan on wiring the following MDU's in 2023 and expect to add more: Blazing Saddles (28 units plus 6 businesses) and Hermit Placer (12 units).

We have submitted a Letter of Intent to apply for grant funding through the Colorado Broadband Office. We are also looking at NTIA Middle Mile grants to help support these future construction efforts. We continue to monitor other funding opportunities and will apply for grants when we qualify.

Residents and businesses can learn more and sign up for service by navigating to:

<https://www.townofbreckenridge.com/live/town-projects-and-issues/breckenridge-broadband-project>
<https://www.allocommunications.com/locations/breckenridge/>

Project Funding	
2022 Capital Prior Spending Authority	\$1,874,219
2023 CIP	\$3,000,000
2022 CIP funds from DOLA grant	\$850,000
TOTAL	\$5,724,219

Blue River Rebuild Project & Coyne Valley Road

Landscaping crews mobilized to the site this week to continue weed mitigation efforts and begin tree and shrub planting along the project corridor. Plantings are scheduled to be completed by the end of August.





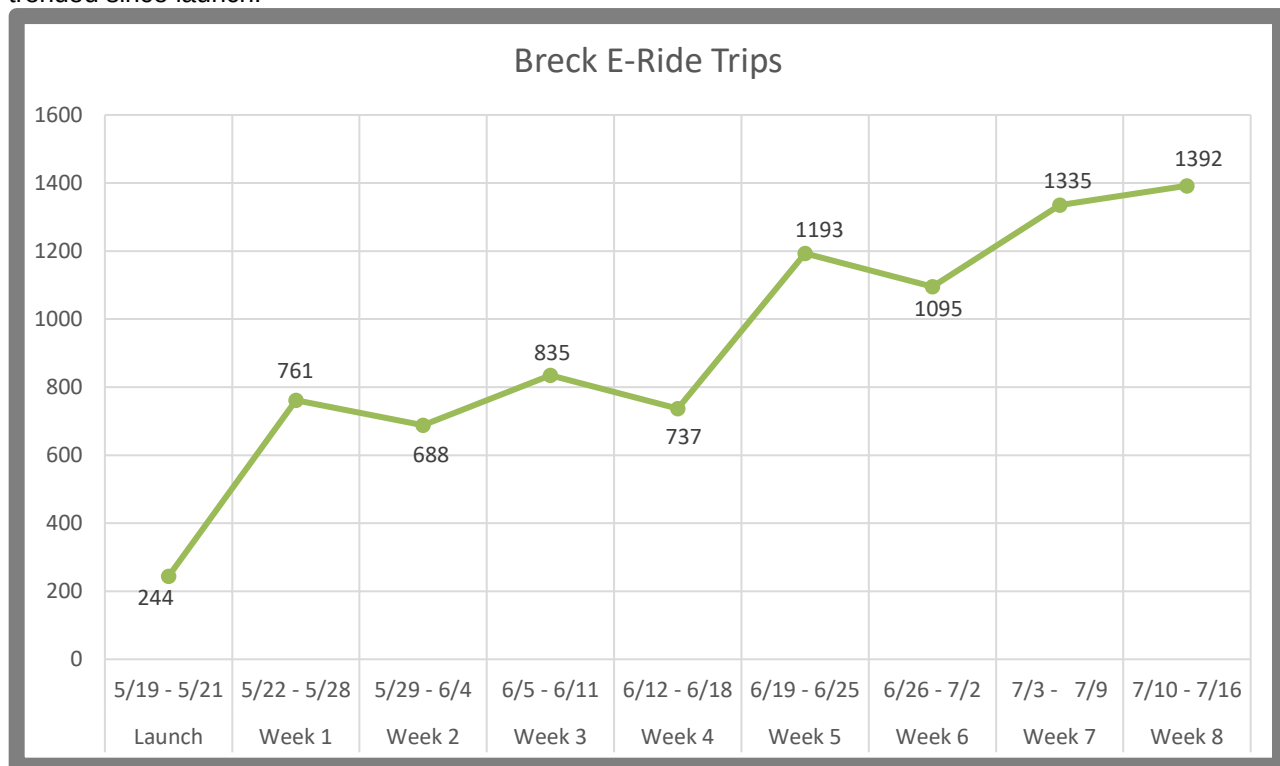
Project Funding	
2022 Capital Fund -Culverts	\$3,500,000
2022 Capital Fund - River	\$4,500,000
2022 Supplemental Appropriation	\$1,858,500
2023 Open Space Fund	\$ 100,000
TOTAL:	\$9,958,500

Memo

To: Breckenridge Town Council Members
 From: Mobility Staff
 Date: 7/19/2023 (For July 25—TC Work Session)
 Subject: **Mobility Update**

Breck E-Ride (e-bikeshare)

Through 7/16/2023, 8,280 trips were taken using the Breck E-Ride e-bikeshare program, an average of 140 trips/day. Approximately 25% of those trips were made using the “Pay-as-you-go” payment option and 75% were made using locals-only membership options. The average trip duration has been about 17 minutes, and average trip length has been about 1.8 miles. Below is a graph showing how ridership has trended since launch:



A mid-season survey about the E-Ride was launched on 7/17 and will remain open through 7/31 for responses and can be found here: [Breck E-Ride Survey](#). Both users and non-users of the program are encouraged to take the survey to provide some midseason feedback on how we might be able to improve their experience and continue growing ridership. We also plan to run an end-of-season survey in October.

Traffic Counts

Traffic counts at the EJ Tunnel for June were slightly higher than June 2022, whereas Hwy 9/Tiger Rd traffic counts were slightly lower compared to the previous year. The counter at the south end of town showed lower traffic counts as well, however this is expected as CDOT recalibrated the counter on April 3rd of this year to exclude counting vehicles turning in/out of River Park Dr.

CDOT Eisenhower Tunnel, Average Daily Total Traffic Counts (EB & WB)

	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>MAY</u>	<u>JUN</u>	<u>JUL</u>	<u>AUG</u>	<u>SEP</u>	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>
2023	37290	39671	38648	31414	30132	37837						
2022	35851	38394	38795	30636	29665	37365	41946	39936	39582	32790	30145	34528
2021	34470	35126	37618	31250	31204	39513	41774	35557	38799	32166	31015	34600
2020	37669	35303	23910	11390	21442	33539	40756	34938	36790	33901	26787	32224
2019	38244	36034	38436	31567	30318	37402	44100	41526	38335	33214	29141	34553
2018	36771	36596	38333	29045	29940	38818	43998	40649	38010	29761	30153	36008
2017	33269	36718	39162	31483	N/A	40217	44022	39719	35614	30216	29087	32690

CDOT Hwy 9 & Tiger Rd, Average Daily Total Traffic Counts (NB & SB)

	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>MAY</u>	<u>JUN</u>	<u>JUL</u>	<u>AUG</u>	<u>SEP</u>	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>
2023	25561	26129	25423	20266	17932	22107						
2022	25343	26314	25528	19385	17755	22419	25576	25157	23340	20126	19542	23392
2021	23613	23681	24455	19981	18729	23885	26569	24052	22303	19357	19779	23740
2020	26091	24334	16206	8459	12873	20096	25398	24184	23870	21272	18851	22557
2019	26864	25558	25043	19475	17420	19707	22715	25287	23769	18932	19522	23106
2018	24454	23112	23746	17638	16681	21491	25586	23805	21848	17993	19613	24572
2017	22314	22238	22640	16863	15739	20133	23872	22365	20694	17736	17914	22213

Hwy 9/River Park Drive CDOT Average Daily Total Traffic Counts (NB & SB)

	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>MAY</u>	<u>JUN</u>	<u>JUL</u>	<u>AUG</u>	<u>SEP</u>	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>
2023	9677	9770	9490	6945	6884	9139						
2022	Not Available			6692	6947	9358	11132	10272	9763	7034	7525	9217

Memo

To: Town Council
From: Sustainability Division
Date: 7/25/23
Subject: Sustainability Update

EV Charging– Four new public EV charging plugs were added out at the Breckenridge Golf Course/Gold Run Nordic Center and were available starting on 7/14. About 80% of the project costs were covered through outside funds, thanks to an \$18,000 grant from the Colorado Energy Office and through participation in Xcel Energy's EV Supply Infrastructure program which covered the make-ready infrastructure costs. Pricing for using these chargers is set to \$0.20/kWh, with no time restrictions.



On Thursday July 27th, 3:30-5pm, High Country Conservation Center and Xcel Energy are hosting a free workshop for any businesses or HOAs interested in learning more about EV charging installation, programs, and incentives. It is free to attend, but participants must [register in advance](#). The workshop will take place at the Freemont Room in the Senior Center, 83 Nancy's Place, Frisco, CO 80443.

PAYT/URO – Staff met with the team at HC3 to develop an HOA letter communicating about upcoming URO requirements and to talk more in detail about implementation for group accounts. We have scheduled hauler meetings for early August to better understand how they are approaching group accounts. HC3 is actively meeting with HOAs to assist with compliance and answer questions. Staff is fielding questions from the public and working with the haulers when needed.

Plastic Pollution – Staff has been working to develop a list of products that are available under the ordinance and that are carried by Shamrock, U.S. Foods, and Sysco. Councilmember Beckerman has been advising staff on best approaches that will be most useful to the restaurant community. Staff is also working on a final scope of work with Launch Media for the outreach campaign.

Material Management – Staff continues working on collecting payments for the Materials Management Fee with 165 invoices paid totaling \$106,000 in revenue. Outreach will continue for any delinquent users with keycards deactivated. Direct outreach and warnings continue for any documented case of contamination or illegal dumping. Staff has reinstated glass collection at the Baldy enclosure at the request of The Carlin. Users of the enclosure have been informed and staff has requested any business that is interested in recycling glass to reach out for access and assistance.

Mountain Towns 2030 – This year's [Climate Solutions Summit](#) will take place in Vail, October 18-19. Registration and hotel information is available on the website. The goal of the Summit is to convene community leaders in a collaborative environment for peer-to-peer sharing of ideas and approaches to solving our most pressing climate challenges.

Tennis Center Solar – The review committee decided to award the RFP to Active Energies Solar ("AES"), for \$512k for a 172 kW system. With changes made under the 2022 Inflation Reduction Act, non-taxable entities like the Town of Breckenridge are now able to receive the 30% rebate for solar projects like this one. This project is now underway, with applications to Xcel already submitted.

The Recreation Advisory Committee held its quarterly meeting 5:30-7:00 pm in the Quandary Peak Conference Room at the Recreation Center.

Committee members present: Judy Farrell, Jack Farrell, Marty Ferris, Katie Ahern, and Amy Perchick. Javier Gaspar was absent.

Staff present: Scott Reid, Patt Reyes, and Molly Boyd

Scott updated the committee on the following:

Rec Staffing updates

- a) Summer staffing has been very successful. Great programs staff, few summer staff shakeouts with GCO, GCM, and OST summer staff. To be expected.
 - i) Plateaued with the number of youth programs the Rec Department can offer
 - ii) Very experienced staff
 - iii) Programs have been a high point for Rec
- b) Already uploaded all programs for the school year
- c) Pending management change
 - i) Shannon Haynes will be the next Town Manager. Scott Reid will take the Deputy Town Manager sometime in the fall.
 - (1) Working on succession plan at Recreation.

Rec Capitol Project

Tennis Courts at Carter Park were updated last year to include pickleball lines
This year:

- 2) Clay courts at the Tennis Center – July 17th start date
 - a) 3 week project
 - b) Tennis clay court project and will also do the outdoor basketball court at the same time
- 3) Leisure Pool – August 7th closure date – covered in the last RAC meeting
 - a) Have reciprocity with Silverthorne Rec Center

Project goals for Town Council – Priorities

- 1) Artificial Turf for ball fields at Kingdom Park- potentially as soon as 2024
 - a. Sustainable, increase usability, and more efficient use of staff time
 - b. Hardscape area potentially 2025
- 2) Expand the skate park
 - a. An additional “street line”
- 3) Summit Youth Hockey requested another sheet of Ice
 - a. Council was not interested in another sheet of ice.
 - b. Trying to work with SYH to utilize different ice times
 - c. Adding Summit School District Academic Athlete for hockey
 - d. Have more split ice and be more efficient
 - e. Use outdoor rink for Soccer, Lacrosse, and inflatables
- 4) Department Updates
 - a) Budget for 2024
 - i) Our goal is to provide amazing amenities to the local community – meet local demand first
 - b) Programs are up and are doing well

- (1) Fall/Winter programs - First open programs to TOB employees, then to the School District kids before opening to the general public. Prioritize local kids.
- (2) Programs has grown and Programs feels like we have reached max capacity
- (3) Full capacity for July – 100 kids a day in BMC, most programs are full
- c) Sports & Special Events
 - i) 3 successful running races and 3 successful bike races (despite the weather).
 - ii) Firecracker 50 next week
- d) Ice Arena
 - i) Indoor Soccer league was very successful
 - ii) Summer Hockey leagues are full
 - iii) Octoberfest women's tournament filling up
- e) Nordic – winter planning
- f) Golf is very busy
 - i) Elk 9 is opening Saturday, July 1.
- 5) OST is busy
- 6) Cybex (fitness equipment) is going out of business
 - a) Parts replacement up to 7 years – have already started to order replacement cables and parts
- 7) Stages cycling going out of business – not totally confirmed
 - a) Working on other options
 - b) Should have stages for up to 5 years
- 8) Moving more classes into turf – high demand, having a hard time finding instructors for 5:45 am classes
- 9) Looking at updating all bathrooms to be ADA compliant
- 10) Holding off on locker rooms, but updating family locker room

11) **Feedback & Comments from Committee Members**

Are you going to do events for Halloween, Easter, Winterfest etc.?

Yes, we are working on it.

Do we plan on having swim lessons while the lap pool is open?

Yes, we are making every effort.

Do you have a plan for the Rec Director?

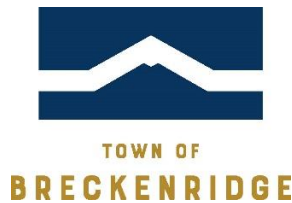
Yes, it will likely be an internal hire.

Done a great job with the fitness program.

Hard to get in and out of the parking lot in the morning and evenings. Cars are parked on the side to pick up kids, making it challenging.

Next meeting Wed Sept 20th

The committee adjourned at 6:40 pm.



Memo

To: Breckenridge Town Council Members
From: Jon Dorr, Assistant Director of Recreation/Programs
Date: 7/17/2023
Subject: Breckenridge Events Committee

The Breckenridge Events Committee met on July 12, 2023. Below you will find the meeting minutes and a link to the SEPA calendar. Event details of the Ram Walk, 10 Mile Pride, and all July 4th activation were shared with positive feedback across the board. BTO gave an overview of Oktoberfest outlining footprint and dates. There are no additional items of note.

**Minutes
Breckenridge Events Committee
Wednesday, July 12, 2023
*Right event, right time, right result***

Attending: Maddie Schilling, Kelly Owens, Jon Dorr, Shannon Haynes, Lucy Kay, Neal Kerr, Carrie Benefiel, Dave Feller, Chase Banachowski, Andy Banas

Guests: Sarah Wetmore, Majai Bailey, Melissa Andrews, Ashley Zimmerman, Juli Rathke, Tara Dew, Tina Cunningham, Kat Slaughter, Tina Cunningham

I. The Vice Chair called the meeting to order at 9am.

- a Chair took roll call of committee members.
- b A motion was made to approve the June 7, 2023, meeting.

M/S/P

II. Upcoming Events – The committee reviewed list of upcoming events.

- a 7.15.23 Breckenridge Beer Fest @ Beaver Run - *Private Property, minimal impact*
- b 7.22.23 Summerfest '23 Roller Ski Sprint Race @ Denison Placer, *Minimal impact*
- c 7.28-30.23 Breckenridge Food & Wine @ MSS , *Private Property, minimal impact*
- d 7.28.23 Riverwalk 30 Ann. Carnival ft. Asleep at the Wheel, *Private Property, minimal impact*
- e 8.3-5.23 22nd Annual Breckenridge Aug Art Festival @ MSS, *Private Property, minimal impact*
- f 8.3.23 Backstage Theatre Annual Gala, *Minimal impact*
- g 8.11.23 BIFA – BCA gave an update on 2023 BIFA Programming
<https://breckcreate.org/bifa>
- h 8.13-15.23 Breck Epic
- i 8.24-26.23 Wine Classic @ Beaver Run, *Private Property, minimal impact*
- j 8.25-27.23 Hogfest: Bacon & Bourbon @ MSS, *Private Property, minimal impact*
- k 9.2.23 The Great Rubber Duck Race

- l 9.15-17.23 48th Annual Gathering At Great Divide Art Fest @ CMC, *Private Property, minimal impact*
 - m **9.15-17.23 Oktoberfest** – Planning for same footprint as last year. Adding an additional beer trailer on Main Street to try and alleviate beer lines. Stein sales are currently live. Sponsorship still pending. Stein distribution will be out of the River walk Center again this year.
 - n **9.21-24.23 Breckenridge Film Festival**
 - o 9.29-10.1.23 Strings, Ciders, & Sours, *Private Property, minimal impact*
- III. **Pending SEPA** - Committee reviewed the list of pending SEPAs and had no concerns.
- IV. **General Updates and Discussions**
- a Update from Sustainability Sub-Group
 - Jon Dorr met with TOB Sustainability to discuss progress with enforcing compliance with new plastic ordinance. Town should receive new water trailers within the month. Jessie Burley working on water campaign with Launch Media.
 - RCup program introduced to Town Party. Around 75% return rate of cups. Need to get a better understanding of what happened to 25% of the cups and if the program is actually making a positive impact. Some discussion around the benefits of adopting program more universally across Town in terms of ability to educate the community on how the program works and to be able to enforce compliance.
- V. **Review Past Events**
- a **6.9-10.23 10 Mile Pride** – Intimate event that received considerable amount of positive feedback from the community. No issues or concerns from PD. Looking at reserving venues now for next year. Suggestion that other Pride events that were held simultaneously across the County may have pulled some attendance away from Breckenridge's event.
 - b **6.10.23 RAM Walk** – BGV – Successful event, no concerns. Positive feedback from community, great family activation. Attendance was back up to pre-covid levels. Raised 180K for heart health initiatives and local nonprofits. Final sustainably numbers still pending. Event tentatively scheduled for June 8th 2024.
 - c **6.15.23 Town Party** – TC happy with the amount of local community in attendance. Event included a free concert, food & beverage sales & the chance to discover details about community activities, events & volunteer opportunities presented by local nonprofits. BCA estimates around 700 ppl attended.
 - d **7.4.23 Fourth of July Activation** –
 - 32 Parade Floats including two marching bands and the Denver Nuggets Mascot. Parade lasted around 40 min. CJ Mueller read declaration of independence. RWB water activation on Main Street.
 - BCA feels they may be reaching capacity with their activation in the Arts District. Some discussion around brining something back to the RWC Lawn. Committee voiced caution around adding more programming to an already packed schedule. Cautious about doing more.
 - Rec Department – 1600 participants across three different events. 10K registration almost reached full capacity. Minimal town impact. Inaugural Sparkler 50 yarder was great success with 101 toddlers on Striders. Firecracker 50 was also extremely successful. More team registrations than in past years
- VI. **Next BEC Meeting – Aug 2, 2023**

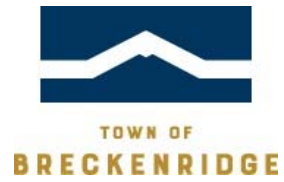
VII. The Meeting adjourned at 9:40am.

The Breckenridge Events Committee evaluates events against four strategic goals:

- **Build Business** - An event designed to drive revenue for greater business community and /or the event producer.
- **Branding/Media** - An event designed to draw external media (national & international) promoting the Breckenridge brand.
- **Fundraising** - An event designed to raise awareness and funding for a non-profit organization's mission.
- **Resident Focused** - An event designed specifically for residents vs. an event more broadly marketed to visitors and residents.

LINK TO SEPA CALENDAR

<https://calendar.google.com/calendar/u/0?cid=cmN0NTI3bnUwZ2dpZjE2azRyY2ttaGF2cW9AZ3JvdXAuY2FsZW5kYXluZ29vZ2xhLmNvbQ>



June 30, 2023

Department of Finance



Executive Summary

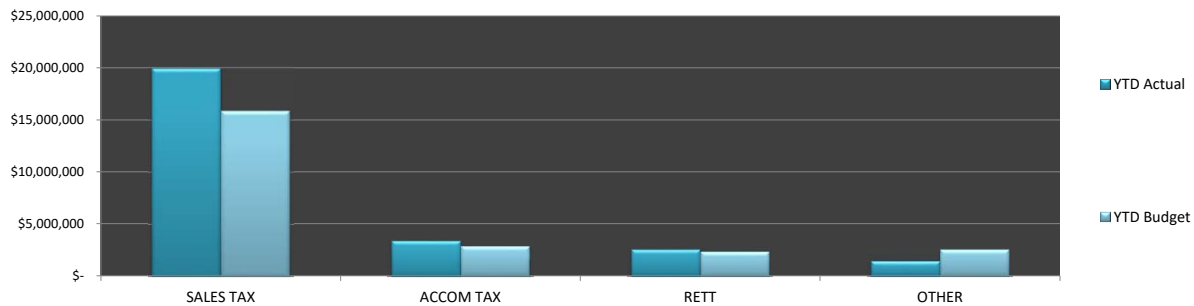
June 30, 2023

This report covers the 6 months of 2023. June is largely reflective of May tax collections

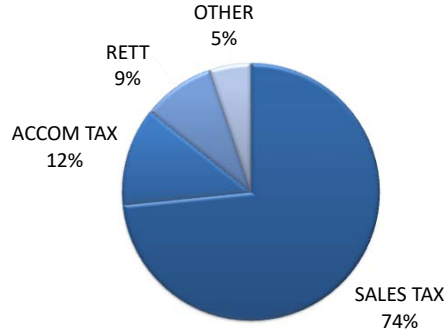
Overall, we are approximately \$3.6M over 2023 budgeted revenues in the Excise fund. Sales tax is currently \$4M over YTD budget, and \$1M ahead of prior year. Accommodations tax is \$.5M ahead of budget, and \$.2M behind from last year. Real Estate Transfer Tax is \$.1M ahead of budget, and \$.9M behind prior year.

See the Tax Basics section of these financial reports for more detail on the sales, accommodations, and real estate transfer taxes.

Excise YTD Actual vs. Budget - by Source



YTD Actual Revenues - Excise



	YTD Actual	YTD Budget	% of Budget	Annual Budget	Prior YTD Actual	Prior Annual Actual
SALES TAX	\$ 19,924,000	\$ 15,862,611	126%	\$ 32,551,152	\$ 18,824,735	\$ 34,470,250
ACCOMMODATIONS TAX	3,347,474	2,861,173	117%	5,476,500	3,509,278	6,224,551
REAL ESTATE TRANSFER	2,457,182	2,297,999	107%	5,405,283	3,368,679	6,872,481
OTHER*	1,418,542	2,476,145	57%	5,351,055	296,740	1,024,037
TOTAL	\$ 27,147,199	\$ 23,497,928	116%	\$ 48,783,990	\$ 25,999,433	\$ 48,591,318

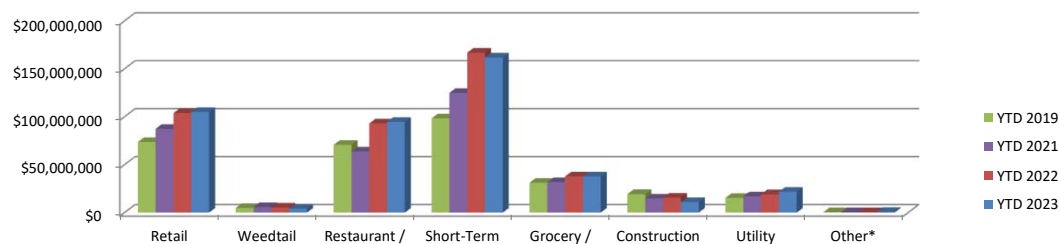
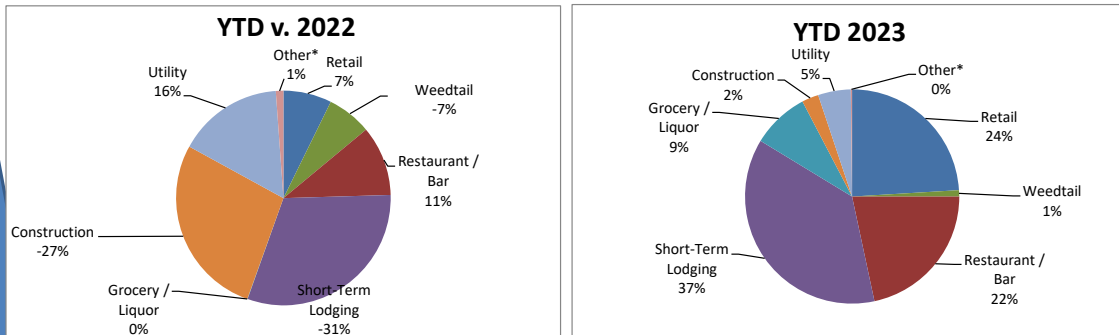
* Other includes Franchise Fees (Telephone, Public Service and Cable), Cigarette Tax, and Investment Income

The Tax Basics: May 2023

Net Taxable Sales by Industry-YTD

Description	YTD 2019	YTD 2021	YTD 2022	2022 % of Total	YTD 2023	2022/2023 \$ Change	2022/2023 % Change	2023 % of Total
Retail	\$73,668,630	\$87,450,652	\$103,819,620	23.50%	\$105,004,621	\$1,185,001	1.14%	24.04%
Weedtail	\$4,922,353	\$5,852,324	\$5,224,232	1.18%	\$4,138,230	(\$1,086,002)	-20.79%	0.95%
Restaurant / Bar	\$70,720,985	\$63,836,908	\$92,986,942	21.05%	\$94,703,924	\$1,716,981	1.85%	21.68%
Short-Term Lodging	\$98,239,493	\$124,830,468	\$166,779,540	37.76%	\$161,765,615	(\$5,013,925)	-3.01%	37.03%
Grocery / Liquor	\$31,183,930	\$31,734,415	\$37,686,805	8.53%	\$37,679,646	(\$7,158)	-0.02%	8.63%
Construction	\$19,356,661	\$14,640,795	\$15,520,611	3.51%	\$11,056,098	(\$4,464,512)	-28.77%	2.53%
Utility	\$15,315,697	\$16,932,086	\$19,124,601	4.33%	\$21,706,270	\$2,581,670	13.50%	4.97%
Other*	\$469,533	\$471,897	\$582,097	0.13%	\$767,780	\$185,682	31.90%	0.18%
Total	\$313,877,282	\$787,473,992	\$441,724,448	100.00%	\$436,822,184	(\$4,902,263)	-1.11%	100.00%

* Other includes activities in Automobiles and Undefined Sales.



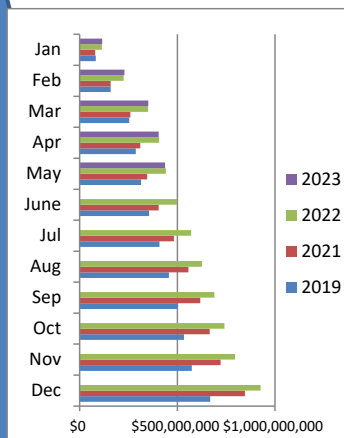
New Items of Note:

- May YTD net taxable sales are currently behind of May YTD 2022 by 1.11%.
- For May YTD 2023, there were increases in Retail (1.14%), Restaurant/Bar (1.85 %) and Utilities (13.50 %) and a decrease in Weedtail (-20.79%) , Short-Term Lodging (-3.01%), Grocery/Liquor (.02 %) and Construction (-28.77%), compared to May YTD 2022.
- May YTD 2023 is ahead of May YTD 2019 by 39.17%.

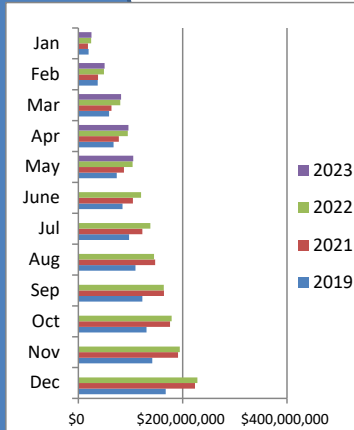
Historical Notes:

- Due to COVID-19, on March 16, 2020 Town-Wide business closures/operating limitations went into effect. On November 22, 2020 indoor dining closed due to Summit County entering level red on the State COVID 19 dial dashboard on November 20th. Restaurants started reopening for indoor dining on December 18, 2020 through the five star certification program.
- By executive order, Town bag fees were waived for large grocers during the COVID-19 pandemic March 27, 2020 - September 9, 2020, and again November 19, 2020 - April 28, 2021.
- Colorado COVID-19 Public Health emergency expired May 11, 2023.
- Short Term Lodging taxes are generally remitted based on reservation date.
- In 2014, a new category was added to the Sales by Sector pages for the Weedtail sector. The category encompasses all legal marijuana sales, regardless of medical or recreational designation.
- A section on Disposable Bag Fees was added in 2014.
- A section on Short Term Rentals was added in 2018.
- Taxes collected from the customer by the vendor are remitted to the Town on the 20th of the following month.
- Quarterly taxes are reported in the last month of the period. For example, taxes collected in the first quarter of the year (January – March), are included on the report for the period of March.
- Net Taxable Sales are continually updated as late tax returns are submitted to the Town of Breckenridge. Therefore, you may notice slight changes in prior months, in addition to the reporting for the current month.
- "Other" sales relate to returns that have yet to be classified. Much of this category will be reclassified to other sectors as more information becomes available.

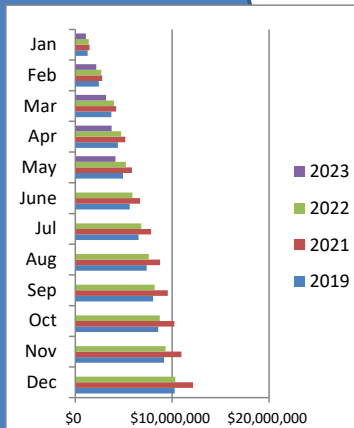
Net Taxable Sales by Sector-Town of Breckenridge Tax Base



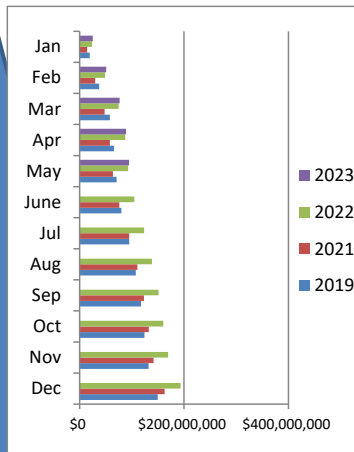
Total Net Taxable Sales						
	2019	2021	2022	2023	% change from PY	% change from '19
Jan	\$82,322,443	\$79,027,302	\$113,608,612	\$115,028,849	1.25%	39.73%
Feb	\$75,811,953	\$79,756,522	\$111,338,870	\$113,751,026	2.17%	50.04%
Mar	\$95,183,824	\$100,240,430	\$125,726,058	\$122,523,592	-2.55%	28.72%
Apr	\$33,990,319	\$51,021,983	\$56,511,686	\$53,484,242	-5.36%	57.35%
May	\$26,568,743	\$35,703,308	\$34,539,221	\$32,034,474	-7.25%	20.57%
June	\$41,041,039	\$58,731,249	\$56,232,343	\$0	n/a	n/a
Jul	\$53,773,050	\$77,776,788	\$72,887,360	\$0	n/a	n/a
Aug	\$48,091,755	\$74,672,063	\$55,893,366	\$0	n/a	n/a
Sep	\$45,110,631	\$60,889,227	\$62,995,678	\$0	n/a	n/a
Oct	\$32,300,192	\$48,311,322	\$51,453,084	\$0	n/a	n/a
Nov	\$39,932,842	\$55,302,573	\$53,833,961	\$0	n/a	n/a
Dec	\$93,947,588	\$124,953,272	\$131,392,224	\$0	n/a	n/a
Total	\$668,074,379	\$846,386,039	\$926,412,462	\$436,822,184	-52.85%	-34.61%



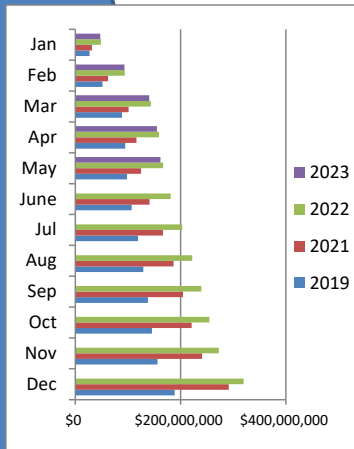
Retail						
	2019	2021	2022	2023	% change from PY	% change from '19
Jan	\$19,611,835	\$18,326,302	\$24,325,071	\$25,157,660	3.42%	28.28%
Feb	\$17,374,017	\$19,257,919	\$24,774,629	\$25,052,192	1.12%	44.19%
Mar	\$21,694,451	\$25,932,215	\$31,201,771	\$31,473,692	0.87%	45.08%
Apr	\$8,703,441	\$13,935,382	\$14,391,482	\$14,171,285	-1.53%	62.82%
May	\$6,284,885	\$9,998,833	\$9,126,666	\$9,149,792	0.25%	45.58%
June	\$10,800,684	\$17,029,901	\$16,357,808	\$0	n/a	n/a
Jul	\$12,822,892	\$18,164,123	\$17,904,772	\$0	n/a	n/a
Aug	\$12,049,046	\$24,629,017	\$6,889,541	\$0	n/a	n/a
Sep	\$13,192,543	\$16,790,614	\$18,773,860	\$0	n/a	n/a
Oct	\$8,177,952	\$11,785,796	\$15,166,153	\$0	n/a	n/a
Nov	\$10,978,771	\$15,247,642	\$15,610,894	\$0	n/a	n/a
Dec	\$25,851,630	\$32,357,559	\$33,640,698	\$0	n/a	n/a
Total	\$167,542,148	\$223,455,304	\$228,163,346	\$105,004,621	-53.98%	-37.33%



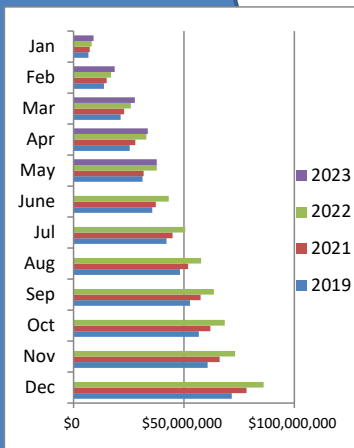
Weedtail						
	2019	2021	2022	2023	% change from PY	% change from '19
Jan	\$1,278,628	\$1,478,465	\$1,390,691	\$1,085,499	-21.95%	-15.10%
Feb	\$1,143,834	\$1,294,638	\$1,290,570	\$1,071,374	-16.98%	-6.33%
Mar	\$1,291,752	\$1,441,196	\$1,310,491	\$1,021,416	-22.06%	-20.93%
Apr	\$682,583	\$942,276	\$732,968	\$577,496	-21.21%	-15.40%
May	\$525,557	\$695,750	\$499,512	\$382,445	-23.44%	-27.23%
June	\$691,544	\$841,867	\$670,484	\$0	n/a	n/a
Jul	\$905,548	\$1,116,858	\$912,870	\$0	n/a	n/a
Aug	\$845,682	\$936,140	\$777,363	\$0	n/a	n/a
Sep	\$658,693	\$802,336	\$611,456	\$0	n/a	n/a
Oct	\$536,078	\$665,889	\$529,983	\$0	n/a	n/a
Nov	\$605,820	\$737,780	\$581,583	\$0	n/a	n/a
Dec	\$1,088,987	\$1,195,620	\$1,014,636	\$0	n/a	n/a
Total	\$10,254,704	\$12,148,814	\$10,322,606	\$4,138,230	-59.91%	-59.65%



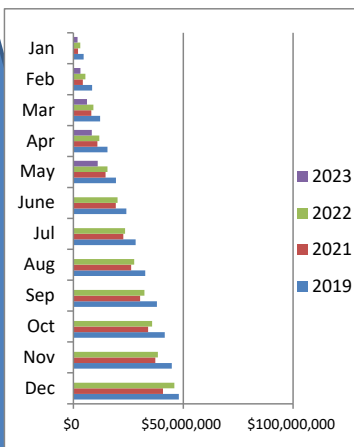
Restaurant / Bar						
	2019	2021	2022	2023	% change from PY	% change from '19
Jan	\$19,257,344	\$14,372,467	\$23,591,432	\$25,009,257	6.01%	29.87%
Feb	\$18,251,145	\$15,293,976	\$24,974,867	\$25,865,915	3.57%	41.72%
Mar	\$20,276,191	\$18,001,752	\$26,280,138	\$25,821,441	-1.75%	27.35%
Apr	\$8,183,550	\$10,103,518	\$12,415,528	\$12,209,139	-1.66%	49.19%
May	\$4,752,756	\$6,065,196	\$5,724,977	\$5,798,172	1.28%	22.00%
Jun	\$9,334,516	\$12,074,689	\$11,796,384	\$0	n/a	n/a
Jul	\$14,827,380	\$19,085,898	\$18,692,700	\$0	n/a	n/a
Aug	\$12,693,004	\$15,737,756	\$14,956,807	\$0	n/a	n/a
Sep	\$10,012,989	\$12,545,273	\$12,668,238	\$0	n/a	n/a
Oct	\$6,463,032	\$9,054,163	\$9,309,000	\$0	n/a	n/a
Nov	\$8,198,131	\$9,429,392	\$9,038,337	\$0	n/a	n/a
Dec	\$17,310,078	\$20,911,542	\$24,126,957	\$0	n/a	n/a
Total	\$149,560,115	\$162,675,623	\$193,575,365	\$94,703,924	-51.08%	-36.68%



Short-Term Lodging						
	2019	2021	2022	2023	% change from PY	% change from '19
Jan	\$26,972,450	\$31,752,506	\$48,613,697	\$47,461,191	-2.37%	75.96%
Feb	\$24,828,849	\$30,607,518	\$45,169,344	\$45,718,751	1.22%	84.14%
Mar	\$37,084,360	\$38,833,031	\$49,654,941	\$47,101,567	-5.14%	27.01%
Apr	\$6,084,075	\$14,797,935	\$15,604,892	\$14,576,157	-6.59%	139.58%
May	\$3,269,759	\$8,839,478	\$7,736,666	\$6,907,949	-10.71%	111.27%
Jun	\$8,616,999	\$16,110,696	\$14,454,476	\$0	n/a	n/a
Jul	\$12,277,101	\$25,496,064	\$21,720,310	\$0	n/a	n/a
Aug	\$10,003,552	\$20,237,448	\$19,219,232	\$0	n/a	n/a
Sep	\$8,761,172	\$17,984,049	\$17,234,547	\$0	n/a	n/a
Oct	\$7,656,277	\$16,267,787	\$15,303,928	\$0	n/a	n/a
Nov	\$10,643,615	\$19,659,292	\$18,013,772	\$0	n/a	n/a
Dec	\$32,413,202	\$50,715,608	\$46,896,490	\$0	n/a	n/a
Total	\$188,611,410	\$291,301,413	\$319,622,294	\$161,765,615	-49.39%	-14.23%



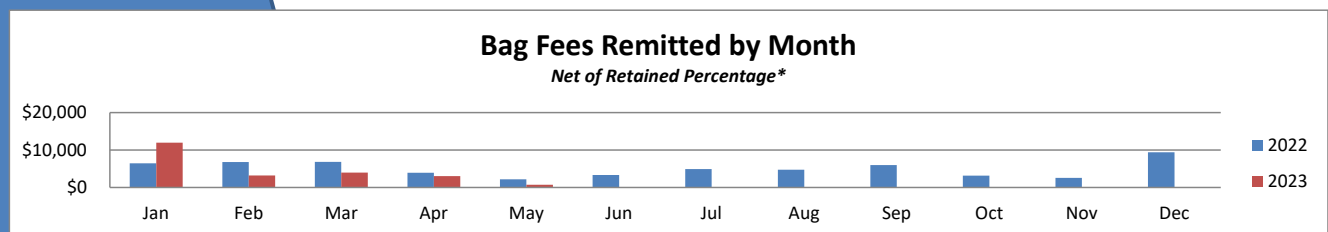
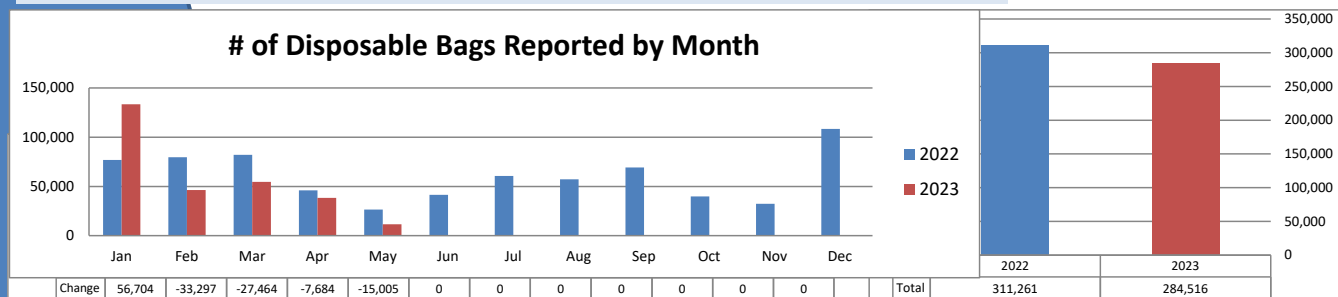
Grocery / Liquor						
	2019	2021	2022	2023	% change from PY	% change from '19
Jan	\$6,728,312	\$7,287,839	\$8,170,578	\$8,997,217	10.12%	33.72%
Feb	\$6,986,584	\$7,698,418	\$8,753,193	\$9,587,315	9.53%	37.22%
Mar	\$7,555,406	\$7,875,044	\$9,019,659	\$9,151,128	1.46%	21.12%
Apr	\$4,143,198	\$5,116,542	\$6,998,996	\$5,851,774	-16.39%	41.24%
May	\$5,770,430	\$3,756,571	\$4,744,379	\$4,092,212	-13.75%	-29.08%
Jun	\$4,477,840	\$5,487,526	\$5,436,849	\$0	n/a	n/a
Jul	\$6,441,916	\$7,596,984	\$7,431,072	\$0	n/a	n/a
Aug	\$6,036,270	\$7,082,310	\$7,177,335	\$0	n/a	n/a
Sep	\$4,599,869	\$5,595,731	\$5,816,776	\$0	n/a	n/a
Oct	\$3,956,333	\$4,452,681	\$4,953,494	\$0	n/a	n/a
Nov	\$3,980,326	\$4,209,254	\$4,692,648	\$0	n/a	n/a
Dec	\$10,973,358	\$12,158,623	\$12,887,729	\$0	n/a	n/a
Total	\$71,649,842	\$78,317,524	\$86,082,707	\$37,679,646	-56.23%	-47.41%



Construction							
	2019	2021	2022	2023	% change from PY	% change from '19	
Jan	\$4,617,707	\$2,068,745	\$3,087,979	\$1,896,022	-38.60%	-58.94%	
Feb	\$3,924,001	\$2,195,750	\$2,329,985	\$1,329,535	-42.94%	-66.12%	
Mar	\$3,626,832	\$3,880,970	\$3,659,430	\$2,951,113	-19.36%	-18.63%	
Apr	\$3,340,641	\$2,799,808	\$2,689,995	\$2,220,675	-17.45%	-33.53%	
May	\$3,847,480	\$3,695,521	\$3,753,221	\$2,658,753	-29.16%	-30.90%	
Jun	\$4,753,416	\$4,674,905	\$4,564,515	\$0	n/a	n/a	
Jul	\$4,225,825	\$3,429,834	\$3,420,384	\$0	n/a	n/a	
Aug	\$4,380,782	\$3,559,510	\$4,155,216	\$0	n/a	n/a	
Sep	\$5,278,007	\$4,014,804	\$4,670,892	\$0	n/a	n/a	
Oct	\$3,589,116	\$3,702,556	\$3,476,544	\$0	n/a	n/a	
Nov	\$3,210,387	\$3,262,427	\$2,663,371	\$0	n/a	n/a	
Dec	\$3,173,337	\$3,496,696	\$7,432,985	\$0	n/a	n/a	
Total	\$47,967,531	\$40,781,527	\$45,904,519	\$11,056,098	-75.92%	-76.95%	

Disposable Bag Fees

The Town adopted an ordinance April 9, 2013 (effective October 15, 2013) to discourage the use of disposable bags, achieving a goal of the SustainableBreck Plan. As of May 4th 2023 the \$.10 fee has been changed to \$.25, this continues to apply to most plastic and paper bags given out at retail and grocery stores in Breckenridge. The program is intended to encourage the use of reusable bags and discourage the use of disposable bags, thereby furthering the Town's sustainability efforts. Revenues from the fee are used to provide public information about the program and promote the use of reusable bags.



*As of May 4th 2023 a change has taken into effect and retailers are permitted to retain 40% of the fee (up to a maximum of \$1000/month through October 31, 2014; changing to a maximum of \$100/month beginning November 1, 2014) in order to offset expenses incurred related to the program. The retained percent may be used by the retail store to provide educational information to customers; provide required signage; train staff; alter infrastructure; fee administration; develop/display informational signage; encourage the use of reusable bags or promote recycling of disposable bags; and improve infrastructure to increase disposable bag

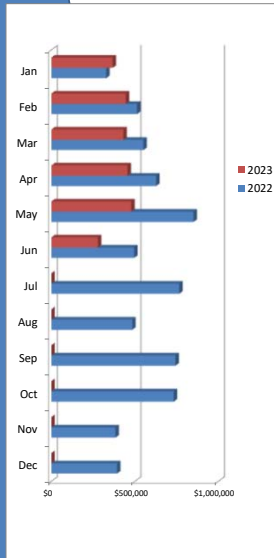
Real Estate Transfer Tax

New Items of Note:

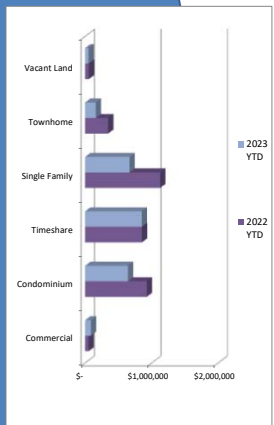
- Revenue June YTD is ahead of the budget by \$.1M and below the prior year by \$.9M.
- Timeshare sales account for the majority of the sales (34.58%), with Single Family sales in the second position of highest sales (27.11%) subject to the tax. Timeshare sales are higher YTD by .34% and Single Family sales are lower YTD by -40.86%. Condominium activity is representing 26.19% of the activity.
- June YTD 2023 churn was 55.41% below June YTD 2022.

Continuing Items of Note:

- 2023 Real Estate Transfer Tax budget is based upon a 5 year historical budget phasing.

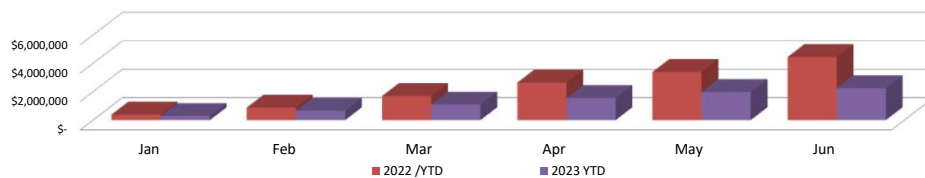


Total RETT								
	2019	2021	2022	2023	% change	2023 budget	+/- Budget	
Jan	\$536,802	\$394,201	\$328,719	\$366,761	11.57%	\$298,205	\$68,556	
Feb	\$441,411	\$493,987	\$512,843	\$445,546	-13.12%	\$342,714	\$102,832	
Mar	\$454,470	\$813,726	\$551,693	\$431,380	-21.81%	\$382,978	\$48,402	
Apr	\$674,070	\$946,247	\$627,842	\$456,127	-27.35%	\$433,275	\$22,852	
May	\$781,528	\$743,447	\$851,657	\$478,584	-43.81%	\$454,505	\$24,079	
Jun	\$480,111	\$1,052,494	\$495,925	\$278,784	-43.79%	\$386,322	-\$107,538	
Jul	\$510,302	\$841,992	\$765,641	\$0	n/a	\$441,027	n/a	
Aug	\$784,245	\$1,024,008	\$484,573	\$0	n/a	\$558,753	n/a	
Sep	\$684,950	\$1,027,878	\$742,908	\$0	n/a	\$674,590	n/a	
Oct	\$561,093	\$2,446,257	\$732,723	\$0	n/a	\$748,951	n/a	
Nov	\$604,298	\$579,469	\$384,336	\$0	n/a	\$365,827	n/a	
Dec	\$653,338	\$674,950	\$393,620	\$0	n/a	\$318,136	n/a	
Total	\$7,166,618	\$11,038,657	\$6,872,481	\$2,457,183		\$5,405,283		



by Category						
Description	2022 YTD	2023 YTD	\$ change	% change	% of Total	
Commercial	\$ 51,900	\$ 87,456	\$ 35,556	68.51%	3.56%	
Condominium	\$ 926,290	\$ 643,628	\$ (282,661)	-30.52%	26.19%	
Timeshare	\$ 852,574	\$ 849,683	\$ (2,890)	-0.34%	34.58%	
Single Family	\$ 1,126,495	\$ 666,197	\$ (460,297)	-40.86%	27.11%	
Townhome	\$ 345,295	\$ 159,103	\$ (186,192)	-53.92%	6.48%	
Vacant Land	\$ 55,752	\$ 51,100	\$ (4,652)	-8.34%	2.08%	
Total	\$ 3,358,304	\$ 2,457,168	\$ (901,137)	-26.83%	100.00%	

YTD Churn Analysis

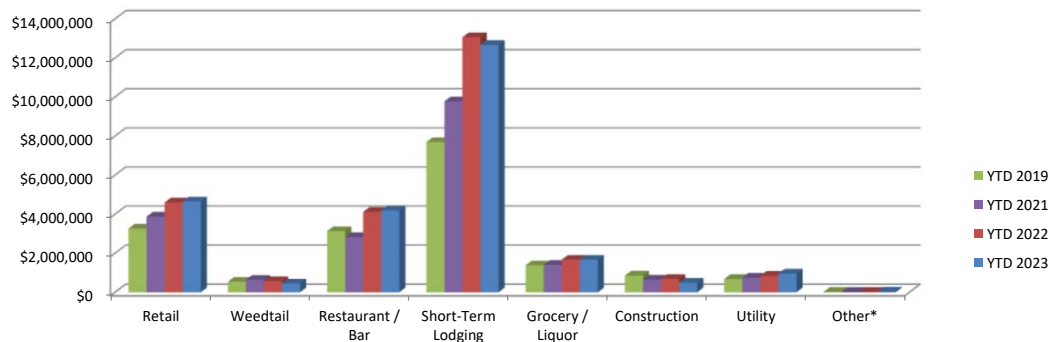
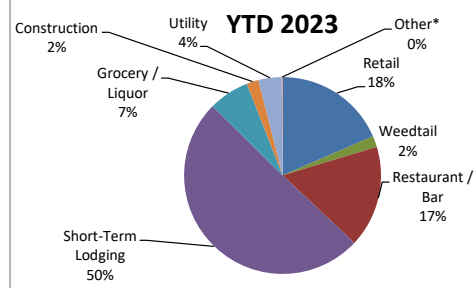
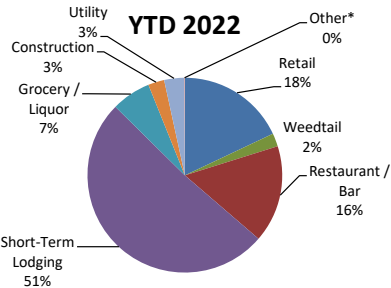


TAXES DUE - SALES, ACCOMMODATIONS, AND MARIJUANA TAXES

Tax Due by Industry-YTD

Description	YTD 2019	YTD 2021	YTD 2022	2022 % of Total	YTD 2023	2022/2023 \$ Change	2022/2023 % Change	2023 % of Total
Retail	\$3,263,520	\$3,874,064	\$4,599,209	17.98%	\$4,651,705	\$52,496	1.14%	18.52%
Weedtail	\$538,013	\$639,659	\$571,009	2.23%	\$452,309	(\$118,700)	-20.79%	1.80%
Restaurant / Bar	\$3,132,940	\$2,827,975	\$4,119,322	16.10%	\$4,195,384	\$76,062	1.85%	16.70%
Short-Term Lodging	\$7,692,152	\$9,774,226	\$13,058,838	51.05%	\$12,666,248	(\$392,590)	-3.01%	50.42%
Grocery / Liquor	\$1,381,448	\$1,405,835	\$1,669,525	6.53%	\$1,669,208	(\$317)	-0.02%	6.64%
Construction	\$857,500	\$648,587	\$687,563	2.69%	\$489,785	(\$197,778)	-28.77%	1.95%
Utility	\$678,485	\$750,091	\$847,220	3.31%	\$961,588	\$114,368	13.50%	3.83%
Other*	\$20,800	\$20,905	\$25,787	0.10%	\$34,013	\$8,226	31.90%	0.14%
Total	\$17,564,859	\$19,941,342	\$25,578,472	100.00%	\$25,120,239	(\$458,234)	-1.79%	100.00%

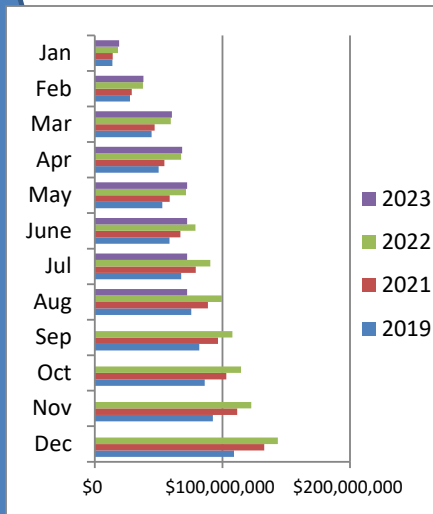
* Other includes activities in Automobiles and Undefined Sales.



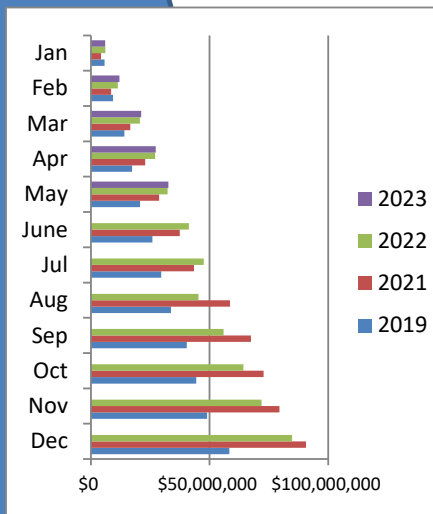
Items of Note:

- The general sales tax rate includes the 2.5% Town sales tax + 1.93% County sales tax distributed to the Town.
- The Short -Term Lodging sector includes an additional 3.4% accommodation tax.
- Weedtail includes an additional 5% marijuana tax (recreational and medical). The 1.5% distribution from the State is also included in this category. While the State distribution is only due on recreational sales, the majority of weedtail sales are recreational and the distribution has been applied to the entire sector.
- Report assumptions include: applying tax specific to a sector to the entire sector, as well as assuming the same tax base across the State, County, and Town taxes due. As a result, the numbers indicated above are a rough picture of taxes due to the Town and not an exact representation. Additionally, the data is representative of taxes due to the Town and not necessarily taxes collected year to date.

The Tax Basics: Retail Sales Sector Analysis

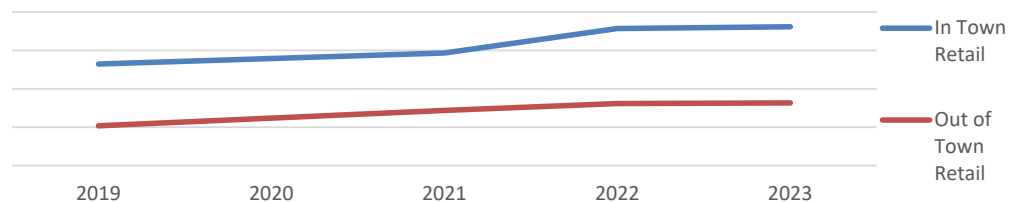


Retail: In-Town					
	2019	2021	2022	2023	% change from PY
Jan	\$13,874,223	\$14,077,047	\$18,209,812	\$19,136,159	5.09%
Feb	\$13,755,726	\$14,977,129	\$19,537,129	\$19,070,261	-2.39%
Mar	\$16,905,640	\$17,839,105	\$21,866,358	\$22,259,549	1.80%
Apr	\$5,471,956	\$7,661,522	\$8,025,948	\$8,024,663	-0.02%
May	\$2,941,690	\$4,165,067	\$3,833,477	\$3,848,842	0.40%
Jun	\$5,600,801	\$8,329,620	\$7,426,984	\$0	n/a
Jul	\$9,136,287	\$12,135,190	\$11,603,472	\$0	n/a
Aug	\$7,911,724	\$9,492,636	\$9,144,401	\$0	n/a
Sep	\$6,331,984	\$7,930,968	\$8,204,963	\$0	n/a
Oct	\$4,203,590	\$6,429,451	\$6,771,369	\$0	n/a
Nov	\$6,421,375	\$8,605,141	\$7,965,280	\$0	n/a
Dec	\$16,458,003	\$21,118,675	\$20,763,542	\$0	n/a
Total	\$109,012,999	\$132,761,551	\$143,352,734	\$72,339,474	



Retail: Out-of-Town					
	2019	2021	2022	2023	% change from PY
Jan	\$5,735,400	\$4,248,956	\$6,115,260	\$6,021,501	-1.53%
Feb	\$3,616,932	\$4,280,790	\$5,237,500	\$5,981,931	14.21%
Mar	\$4,787,452	\$8,088,806	\$9,333,757	\$9,214,142	-1.28%
Apr	\$3,230,126	\$6,273,861	\$6,365,534	\$6,146,622	-3.44%
May	\$3,342,797	\$5,828,461	\$5,293,190	\$5,301,100	0.15%
Jun	\$5,199,550	\$8,697,814	\$8,930,541	\$0	n/a
Jul	\$3,686,155	\$6,028,933	\$6,301,016	\$0	n/a
Aug	\$4,136,873	\$15,136,381	-\$2,254,860	\$0	n/a
Sep	\$6,697,506	\$8,847,937	\$10,568,897	\$0	n/a
Oct	\$3,973,939	\$5,356,346	\$8,391,215	\$0	n/a
Nov	\$4,556,988	\$6,642,501	\$7,645,614	\$0	n/a
Dec	\$9,393,219	\$11,236,986	\$12,877,156	\$0	n/a
Total	\$58,356,938	\$90,667,772	\$84,804,818	\$32,665,297	

January Trending Retail Sales



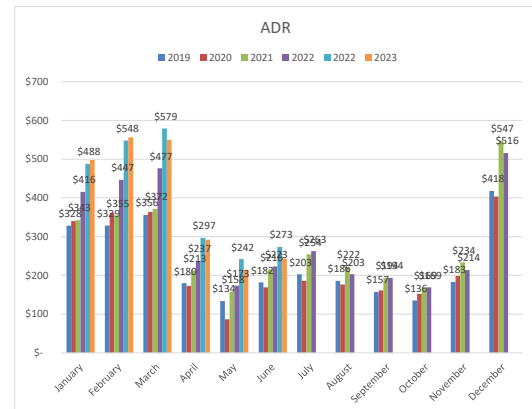
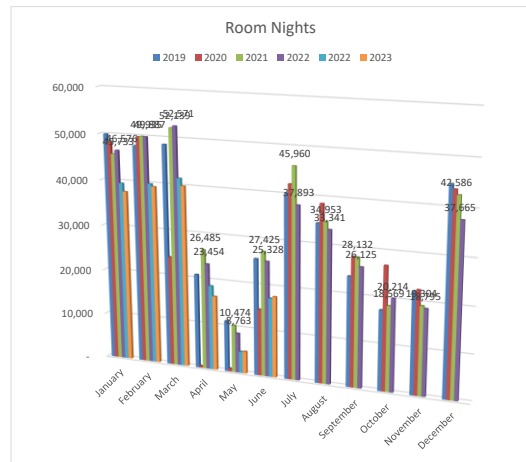
New Items of Note:

- Starting in March 2019, the Finance Department has split the Retail sector into two categories, In-Town Retail sales and Out-of-Town Retail sales. In-Town Retail sales comprise businesses that are in Town limits, the sector had an overall increase of .40% in 2023 as compared to 2022. The Out-of-Town Retail Sales had a overall increase in sales of .15% for 2023 compared to 2022.

Occupied Room

Nights	DMX 2019	DMX 2020	DMX 2021	DMX 2022	Key Data 2022	Key Data 2023
January	49,948	48,246	45,733	46,576	39,494	37,715
February	47,850	49,813	49,935	49,887	39,865	39,310
March	48,554	24,202	52,139	52,571	41,549	39,953
April	20,895	350	26,485	23,454	18,705	16,446
May	11,274	637	10,474	8,763	4,759	4,886
June	25,696	14,696	27,425	25,328	17,398	17,826
July	40,131	42,162	45,960	37,893		
August	34,515	38,623	34,953	33,341		
September	23,973	28,205	28,132	26,125		
October	17,516	26,959	18,569	20,214		
November	22,132	22,574	19,304	18,795		
December	44,693	43,650	42,586	37,665		
Total	387,177	340,117	401,695	380,612	161,770	156,136

ADR	DMX 2019	DMX 2020	DMX 2021	DMX 2022	Key Data 2022	Key Data 2023
January	\$ 328	\$ 340	\$ 343	\$ 416	\$ 488	\$ 498
February	\$ 329	\$ 361	\$ 355	\$ 447	\$ 548	\$ 556
March	\$ 356	\$ 364	\$ 372	\$ 477	\$ 579	\$ 550
April	\$ 180	\$ 173	\$ 213	\$ 237	\$ 297	\$ 292
May	\$ 134	\$ 87	\$ 158	\$ 173	\$ 242	\$ 213
June	\$ 182	\$ 169	\$ 216	\$ 223	\$ 273	\$ 243
July	\$ 203	\$ 186	\$ 254	\$ 263		
August	\$ 186	\$ 177	\$ 222	\$ 203		
September	\$ 157	\$ 161	\$ 194	\$ 194		
October	\$ 136	\$ 152	\$ 169	\$ 169		
November	\$ 183	\$ 199	\$ 234	\$ 214		
December	\$ 418	\$ 404	\$ 547	\$ 516		
Total	\$ 233	\$ 231	\$ 273	\$ 294	\$ 405	\$ 392



JUNE 2023
ALL FUNDS
REVENUE AND EXPENDITURE SUMMARY
INCLUDES TRANSFERS AND FULL APPROPRIATIONS OF FUND BALANCES

	BUDGET FY23	ACTUAL FY23 YTD	BUDGET FY23 YTD	ACTUAL vs BUDGET FY23 YTD	VARIANCE EXPLANATION
FUND BALANCE, JANUARY 1, 2023	\$ 255,492,157	\$ 255,492,157	\$ 255,492,157		
REVENUE SUMMARY					
GENERAL GOVERNMENT (GF)	\$ 24,009,281	\$ 13,150,495	\$ 11,979,188	\$ 1,171,307	INCREASED PROPERTY TAXES: BUDGET PHASING
FINANCE (GF)	\$ 33,000	\$ 15,751	\$ 16,500	\$ (749)	BEAR PROOF TRASH CANS GRANT: \$159K
PUBLIC SAFETY (GF)	\$ 81,350	\$ 33,605	\$ 42,574	\$ (8,969)	INCREASED FEES: BUDGET PHASING
COMMUNITY DEVELOPMENT (GF)	\$ 1,102,253	\$ 701,704	\$ 520,556	\$ 181,148	TRANSFER FROM HOUSING: BUDGET PHASING
PUBLIC WORKS (GF)	\$ 797,316	\$ 589,856	\$ 412,148	\$ 177,708	INVESTMENT ALLOCATION
RECREATION (GF)	\$ 3,755,984	\$ 2,720,319	\$ 1,949,514	\$ 770,805	FAVORABLE ACCOMODATION TAX: BUDGET PHASING
UTILITY FUND	\$ 9,813,588	\$ 3,737,156	\$ 4,414,230	\$ (677,074)	GREEN FEES: \$538K
CAPITAL FUND	\$ 11,674,712	\$ 6,604,636	\$ 6,370,049	\$ 234,587	FAVORABLE SALES TAX: BUDGET PHASING
MARKETING FUND	\$ 4,588,917	\$ 2,933,038	\$ 2,294,370	\$ 638,668	SCG HOUSING HELPS PAYMENT: \$490K; RENTAL INCOME: \$95K; SLES TAX: \$445K; SALE OF 301 N. FRENCH: \$261K
GOLF COURSE FUND	\$ 3,875,671	\$ 1,536,491	\$ 1,019,893	\$ 516,598	FAVORABLE SALES TAX: BUDGET PHASING
EXCISE TAX FUND	\$ 48,783,990	\$ 27,147,556	\$ 23,497,928	\$ 3,649,628	DELAY OF BUS GRANTS - BUSES PURCHASED, REIMBURSEMENT REQUEST SUBMITTED
HOUSING FUND	\$ 27,151,777	\$ 18,818,192	\$ 17,265,978	\$ 1,552,214	
OPEN SPACE ACQUISITION FUND	\$ 3,609,967	\$ 2,447,366	\$ 1,784,910	\$ 662,456	
CONSERVATION TRUST FUND	\$ 55,000	\$ 37,096	\$ 27,500	\$ 9,596	
GARAGE SERVICES FUND	\$ 7,105,991	\$ 2,498,331	\$ 4,805,791	\$ (2,307,460)	
INFORMATION TECHNOLOGY FUND	\$ 1,661,777	\$ 846,033	\$ 830,856	\$ 15,177	
FACILITIES MAINTENANCE FUND	\$ 1,117,311	\$ 615,962	\$ 558,618	\$ 57,344	
SPECIAL PROJECTS FUND	\$ 4,741,263	\$ 2,379,232	\$ 2,370,534	\$ 8,698	
MARIJUANA FUND	\$ 650,000	\$ 335,656	\$ 330,088	\$ 5,568	
CEMETERY FUND	\$ 15,605	\$ 6,093	\$ 7,800	\$ (1,707)	
CHILD CARE FUND	\$ 2,034,000	\$ 1,191,927	\$ 1,026,964	\$ 164,963	
PARKING & TRANSPORTATION FUND	\$ 8,380,158	\$ 6,756,120	\$ 5,120,716	\$ 1,635,404	
HEALTH BENEFITS FUND	\$ 5,235,499	\$ 2,413,657	\$ 2,617,661	\$ (204,004)	
SUSTAINABILITY FUND	\$ 2,927,921	\$ 1,612,290	\$ 1,452,233	\$ 160,057	
ACCOMMODATION UNIT COMPLIANCE FUND	\$ 7,720,004	\$ 7,189,963	\$ 7,720,004	\$ (530,041)	
TOTAL REVENUES	\$ 180,922,335	\$ 106,318,525	\$ 98,436,603	\$ 7,881,922	
EXPENDITURES BY CATEGORY					
PERSONNEL	\$ 34,804,395	\$ 15,397,978	\$ 17,181,104	\$ 1,783,126	
MATERIALS & SUPPLIES	\$ 3,899,489	\$ 1,796,435	\$ 1,749,820	\$ (46,615)	
CHARGES FOR SERVICES	\$ 34,728,757	\$ 15,846,951	\$ 19,621,403	\$ 3,774,452	
MINOR CAPITAL	\$ 60,754,259	\$ 17,138,437	\$ 29,353,354	\$ 12,214,917	
FIXED CHARGES	\$ 711,219	\$ 900,052	\$ 683,460	\$ (216,592)	
DEBT SERVICES	\$ 7,301,112	\$ 1,574,392	\$ 3,428,069	\$ 1,853,677	
GRANTS/CONTINGENCIES	\$ 4,308,851	\$ 4,003,988	\$ 1,964,586	\$ (2,039,402)	
ALLOCATION	\$ 6,963,699	\$ 3,481,850	\$ 3,481,710	\$ (140)	
TRANSFERS	\$ 56,753,535	\$ 33,059,830	\$ 33,634,199	\$ 574,369	
TOTAL EXPENDITURES BY CATEGORY	\$ 210,225,316	\$ 93,199,913	\$ 111,097,705	\$ 17,897,792	
EXPENDITURES BY PROGRAM					
GENERAL GOVERNMENT (GF)	\$ 6,484,981	\$ 3,173,690	\$ 2,739,960	\$ (433,730)	FIRC GRANT TIMING VS THE BUDGET: (\$500K)
FINANCE (GF)	\$ 1,473,373	\$ 605,821	\$ 765,454	\$ 159,633	REDUCED COMPENSATION: \$89K (NEW HIRE/MERIT TIMING); OTHER EXPENSE BUDGET PHASING
PUBLIC SAFETY (GF)	\$ 5,090,492	\$ 2,372,856	\$ 2,475,396	\$ 102,540	REDUCED COMPENSATION: \$245K (2.5 UNDERSTAFF/MERIT TIMING); EVACUATION SIGNS BUDGET PHASING: (\$166K)
COMMUNITY DEVELOPMENT (GF)	\$ 2,272,231	\$ 1,036,473	\$ 1,187,202	\$ 150,729	REDUCED COMPENSATION: \$93K (1.9 UNDERSTAFF/MERIT TIMING); OTHER EXPENSE BUDGET PHASING
PUBLIC WORKS (GF)	\$ 10,709,357	\$ 4,377,451	\$ 5,471,404	\$ 1,093,954	REDUCED COMPENSATION: \$466K (3.4 UNDERSTAFF/MERIT TIMING); OTHER EXPENSE BUDGET PHASING
RECREATION (GF)	\$ 8,357,035	\$ 3,498,578	\$ 3,915,006	\$ 416,428	REDUCED COMPENSATION: \$114K (MERIT TIMING);OTHER EXPENSE BUDGET PHASING
UTILITY FUND	\$ 11,357,465	\$ 3,501,070	\$ 3,491,076	\$ (9,994)	
CAPITAL FUND	\$ 26,533,443	\$ 3,512,658	\$ 13,034,609	\$ 9,521,951	PROJECTS BUDGET PHASING
MARKETING FUND	\$ 4,835,755	\$ 2,796,344	\$ 2,811,245	\$ 14,901	PRO SHOP MERCHANDISE: BUDGET PHASING
GOLF COURSE FUND	\$ 3,533,097	\$ 1,699,402	\$ 1,526,199	\$ (173,203)	
EXCISE TAX FUND	\$ 42,829,884	\$ 26,110,891	\$ 26,123,213	\$ 12,322	BUDGET PHASING FOR AFFORDABLE HOUSING PROJECTS
HOUSING FUND	\$ 35,088,834	\$ 13,601,024	\$ 18,694,372	\$ 5,093,348	REDUCED COMPENSATION: \$88K: MERIT TIMING; LAND ACQUISITION EXPENSE PHASING
OPEN SPACE ACQUISITION FUND	\$ 6,386,881	\$ 4,228,945	\$ 4,761,964	\$ 533,019	
CONSERVATION TRUST FUND	\$ 55,000	\$ 27,500	\$ 27,498	\$ (2)	
GARAGE SERVICES FUND	\$ 6,894,972	\$ 4,126,872	\$ 4,717,011	\$ 590,139	
INFORMATION TECHNOLOGY FUND	\$ 1,535,003	\$ 602,235	\$ 770,534	\$ 168,299	COMPUTER SUPPORT BUDGET PHASING
FACILITIES MAINTENANCE FUND	\$ 821,976	\$ 84,941	\$ 412,880	\$ 327,939	BUDGET PHASING
SPECIAL PROJECTS FUND	\$ 4,698,763	\$ 3,077,400	\$ 2,461,836	\$ (615,564)	
MARIJUANA FUND	\$ 909,292	\$ 408,269	\$ 455,708	\$ 47,439	
CEMETERY FUND	\$ 18,586	\$ 79	\$ 9,338	\$ 9,259	
CHILD CARE FUND	\$ 1,904,644	\$ 693,437	\$ 994,267	\$ 300,830	TIMBERLINE EXPANSION: BUDGET PHASING
PARKING & TRANSPORTATION FUND	\$ 14,087,778	\$ 6,334,921	\$ 7,004,858	\$ 669,937	REDUCED COMPENSATION: \$391K (8 UNDERSTAFF/MERIT TIMING); OTHER EXPENSE BUDGET PHASING
HEALTH BENEFITS FUND	\$ 4,500,000	\$ 2,438,373	\$ 2,249,978	\$ (188,395)	UMR PAYMENTS: BUDGET PHASING
SUSTAINABILITY FUND	\$ 2,927,776	\$ 1,388,073	\$ 1,466,772	\$ 78,699	
ACCOMMODATION UNIT COMPLIANCE FUND	\$ 6,918,698	\$ 3,502,612	\$ 3,529,925	\$ 27,313	
TOTAL EXPENDITURES BY PROGRAM	\$ 210,225,316	\$ 93,199,913	\$ 111,097,705	\$ 17,897,792	
PROJECTED FUND BALANCE DECEMBER 31, 2022	226,189,176	268,610,769	242,831,055		
RESTRICTIONS	\$ 161,367,486	\$ 161,367,486	\$ 161,367,486		
NET FUND BALANCE	\$ 64,821,690	\$ 107,243,283	\$ 81,463,569	\$ 25,779,714	
FTYR FTE	214.32	197.44	214.32	16.88	

2023 BUDGET WALKTHROUGH
REVENUE AND EXPENDITURE SUMMARY
INCLUDES TRANSFERS AND FULL APPROPRIATIONS OF FUND BALANCES

	OCTOBER BUDGET RETREAT	BUDGET CHANGES	NOVEMBER BUDGET RESOLUTION	FEBRUARY BUDGET APPROPRIATION	REVISED 2023 BUDGET	JULY BUDGET APPROPRIATION	REVISED 2023 BUDGET
FUND BALANCE, JANUARY 1, 2023	\$ 259,179,822	\$ (15,744,520)	\$ 243,435,302	\$ -	\$ 253,807,962	\$ -	\$ 253,807,962
REVENUE BY FUND							
GENERAL FUND	\$ 29,779,984	\$ -	\$ 29,779,984	\$ -	\$ 29,779,984	\$ (800)	\$ 29,779,184
UTILITY FUND	\$ 16,274,088	\$ -	\$ 16,274,088	\$ (549,193)	\$ 15,724,895	\$ (5,911,307)	\$ 9,813,588
CAPITAL FUND	\$ 16,230,000	\$ -	\$ 16,230,000	\$ (4,554,488)	\$ 11,675,512	\$ (800)	\$ 11,674,712
MARKETING FUND	\$ 4,588,917	\$ -	\$ 4,588,917	\$ -	\$ 4,588,917	\$ -	\$ 4,588,917
GOLF COURSE FUND	\$ 3,875,671	\$ -	\$ 3,875,671	\$ -	\$ 3,875,671	\$ -	\$ 3,875,671
EXCISE TAX FUND	\$ 45,383,990	\$ -	\$ 45,383,990	\$ 3,015,000	\$ 48,398,990	\$ 385,000	\$ 48,783,990
HOUSING FUND	\$ 16,764,273	\$ 8,362,188	\$ 25,126,461	\$ 2,025,316	\$ 27,151,777	\$ -	\$ 27,151,777
OPEN SPACE ACQUISITION FUND	\$ 3,609,967	-	\$ 3,609,967	\$ -	\$ 3,609,967	\$ -	\$ 3,609,967
CONSERVATION TRUST FUND	\$ 55,000	\$ -	\$ 55,000	\$ -	\$ 55,000	\$ -	\$ 55,000
GARAGE SERVICES FUND	\$ 7,105,991	\$ -	\$ 7,105,991	\$ -	\$ 7,105,991	\$ -	\$ 7,105,991
INFORMATION TECHNOLOGY FUND	\$ 1,661,777	\$ (599)	\$ 1,661,178	\$ 599	\$ 1,661,777	\$ -	\$ 1,661,777
FACILITIES MAINTENANCE FUND	\$ 939,058	\$ -	\$ 939,058	\$ 178,253	\$ 1,117,311	\$ -	\$ 1,117,311
SPECIAL PROJECTS FUND	\$ 3,595,000	\$ -	\$ 3,595,000	\$ 1,146,263	\$ 4,741,263	\$ -	\$ 4,741,263
MARIJUANA FUND	\$ 650,000	\$ -	\$ 650,000	\$ -	\$ 650,000	\$ -	\$ 650,000
CEMETERY FUND	\$ 15,605	\$ -	\$ 15,605	\$ -	\$ 15,605	\$ -	\$ 15,605
CHILD CARE FUND	\$ 1,974,000	\$ 60,000	\$ 2,034,000	\$ -	\$ 2,034,000	\$ -	\$ 2,034,000
PARKING & TRANSPORTATION FUND	\$ 8,865,158	\$ -	\$ 8,865,158	\$ (485,000)	\$ 8,380,158	\$ -	\$ 8,380,158
HEALTH BENEFITS FUND	\$ 5,279,675	\$ -	\$ 5,279,675	\$ (44,176)	\$ 5,235,499	\$ -	\$ 5,235,499
SUSTAINABILITY FUND	\$ -	\$ -	\$ -	\$ 2,927,921	\$ 2,927,921	\$ -	\$ 2,927,921
ACCOMMODATION UNIT COMPLIANCE FUND	\$ 7,353,612	\$ -	\$ 7,353,612	\$ 366,392	\$ 7,720,004	\$ -	\$ 7,720,004
TOTAL REVENUE BY PROGRAM	\$ 174,001,766	\$ 8,421,589	\$ 182,423,355	\$ 4,026,887	\$ 186,450,242	\$ (5,527,907)	\$ 180,922,335
EXPENDITURES BY CATEGORY							
PERSONNEL	\$ 33,549,006	\$ -	\$ 33,549,006	\$ 1,255,389	\$ 34,804,395	\$ -	\$ 34,804,395
MATERIALS & SUPPLIES	\$ 3,649,489	\$ -	\$ 3,649,489	\$ -	\$ 3,649,489	\$ 250,000	\$ 3,899,489
CHARGES FOR SERVICES	\$ 28,090,918	\$ 2,293,200	\$ 30,384,118	\$ 4,286,628	\$ 34,670,746	\$ 58,011	\$ 34,728,757
MINOR CAPITAL	\$ 63,737,927	\$ (12,524,781)	\$ 51,213,146	\$ 3,196,665	\$ 54,409,811	\$ 6,344,448	\$ 60,754,259
FIXED CHARGES	\$ 801,442	\$ -	\$ 801,442	\$ (90,223)	\$ 711,219	\$ -	\$ 711,219
DEBT SERVICES	\$ 9,418,493	\$ 750	\$ 9,419,243	\$ (2,118,131)	\$ 7,301,112	\$ -	\$ 7,301,112
GRANTS/CONTINGENCIES	\$ 3,504,189	\$ -	\$ 3,504,189	\$ 204,662	\$ 3,708,851	\$ 600,000	\$ 4,308,851
ALLOCATION	\$ 6,807,830	\$ -	\$ 6,807,830	\$ 155,869	\$ 6,963,699	\$ -	\$ 6,963,699
TRANSFERS	\$ 48,191,951	\$ 8,362,188	\$ 56,554,139	\$ 149,396	\$ 56,703,535	\$ 50,000	\$ 56,753,535
TOTAL EXPENDITURES BY CATEGORY	\$ 197,751,245	\$ (1,868,643)	\$ 195,882,603	\$ 7,040,255	\$ 202,922,856	\$ 7,302,459	\$ 210,225,316
EXPENDITURES BY PROGRAM							
GENERAL FUND	\$ 32,501,216	\$ -	\$ 32,501,216	\$ 988,241	\$ 33,489,457	\$ 891,262	\$ 34,380,719
UTILITY FUND	\$ 13,203,020	\$ -	\$ 13,203,020	\$ (1,845,555)	\$ 11,357,465	\$ -	\$ 11,357,465
CAPITAL FUND	\$ 20,771,483	\$ -	\$ 20,771,483	\$ 5,549,012	\$ 26,320,495	\$ 212,948	\$ 26,533,443
MARKETING FUND	\$ 4,835,755	\$ -	\$ 4,835,755	\$ -	\$ 4,835,755	\$ -	\$ 4,835,755
GOLF COURSE FUND	\$ 3,268,503	\$ -	\$ 3,268,503	\$ 264,594	\$ 3,533,097	\$ -	\$ 3,533,097
EXCISE TAX FUND	\$ 36,500,775	\$ 8,362,188	\$ 44,862,963	\$ (2,033,079)	\$ 42,829,884	\$ -	\$ 42,829,884
HOUSING FUND	\$ 43,941,076	\$ (10,216,968)	\$ 33,724,108	\$ 1,354,726	\$ 35,078,834	\$ 10,000	\$ 35,088,834
OPEN SPACE ACQUISITION FUND	\$ 2,672,155	\$ -	\$ 2,672,155	\$ 52,226	\$ 2,724,381	\$ 3,669,250	\$ 6,393,631
CONSERVATION TRUST FUND	\$ 55,000	\$ -	\$ 55,000	\$ -	\$ 55,000	\$ -	\$ 55,000
GARAGE SERVICES FUND	\$ 4,339,486	\$ -	\$ 4,339,486	\$ 36,486	\$ 4,375,972	\$ 2,519,000	\$ 6,894,972
INFORMATION TECHNOLOGY FUND	\$ 1,521,454	\$ -	\$ 1,521,454	\$ 13,549	\$ 1,535,003	\$ -	\$ 1,535,003
FACILITIES MAINTENANCE FUND	\$ 818,164	\$ -	\$ 818,164	\$ 3,812	\$ 821,976	\$ -	\$ 821,976
SPECIAL PROJECTS FUND	\$ 3,540,000	\$ 12,500	\$ 3,552,500	\$ 1,146,263	\$ 4,698,763	\$ -	\$ 4,698,763
MARIJUANA FUND	\$ 908,311	\$ -	\$ 908,311	\$ 981	\$ 909,292	\$ -	\$ 909,292
CEMETERY FUND	\$ 18,500	\$ -	\$ 18,500	\$ 86	\$ 18,586	\$ -	\$ 18,586
CHILD CARE FUND	\$ 1,924,843	\$ (26,364)	\$ 1,898,479	\$ 6,165	\$ 1,904,644	\$ -	\$ 1,904,644
PARKING & TRANSPORTATION FUND	\$ 15,077,892	\$ -	\$ 15,077,892	\$ (990,114)	\$ 14,087,778	\$ -	\$ 14,087,778
HEALTH BENEFITS FUND	\$ 4,500,000	\$ -	\$ 4,500,000	\$ -	\$ 4,500,000	\$ -	\$ 4,500,000
SUSTAINABILITY FUND	\$ -	\$ -	\$ -	\$ 2,927,776	\$ 2,927,776	\$ -	\$ 2,927,776
ACCOMMODATION UNIT COMPLIANCE FUND	\$ 7,353,612	\$ -	\$ 7,353,612	\$ (434,914)	\$ 6,918,698	\$ -	\$ 6,918,698
TOTAL EXPENDITURES BY PROGRAM	\$ 197,751,245	\$ (1,868,644)	\$ 195,882,601	\$ 7,040,255	\$ 202,922,856	\$ 7,302,460	\$ 210,225,316
PROJECTED FUND BALANCE DECEMBER 31, 2023	\$ 235,430,343	\$ (5,454,288)	\$ 229,976,056	\$ (3,013,368)	\$ 237,335,348	\$ (12,830,367)	\$ 224,504,981
RESTRICTIONS	\$ 162,534,319	\$ (7,867,270)	\$ 154,667,049	\$ 6,700,437	\$ 161,367,486	\$ -	\$ 161,367,486
NET FUND BALANCE	\$ 72,896,024	\$ 2,412,982	\$ 75,309,007	\$ (9,713,805)	\$ 75,967,862	\$ (12,830,367)	\$ 63,137,495
FTYR FTE	214.32	0	214.32	0	214.32	0	214.32

Memo

To: Breckenridge Town Council Members
From: Shannon Smith, Town Engineer
Date: 7/20/2023
Subject: Engineering Regulations Update



The Breckenridge Engineering Design Standards and Construction Specifications have been updated to correct errors, incorporate administrative changes, and update standards to improve the design, construction, and development process. The Town Engineer has the authority to update these standards through Section 10-1-3 of the Town Code. Below is a summary of the changes made to the standards:

- New standard construction details were added or modified in Appendix G.
- Appendix H – Revisions to CDOT Road standards was modified in many sections.
- Clarification of bonding requirements for building permits.
- Addition of minimum trenching requirements to Chapter 3.
- Update of the definition of a private road from four homes to five homes.
- Modification of road intersection spacing requirements.
- Modification of turn lane requirements to be less restrictive.
- Update of private snowmelt system requirements and driveway removal requirements.
- Addition of pool/spa drainage requirements.
- Added language to Chapter 6 for additional development drainage requirements where impervious area is not increasing.
- Addition of the requirement for drywells to be designed by a Professional Engineer
- Numerous changes to correct typos, formatting, clarifying requirements, and administrative updates.

The updated sections of the standards are attached to this memo.

CHAPTER 1 GENERAL PROVISIONS

TABLE OF CONTENTS

1.1	PURPOSE	1
1.2	AUTHORITY	3
1.3	JURISDICTION	3
1.4	AMENDMENTS & REVISIONS	3
1.5	OTHER STANDARDS	3
1.6	RIGHT TO ENFORCE OTHER STANDARDS	34
1.7	RIGHT TO REQUIRE PUBLIC IMPROVEMENTS	4
1.8	REVIEW & APPROVAL	4
1.9	CONSTRUCTION SPECIFICATIONS	4
1.10	VARIANCES	4
1.11	GLOSSARY	5

LIST OF ATTACHMENTS – APPENDIX A

VARIANCE REQUEST FORM

1.1 PURPOSE

These Engineering Design Standards and Construction Specifications, also called the “Standards” or “Engineering Standards”, are established by the Engineering Division of the Public Works Department for the design and construction of public and private improvements in the Town of Breckenridge (Town).

The purpose of these Standards is to set forth certain rules and regulations so there is reasonable degree of assurance that the development of public and private improvements will be completed so that the health, safety, welfare and property of the Town and citizens will be safeguarded and protected; and to assure there will be a certain uniformity in performance with respect to design and construction of public and private improvements; and thereby securing for the present and future residents of the Town the beneficial effects of public and private development, while protecting the community against actions that would deteriorate the quality of the natural and manmade environment. These Standards are established to serve the following objectives:

1. Update Town Standards to reflect changes in the engineering and construction industries
2. Provide greater consistency with local, state, federal, and other agency codes
3. Provide consistent design and construction basis for infrastructure within the Town
4. Ensure public welfare and promote efficient development that considers the future of the community
5. Protect the water quality of the Blue River and its tributaries
6. Protect wetlands and other sensitive habitats in a mountain environment
7. Mitigate traffic caused by development
8. Improve pedestrian and bicycle facilities
9. Provide improved access for people with disabilities
10. Provide guidelines on navigating the Engineering Division development review process
11. Protect the public by establishing the minimum acceptable level for design and construction of infrastructure

To provide consistency in the design of infrastructure within the Town, these Standards generally follow criteria or design methodology that are in conformance with regulations and laws established by the following agencies. Where no requirement is given in the Town Engineering Standards, the following documents shall govern.

1. American Association of State Highway and Transportation (AASHTO)
2. Colorado Department of Transportation (CDOT)
3. Colorado Revised Statutes (CRS)
4. Federal Americans with Disabilities Act (ADA) Regulations
5. Federal Highway Administration (FHWA)
6. Federal Statutes and Regulations (CFR)
7. Mile High Flood District (MHFD)
8. National Cooperative Highway Research Program (NCHRP)
9. U.S. Department of Transportation, Manual of Uniform Traffic Control Devices (MUTCD)
10. United States Access Board (PROWAG and ADAAG)
11. National Cooperative Highway Research Program (NCHRP)

Additionally, the following guides and manuals listed below shall be referenced and used in conjunction with these Standards. Where no requirement is given in the Town Engineering Standards, the following documents shall govern. In the event of a conflict between Town Engineering Standards and the following documents, the more stringent requirement shall typically govern. The most recent version of the documents below shall govern.

1. AASHTO Green Book
2. AASHTO Roadside Design Guide
3. CDOT Roadway Design Guide
4. CDOT Bridge Design Manual
5. CDOT Pavement Design Manual
6. CDOT Drainage Design Manual
7. FEMA National Flood Insurance Program (NFIP)
8. International Fire Code (IFC), 2018
9. ITE Trip Generation Manual, 10th Edition, Institute of Transportation Engineers, 2017
10. ITE Trip Generation Handbook, 3rd Edition, Institute of Transportation Engineers, 2017
11. Highway Capacity Manual, 6th Edition: A Guide for Multimodal Mobility Analysis, Transportation Research Board, 2016
12. State Highway Access Code, State of Colorado, March 2002
13. Manual on Uniform Traffic Control Devices, 2009 with Revisions 1 and 2, Federal Highway Administration, May 2012
14. Mile High Flood District (MHFD) Design Manuals

The following Town Documents shall be referenced and used in conjunction with these Town Engineering Standards. In the event of a conflict between Town Engineering Standards and the following documents, the more stringent requirement shall typically govern. The most recent version of the documents below shall govern.

1. Title 9 of the Breckenridge Town Code, also referred to as the Town Development Code

- ~~1-2.~~ Blue River Walkway Improvements Plan
- ~~2-3.~~ Breckenridge Free Ride Transit Master Plan (2020)
- ~~3-4.~~ Breckenridge Sidewalk Master Plan
- ~~4-5.~~ Breckenridge Transit Master Plan (2020)
- ~~5-6.~~ Cucumber Gulch Recreation Master Plan
- ~~6-7.~~ Handbook of Design Standards
- ~~7-8.~~ Joint Upper Blue Master Plan
- ~~8-9.~~ Park Ave SH 9 Roundabout Modeling and Construction Feasibility Study (2017)
- ~~9-10.~~ _____ Sustainable Breckenridge Plan
- ~~10-11.~~ _____ The Arts District of Breckenridge Master Plan
- ~~11-12.~~ _____ Town of Breckenridge Capital Improvements Program
- ~~12-13.~~ _____ Town of Breckenridge Code of Ordinances (Including the most recent versions of Titles, Chapters, and Ordinances Pending Codification)
- ~~13-14.~~ _____ Town of Breckenridge Comprehensive Plan **2008**

- ~~14-15.~~ Town of Breckenridge Goals and Objectives Report
- ~~15-16.~~ Town of Breckenridge Open Space [and Trails Master Plan](#)
- ~~16-17.~~ Town of Breckenridge Small Cell Procedures and Design Guidelines (~~May 2019~~)
- ~~17.~~ [Town of Breckenridge Trails Plan \(revised August 2008\)](#)
- ~~18.~~ [Town of Breckenridge Trail Standards and Guidelines](#)
- ~~19-18.~~ Town of Breckenridge Vision Plan (2002)
- ~~20-19.~~ Town of Breckenridge Water Construction Standards
- ~~21-20.~~ Transportation, Parking, and Urban Design Study (2016)
- ~~22-21.~~ Upper Blue Nordic Master Plan (revised 2011)

Additional standards and documents referenced for construction specifications are included in Chapter 9. See Chapter 9 for additional information on construction standards and specifications.

Several modifications were made to the criteria in the documents listed above to include flexibility, encourage context-sensitive design, and reflect the local values of the Town. The modifications recognize the constraints of the Town's topography, the desire to maintain and enhance natural drainageways, and the mountain environment of the community. The Town of Breckenridge Engineering Standards supplement or modify the above criteria.

These Standards provide the minimum acceptable standards for safe, consistent, effective, and economical infrastructure. Actual site design may require additional detail or more conservative design parameters to address site-specific issues.

1.2 AUTHORITY

These Standards have been developed by the Engineering Division of the Public Works Department of the Town of Breckenridge. Authority for review and approval required for these Standards shall be per 10-1-3 of the Town Code. Per Section 10-1-3, the Town Engineer has the authority to administratively formulate, update, amend, and add regulations to these standards.

1.3 JURISDICTION

These Standards shall apply to all projects, both private and public, in the Town of Breckenridge, except where superseded by other government regulations.

1.4 AMENDMENTS & REVISIONS

The Engineering Division may periodically update these Standards to reflect current practices or policy revisions per Section 10-1-3 of the Town Code.

1.5 OTHER STANDARDS

Where no requirement is given, the current edition of the AASHTO, CDOT, Urban Storm Drainage Criteria Manual (USDCM), Manual of Uniform Traffic Control Devices (MUTCD), Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG) design standards, or ADA Accessibility Guidelines (ADAAG) or other agency/document listed in Section 1.2 of these Standards shall govern unless otherwise approved by the Engineering Division. Where the Town's documents do not cover a specific situation, consult the Engineering Division to confirm the appropriate standards. If a specific situation is not covered by these, the applicant shall propose a design standard for the Town to review and approve before proceeding with development. In addition to these Standards, designers, developers, and contractors are responsible for following all other applicable federal, state, and local regulations. Where there is a conflict between these Standards and other codes or regulations, the more stringent standard shall generally apply unless otherwise approved by the Town Engineer.

1.6 RIGHT TO ENFORCE OTHER STANDARDS

These Standards may not include all requirements necessary for future development. Special site conditions, project types, or other conditions may warrant the use of additional standards and criteria not included in these Standards. The Town reserves the right, in the Town's best interest, to issue and enforce more stringent criteria when appropriate as determined by the Town Engineer.

1.7 RIGHT TO REQUIRE PUBLIC IMPROVEMENTS

The Town Engineer may require public improvements due to direct or indirect impacts of development. Public improvements may include utilities, streets, sidewalks, trails, open space, parks, bridges, street lights, transit improvements, detention and water quality, wetland enhancements, stream restoration, and any other public improvements as determined by the Town Engineer. Utility work may include Town water, Town fiber (supply and install of equipment), sanitary sewer, storm sewer, street lights, and other utilities as determined necessary. All construction costs of public improvements shall be the responsibility of the development. The Town shall not be responsible for any of the design, development, and construction costs of the public improvements. See the following chapters of these Standards for additional public improvement standards.

1.8 REVIEW & APPROVAL

The Engineering Division will review submittals for general compliance with these Standards per Chapter 2 of these Standards. An approval by the Town does not relieve the owner, contractor, engineer, or designer from responsibility of ensuring that calculations, plans, specifications, and construction are accurate and in compliance with these Standards, accepted engineering practices, or other applicable requirements and regulations.

1.9 CONSTRUCTION SPECIFICATIONS

Construction specifications and details are included in Chapter 9 of these Standards and may be frequently updated. If the Town does not have a required construction specification or detail, CDOT construction specifications and the CDOT M&S Standards shall be used. If neither the Town nor CDOT has a construction specification or detail required for a project, the proposed specifications and details shall be submitted to the Engineering Division for review per Chapter 2 of these Standards.

1.10 VARIANCES

All applications for designs varying from these Standards shall obtain written approval of the variance from the Town Engineer on the Town's Variance Request Form prior to final approval of the plans. The following will be considered when evaluating variances:

1. Site-specific constraints,
2. Effect on safety,
3. Right-of-way constraints,
4. Public benefit,
5. Availability of other alternatives, and
7. Need for mitigation measures.

Variances must be requested in writing using the Town's Variance Request Form (included as an attachment to this chapter) and at a minimum include plans, text, and supporting documentation as necessary to support the information provided in the Variance Request Form.

The variance request must be prepared by or under the direct supervision of a Colorado-licensed professional engineer and be stamped and signed certifying that the variance will not result in any hazard to the public or increase the likelihood of damage to any public or private properties.

Upon receipt of a written request for a variance from a particular provision of these Standards, the Town Engineer will issue a determination on whether the variance should be granted or denied given the specific circumstances for which it was requested. The Town Engineer will provide a copy of the determination to the applicant. Determinations made by the Town Engineer in interpreting and enforcing these Standards involve the considered application of professional engineering and transportation planning judgment and skill in the context of each situation. If a variance request is denied, the applicant may appeal the denial per the provisions of the Town Code.

1.11 GLOSSARY

When the following words, phrases, or abbreviations appear in these Standards, they shall have the following definition and meaning. Where a word, phrase, or abbreviation appear in these Standards, but are not defined below, the definitions and meanings shall be assigned per the Town Code, other referenced standards, or industry accepted definitions.

100-year storm and 2-year storm: These terms refer to the statistical recurrence interval of different types of storms. A recurrence interval is a statistically determined average period of time within which a given rainfall intensity and duration will be equaled or exceeded only once. For example, the 100-year storm refers to the intensity and duration of rainfall which, on the average, will be equaled or exceeded once during a 100-year period. The larger the recurrence interval, the higher the intensity. The 100-year storm will have a higher intensity and total volume than the 2-year storm.

100-year flow/flood: a peak discharge that can be expected to be equaled or exceeded once every hundred years. This event has a 1% chance of occurring during any given year. Discharge rates, water surface elevations, and floodplain boundaries for the Blue River and its major tributaries are provided in the FEMA Flood Insurance Study. .

AASHTO: American Association of State Highway and Transportation Officials

ABC: Aggregate Base Course.

acceleration lane: a speed change lane, including tapered areas, for the purpose of enabling a vehicle entering a roadway to increase its speed to a rate at which it can more safely merge with through traffic.

access: driveway or other point of access such as a street, road, or highway that connects to the general street system. Where two public roadways intersect, the secondary roadway will be the access.

acre foot: a measurement of water volume. An acre foot equals the amount of water necessary to cover an acre at a depth of one foot (43,560 cubic feet).

ADT: Average Daily Traffic. The total bidirectional volume of traffic passing through a given point during a given time period, divided by the number of days in that time period.

alley: Minor public street adjacent to the side or rear of residential, commercial, or industrial property and used for vehicle access.

applicant: The person or designated agent responsible for preparation of Town permit applications and associated permit responsibilities. The terms “applicant” and “developer” may be used interchangeably.

approach: the portion of an intersection leg which is used by traffic approaching the intersection.

auxiliary lane: the portion of the roadway adjoining the traveled way for speed change, turning, weaving, truck climbing, maneuvering of entering and leaving traffic, and other purposes supplementary to through- traffic movement.

ASTM: American Society for Testing and Materials.

basin: an area of land, so defined by a physical boundary that when rain falls upon this area, all the resulting stormwater runoff will drain by gravity toward a common watercourse (natural stream, reach,

river, or manmade channel, ditch, gutter, etc.) and ultimately exits the area at the specific point (known as the outfall).

bicycle facilities: a general term denoting improvements and provisions made by public agencies to accommodate or encourage safe and efficient bicycling or other alternative modes of transportation.

bicycle lane (bike lane): the portion of the roadway that has been designated by striping, signing, pavement markings, colored pavement, or other markings for the preferential or exclusive use of bicycles.

bridge: any structure conveying a roadway or path over a body of water or other feature. Structures shall be designed to carry a combination of loading per appropriate codes and designed by a registered professional engineer. Arch culverts, large diameter culverts, and other structures may be classified as bridges.

building permit: a written document issued by the Town Building Division to allow a developer or contractor to complete building improvements per building codes.

CAD: abbreviation for Autodesk AutoCAD software. Town requires submittals as .dwg extension electronic files compatible with the most recent version of Autodesk AutoCAD Civil 3D software.

capacity: the maximum number of vehicles that have a reasonable expectation of passing over a given roadway or section of roadway in one direction during a given time period under prevailing roadway and traffic conditions.

CDOT: Colorado Department of Transportation

commercial: an area of the Town in which all or a portion of the development is for commercial use. An area may be defined as commercial, even if the majority of the area is zoned as residential use, but there is a sufficient amount of commercial development to generate many commercial pedestrian and vehicle trips.

chicane: offset curb extensions which change the path of vehicular travel from straight to curvilinear and promote traffic calming.

civil construction drawings: detailed engineering plans required for all projects with public infrastructure.

CMP: corrugated metal pipe

CO: Certificate of Occupancy. A written document issued by the Building Division indicating that a building or site is in a condition suitable for occupancy.

code: the latest official adopted ordinance, policies, codes, and/or regulations of Town of Breckenridge or other agencies.

construction: any grading, excavation, earth disturbing activities, roadway work, paving, vertical building, utility work, directional boring, and any other alteration or modification to a site or right-of-way.

consultant engineer: a Colorado licensed professional engineer working on behalf of the Developer.

contract documents: the executed contract agreement, approved plans, technical specifications, and permits, and all other documents prepared by a Colorado licensed professional engineer for construction a facility

contractor: the person, firm, or organization to whom a construction contract is awarded by the Developer, or who has been issued a right-of-way work permit. Contractor may be the same entity as the Applicant or Developer, or may be a separate entity.

contour interval: a contour is a line drawn on a map through points of equal elevation. A contour interval is the elevation difference between contour lines.

critical volume: a traffic volume (or combination of volumes) for a given street which produces the greatest utilization of capacity for that street in terms of passenger cars or mixed vehicles per hour.

cross-section: a view of the interior or horizontal cut through a roadway, structure, or object and includes a representation of all relevant elements.

cross-slope: slope of the pavement surface, excluding gutter, measured perpendicular to the street centerline.

cross-street flow: flow of stormwater runoff across the traffic lanes of a street from external sources, as distinguished from sheet flow of water falling on pavement surface.

culvert: a covered channel or pipe that takes a watercourse under a road, through the downstream embankment of a detention facility or below ground. Some “culverts” may also be classified as “bridges”.

days: calendar days, not normal working days unless stipulated as working days.

deceleration lane: a speed change lane, including tapered areas, for the purpose of enabling a vehicle that is to make an exit turn from a roadway to slow to a safe turning speed after it has left the main stream of faster moving traffic.

design hour volume: hourly traffic volume used for street design and capacity analysis, usually one or more peak hours during a 24-hour period.

design speed: the typical vehicle rate in miles per hour (mph) which a street is designed to accommodate. Design speed shall typically match the posted street speed limit.

design vehicle: the vehicle a street must consider and accommodate for acceptable speed, turning movements, loading, and other considerations.

designer: the person, firm, or organization responsible for the creation and submission of contract documents or construction plans for the construction of a facility. Designer shall be a Colorado licensed professional engineer.

detached sidewalk: a sidewalk that is offset from the roadway and curb by a minimum distance of four feet.

detail: an engineered drawing illustrating all features and requirements for construction of a structure or facility.

detention facility: a basin or structure designed for the storage of stormwater runoff that allows for slower, controlled release during or immediately following a storm. A typical facility consists of a detention pond with an embankment on the downstream side, and a pipe or concrete box outlet. The size of the pond is based on a specific design storm and the amount of water that can be discharged through the outlet. Design features may be incorporated into detention facilities to allow them to function as sediment ponds.

developer: the private person, partnership, or corporation legally responsible for the construction of streets, subdivisions, infrastructure, or any other public or private improvement. Developer shall secure all required approvals and permits from the Town and assume full and complete responsibility for the project. The terms “owner,” “applicant,” and “permit holder” may be used in place of “developer” and hold the same definitions and responsibilities.

development: construction of improvements on land that is vacant or containing minimal infrastructure or improvements.

development code: title 9 – land use and development, of the Town of Breckenridge Code.

development permit: a written document from the Town community development department to complete development per codes, standards, and other documents.

drainageway: a route or course along which water moves or may move to drain an area. A “natural” drainageway refers to the route or course in an area prior to the construction of any urban improvements.

drainage easement: a grant to the Town of the right to control development, access, or maintenance of a drainage right-of-way or an area subject to periodic flooding.

driveway: a constructed access serving three or less units and connecting to a street or adjacent driveway. May also be called a “private access.”

easement: the portion of public or private land dedicated to the public or another entity for the installation, maintenance, and use of utilities, drainage, vehicle access, pedestrian access, snow storage, or other public uses. Easements may be granted through a subdivision plat or other legal instrument as approved by the Town Attorney. Easements shall grant the legal right of use of the property by the grantee. Easements may grant the Town the ability to complete maintenance work, but does not require the Town to complete maintenance.

Encroachment License Agreement: A written document granting a property owner the ability to construct and maintain private improvements within a Town ROW or easement. The encroachment license is revocable and sets many requirements of the property owner for the encroachment.

EPA: United States Environmental Protection Agency.

ESA: Environmentally sensitive areas. An area such as wetlands, streams, lakes, ponds, Cucumber Gulch Wildlife Preserve, and other special wildlife habitat areas which require special requirements to protect their sensitive nature during development.

fees: monetary charges which compensate the Town for services rendered or infrastructure constructed.

FEMA: Federal Emergency Management Agency.

FHWA: Federal Highway Administration, Department of Transportation.

field order: a written notice given by the Town to the Designer, Contractor, or Developer detailing a change, request, mandate, or corrective action necessary to conform to these Standards, approved plans, or other applicable Local Entity Codes.

final acceptance: the written notification from the Town, after the Town finds the warranty period to be satisfactorily completed, that all public improvements are free of defects and the Town releases the Developer from future maintenance obligations.

FIRM: Flood Insurance Rate Map.

floodplain development permit: a document granted to developers or contractors to construct improvements or complete earthwork activities within 100 feet of the 100-year floodplain.

freeboard: the elevation difference between the normal maximum level of water surface and the bottom of the confining structure, which is provided so debris may more readily pass through the structure without creating blockage and waves and other movements of the water will not overtop such confining structures.

grade: the inclination or slope of a channel, canal, conduit, street, etc., or other natural ground surface, usually expressed in terms of the percentage or number of units of vertical rise (or fall) per unit of horizontal distance.

grading plan: a detailed engineering plan showing contours, slopes, existing elevations, proposed elevations, retaining walls, and other grading features for a site.

HCM: Highway Capacity Manual. Publication of the Transportation Research Board of the National Academies of Science which defines the ideal conditions of uninterrupted traffic flow.

HMA: Hot Mix Asphalt.

HEC: Hydrologic Engineering Center, an element of the USACE, Institute for Water Resources (CEIWR) that supports the nation in its water resources management responsibilities by increasing technical capability in hydrologic engineering and water resources planning and management.

HMS: Hydrologic Modeling System (HEC-HMS) developed by the USACE to simulate the complete hydrologic processes of dendritic watershed systems.

LOS: level of service. A qualitative measures used to relate the quality of motor or pedestrian vehicle traffic service; usually measured from a LOS A to LOS F.

initial acceptance: the Town's process to initially accept ownership after the Developer has completed all proposed improvements identified in the approved plans and agreements, and after the Town has inspected and approved improvements. Initial acceptance begins the two year warranty period.

infrastructure: public roadways, sidewalks, pedestrian routes, trails, stormwater improvements, potable water improvements, sanitary sewer improvements, lighting, irrigation, fiber optic cable and conduit, other utilities, stormwater management, transit facilities, retaining walls, signage, and any other structures, improvements, or installations as determined by the Town Engineer.

inlet: 1) an opening into a storm sewer system for the entrance of surface storm runoff; 2) a structure at the upstream end of a conduit; or 3) the upstream connection between the surface of the ground and a drain or sewer for the admission of surface or storm water.

inspector: an authorized representative of the Town Engineer, assigned to make inspections to assure work is completed in compliance with plans, standards and specifications.

intersection sight distance: the minimum distance required for the driver of a motor vehicle stopped at a stop sign on a minor street or driveway to see approaching vehicles, pedestrians, and bicyclists along the intersecting major street and have sufficient space to make any allowed move to cross the major street or merge with traffic on the major street without causing vehicles, pedestrians, or bicyclists traveling at or near the design speed on the major street to slow down.

ITE: Institute of Transportation Engineers

landscaping: materials including, without limitation, grass, ground cover, shrubs, trees, perennials, annuals, non-living material commonly used in landscape development, and irrigation systems.

LTS: Level of Traffic Stress. A measure which quantifies the amount of discomfort which bicyclists experience near vehicular traffic.

MHFD: Mile High Flood District, formerly the Urban Drainage and Flood Control District (UDFCD).

MHT: Method of Handling Traffic. "MHT" may also be referred to as a "Traffic Control Plan (TCP)". Detailed drawings outlining the layout of traffic control devices for a project and signed by a TCS.

MUTCD: Manual on Uniform Traffic Control Devices.

minor storm and major storm: these terms refer to the recurrence intervals of storms used to design stormwater infrastructure. The minor storm (also called the initial storm) is the 2- to 10-year storm depending on land use at the design location. The major storm is the 100-year storm, and the uncontrolled runoff from this storm could possibly cause major property damage or even loss of life.

multimodal: inclusion of several different modes of transportation. Examples include vehicular, pedestrian, bicycle, bus transit, gondolas, and other public transit modes.

NFIP: National Flood Insurance Program.

NRCS: Natural Resource Conservation Service.

open channel: a watercourse which conveys stormwater runoff within the drainage basin to the outfall of the basin. It has a defined bed and banks that confine the runoff, but it has a surface open to the atmosphere and cannot develop pressurized flow.

ordinance: a law established by the Town of Breckenridge.

O&M Plan: operations and maintenance plan. A written document defining work and maintenance procedures to maintain infrastructure and facilities to function per the original design intent.

OSHA: Occupational Safety and Health Administration.

PAR: Pedestrian Access Route. A continuous and unobstructed path of travel provided for pedestrians with disabilities within or coinciding with a pedestrian circulation path.

PDF: Portable Document Format. Town requires electronic file submittals to be a PDF compatible with the most recent version of Adobe Acrobat.

PE: a Colorado licensed professional engineer.

peak hour: the hour in a day which produces the highest volume of vehicle or pedestrian traffic for a portion of roadway, intersection, or pedestrian route in a day.

pedestrian: a person afoot or in a wheel chair or other pedestrian mobility device.

permitee: the holder of a valid permit for the Town of Breckenridge. "Permitee" may be used interchangeably with "developer".

PHF: Peak Hour Factor. A calculation used to convert the hourly traffic volume into the flow rate that represents the busiest 15 minutes of the peak hour. PHF is calculated through the following equation: $(\text{total hourly volume}) / [(\text{peak 15-minute volume within the hour} \times 4)]$.

plans: construction plans completed and stamped by Colorado licensed professional engineer for public or private improvements.

PLS: a Colorado licensed professional land surveyor

private Improvements: any land, structures, infrastructure, or other object to be used, owned, and maintained by a private person, partnership, or corporation.

project: the public or private improvements designated in the approved plans, which are to be constructed in conformance with these standards. "project" includes private projects, public capital projects, utility projects, ROW projects, and any other improvements in the Town.

private street: a roadway serving four or more units or lots. Private streets are not owned or maintained by the Town of Breckenridge.

project engineer: the professional engineer, registered in the State of Colorado, assigned to a project by a Town permit holder to inspect and observe construction and to complete and sign and stamp construction inspection and observation reports.

public improvement: any land, structures, infrastructure, or other object dedicated to the Town, public, or other agency. Public improvements are typically conveyed to the Town and subsequently owned and maintained by the Town. Also include facilities which will be privately owned but serve the public, or private facilities serving a large number of people, such as utilities and stormwater drainage.

punch list: a written list of work items, compiled by the inspector, which do not conform to these Standards, the plans, specifications, or other codes that govern the project. The developer is responsible for completing the list of work items prior to initial acceptance.

rational method: a design method which determines a peak runoff rate based on drainage area, rainfall intensity, and imperviousness for watersheds of 90 acres or less.

record drawings: design drawings updated by a professional engineer, depicting all modifications from the design that occurred during construction.

redevelopment: removal or modification of existing improvements, remodeling, and construction of new improvements on a site which has existing improvements. Sites with minimal existing improvements is not considered redevelopment.

report: a document containing analyses, surveys, tests, exhibits, and other pertinent data prepared by a Colorado licensed professional engineer.

road: the entire width of a public right-of-way, including the roadway, pedestrian routes, landscaped areas, shoulders, and other areas within the right-of-way.

ROW: right-of-way. Land owned by the Town for the use of a public street, alley, sidewalk, path, or other use.

ROW permit: right-of-way permit. A document granted by the Town to a developer or contractor to construct any public or private improvements in the ROW, or for any equipment, materials, or encroachment in the ROW, or disruption to pedestrians or vehicles within a ROW.

SCS: Soil Conservation Service. A hydrological method that uses geographical rainfall time distributions, curve numbers and time of concentration to determine peak runoff that may be used for water sheds of any size or when hydrograph routing is required for design.

SCS method: Soil Conservation Service method.

SFHA: Special Flood Hazard Area. An area identified by FEMA as an area having flood-related hazards and where the NFIP floodplain management regulations must be enforced.

shared use path: a paved path at least 10 feet wide for pedestrians, bicyclists, and other non-motorized transportation uses.

SIA: Subdivision Improvement Agreement. A written document establishing a surety and requirements for a developer to complete improvements in the Town.

sidewalk: paved path for pedestrian use within a ROW or easement and separated from the roadway by a curb or detached at least four feet.

sight distance: the length of roadway which is visible to a vehicle operator.

site plan: a detailed engineering drawing showing proposed improvements to a site.

snow storage: additional area within a right-of-way, easements, or private property for stacking and storing snow and ice. May also be called snow stacking areas.

specifications: a written document describing in detail the scope of work, materials to be used, methods of installation, and quality of workmanship for construction work.

stable channel/ditch: a streambed, drainageway, or ditch in which sediment transport conditions are in balance, neither acquiring significant deposits of sediments nor experiencing significant erosion.

standards: these Town of Breckenridge Engineer Standards, inclusive of all attachments, amendments, and referenced/supplemental codes and standards.

stop work order: a written directive from the Town revoking the developer's and contractor's rights to continue work on the project due to nonconformance with these standards, plans, specifications, or other project documents.

SSD: Stopping Sight Distance. The minimum length of roadway required to be visible for a vehicle operator to safely recognize an object within a roadway and stop the vehicle prior to colliding with the object. SSD can also be defined as the sum of the braking distance and the distance traversed by a vehicle during the reaction time.

storage lane: additional lane footage added to a deceleration lane to store the maximum number of vehicles likely to accumulate during a critical period without interfering with the through lanes.

stormwater runoff: the water from precipitation running off from the surface during and immediately following a period of rain.

storm sewer system: also called a storm drain system; a system of inlets, manholes, and conduits that conveys runoff to drainageways and natural channels. Storm sewers are necessary whenever the street capacity to carry the design storm runoff is exceeded by either the minor or the major storm.

street: the entire width of a public right-of-way, including the roadway, pedestrian routes, landscaped areas, shoulders, and other areas within the right-of-way.

street flow: the total flow of stormwater runoff in a street, usually the sum of the gutter flows on each side of the street.

subdivision: a tract of land surveyed and divided into separate parcels or lots. "Subdivision" may also refer to a neighborhood or several adjoining lots in the Town.

subdivision permit: a type of development permit issued by the Town Community Development Department for dividing a tract of land into separate parcels or lots.

substantial completion: the period when the work has progressed to the point where it is sufficiently complete so some or all of it can be utilized for the purposes which it is intended.

SUE: subsurface utility engineering. The Colorado Senate Bill 18-167 that amended Title 9, Article 1.5 of the Colorado Revised Statutes to improve safety by modifying requirements associated with the location underground utilities prior to construction.

surcharged: a condition when the hydraulic grade line within a storm sewer rises above the elevation of an inlet.

surety: a financial instrument, such as cash, bond, letter of credit, or other instrument acceptable in form to the Town Attorney, securing the developer's responsibility to complete construction of improvements for a project. Surety shall also be a financial instrument to secure the Developer's obligations through the warranty period.

SWMM: Storm Water Management Model, developed by the EPA and used for hydrologic and hydraulic analysis.

SWMP: Stormwater Management Plan. A construction plan and associated written narrative required for construction sites to prevent pollution, contamination, or degradation of waters of the State and to prevent discharge of pollutants from a project site.

TDM: Transportation Demand Management. A set of strategies aimed at reducing travel demand or to redistribute the demand in space or in time.

TCS: certified Traffic Control Supervisor.

Town: abbreviation for the Town of Breckenridge. Town may refer to the entire municipality, the Town Engineering Division, or other Town Departments and Divisions.

Town Code: The Town of Breckenridge Municipal Code. Includes all codification and ordinances pending codification. Town Code is a collection of laws passed by the Town and have the force and effect of law for the Town. The Town Code can be found online.

Town Engineer: the Town of Breckenridge Town Engineer or Town Engineering Representative selected by the Town Engineer.

TIS: Traffic Impact Study. An assessment of the adequacy of the existing or future transportation infrastructure to accommodate additional trips generated by a proposed development, redevelopment, or land rezoning which is prepared and stamped by a Colorado licensed Professional Engineer.

Traffic calming: the combination or mainly physical measures that reduced the negative effects of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users.

trail: any path used by pedestrians or bicyclists within a ROW or easement.

UBSD: Upper Blue Sanitation District.

USACE: United States Army Corps of Engineers.

USDCM: Urban Storm Drainage Criteria Manual, published by the MHFD.

USGS: United States Geological Survey.

utility: a network of infrastructure supplying a service to the Town. Examples include gas, electric, sewer, water, and communication.

variance: an approved deviation from these Standards or other rules of the Town of Breckenridge.

vehicle: an instrument for the purpose of conveying people or objects. Vehicles are typically motorized. Wheelchairs and other pedestrian mobility devices are not considered vehicles.

warranty: a written guarantee from developer or contractor guaranteeing all improvements from material and workmanship defects.

warranty period: the two year period of time after the initiation acceptance when the developer or contractor is responsible for warranty of improvements.

wetlands: areas including lakes, streams, ponds, areas of seasonal standing water, and other bodies of water with a predominance of wetlands vegetation (such as willows, rushes, or sedges), or areas with boggy soils. Wetlands definitions and delineations shall be consistent with those of the Army Corps of Engineers.

wheel path: the three foot wide portion on both sides of a roadway travel lane starting two feet from the center of the lane.

work: all construction activity, including materials, labor, supervision, use of tools and equipment, and all other effort required to complete the project in full compliance with these standards, approved plans, specifications, and other documents.

CHAPTER 2 SUBMITTAL REQUIREMENTS & PERMITS

TABLE OF CONTENTS

2.1	INTRODUCTION	3
2.2	GENERAL FORMATTING	3
2.3	ENGINEERING SUBMITTALS	3
2.3.1	Site and Grading Plans	5
2.3.2	Civil Construction Drawings	5
2.3.3	Drainage Reports	6
2.3.4	Geotechnical Report	6
2.3.5	Traffic Impact Study (TIS)	7
2.3.6	Method of Handling Traffic (MHT)	7
2.3.7	Stormwater Management Plan (SWMP)	7
2.3.8	Construction Management Plan (CMP)	7
2.3.9	Construction Specifications	7
2.3.10	Subsurface Utility Engineering (SUE)	8
2.3.11	Permanent Survey Monumentation	9
2.3.12	Ownership and Maintenance Plan	9
2.4	PERMITS	9
2.4.1	Infrastructure Permit	10
2.4.2	Building Permit (without Infrastructure Permit)	10
2.4.3	Right-of-Way Permit	11
2.4.4	Floodplain Development Permit	11
2.4.5	Additional Local Permits	11
2.4.6	State Permits	11
2.4.7	Federal Permits	11
2.5	EMERGENCY WORK	12
2.6	ENCROACHMENT LICENSE AGREEMENTS	12
2.7	POST-CONSTRUCTION SUBMITTALS (SEE CHAPTER 8)	12

LIST OF TABLES

Table 2.1.	Engineering Division Submittal Requirements	4
Table 2.2.	Project Checklist Reference	4
Table 2.3.	Project Permits	10

LIST OF ATTACHMENTS – APPENDIX B

PERMIT PROCESS FLOW CHART

CHECKLIST 1 SITE & GRADING PLAN REQUIREMENTS

CHECKLIST 2 CIVIL CONSTRUCTION DRAWINGS REQUIREMENTS

CHECKLIST 3 DRAINAGE REPORT REQUIREMENTS

CHECKLIST 4 TRAFFIC IMPACT STUDY REQUIREMENTS

CHECKLIST 5 STORMWATER MANAGEMENT PLAN REQUIREMENTS

CHECKLIST 6 OWNERSHIP & MAINTENANCE PLAN REQUIREMENTS

CHECKLIST 7 BUILDING PERMIT (WITHOUT INFRASTRUCTURE PERMIT) REQUIREMENTS

EXAMPLE O&M PLAN

FLOODPLAIN DEVELOPMENT PERMIT APPLICATION

INFRASTRUCTURE PERMIT APPLICATION

2.1 INTRODUCTION

This chapter of the Engineering Standards establishes the requirements and review process for preconstruction submittals to the Engineering Division of the Public Works Department. The engineering submittals specified in this chapter are for Planning Development Permits, Infrastructure Permits, Floodplain Development Permits, Right-of-Way Permits, civil construction drawings, Preliminary and Final Drainage Reports, Traffic Impact Studies, and Stormwater Management Plans (SWMP).

The Infrastructure Permit issued by the Engineering Division is generally required for projects involving roadways, sidewalks and trails, stormwater infrastructure, potable water infrastructure, sanitary sewer infrastructure, lighting, irrigation, fiber optic cable and conduit, other utilities, stormwater management, transit facilities, retaining walls, signage, and any other public improvements. Single Family Homes (SFH) typically do not require an Infrastructure Permit, but one may be required by the Town Engineer depending on the project scope.

This chapter also includes the Engineering Division submittal requirements for a Building Permit and a Right-of-Way Permit. Planning submittals, including landscaping, architectural, historical, and mineral rights submittal requirements, can be found in Title 9 the Town Code. See Title 9 of the Town Code for additional information on the Town's planning process, the types of development permits listed below, how to obtain a development permit, scheduling pre-application meetings, and other planning related items. This chapter discusses the submittal and approval process prior to construction for the Engineering Division. Chapter 8 of these Standards details inspections and acceptance during and after construction.

A permit process flowchart is included as an attachment in Appendix B.

2.2 GENERAL FORMATTING

All drawing sheets, regardless of content, shall be scalable, clear and legible when printed on 11" x 17" paper. Drawings shall be prepared in AutoCAD or a compatible program approved by Town in the Colorado State Plane Central (unmodified) coordinate system for easy incorporation into the Town's GIS database.

Contents shall be drawn to a scale of multiples of ten (e.g. 1" = 10'; 1" = 30'). To preserve the scale when plotting at both full size and half size, drawings may be produced in AutoCAD with an 11" x 17" format. A larger exterior border may then be used with a 24" x 36" format, with an effective area of 22" x 34", to result in an exact doubling of the 11" x 17" half-sized drawings.

Hard copies of plans are not required. All plans shall be provided electronically, in DWG and in PDF in a format that will print to scale on 11" x 17" paper. DWG files shall be provided in a version of AutoCAD specified by the Town.

Each drawing sheet shall include a title block, scale, north arrow, original and revision dates, and professional engineer's stamp when applicable. Title blocks shall be along the bottom or right margin of each drawing.

Hard copies of reports and specifications are not required. All reports shall be provided in electronic format in PDF so that pages of report text will print to scale on 8.5" x 11" paper. Exhibits may be created to print to scale on 11" x 17" paper.

2.3 ENGINEERING SUBMITTALS

Table 2.1 summarizes the Engineering Division submittals required for subdivision permits, development permits, engineering permits, building permits, and right-of-way permits. See the Town Code for Community Development and Building Department submittal requirements. See the Town of Breckenridge Water Construction Standards for Town of Breckenridge Water Division submittals. Contact other agencies and utility companies (including Red White & Blue Fire Protection District,

Upper Blue Sanitation District, and Xcel Energy) for applicable codes and design criteria. A brief cover letter should be submitted with all Engineering Division submittals that includes the following information. A cover letter is not required for single family home projects without an infrastructure permit.

1. Project title
2. Project description including street address, subdivision, lot, and block
3. Owner contact information
4. Engineer contact information
5. Written justification for any required items omitted from the submittal.

There are several types of submittals requiring both a preliminary and a final submittal. Requirements for these are specified in Table 2.1 and the respective subsection for each submittal type. All the submittals listed in Table 2.1 may not be required for a specific project; consult with the Engineering Division to confirm which submittals are required for a project. Table 2.2 summarizes which checklists shall be referenced for different types of projects. Checklists are included as attachments in Appendix B. Any work of any nature within the Town must have at least one of the following permits before starting work: an Infrastructure Permit, a Building Permit, or a Right-of-Way Permit. All three may be required depending on the nature of the work. Permits are discussed in more detail in Section 2.4. No work of any kind, including demolition, removal, or grading, may begin until the applicable permit(s) listed above have been obtained.

Table 2.1. Engineering Division Submittal Requirements

Permit Type	Engineering Division Submittals									
	Site & Grading Plans	Civil Drawings	Drainage Report	Geotech Report	Traffic Impact Study	MHT *	SWMP **	CMP ***	Tech Specs	Other Agency Permits
Class A/B Development Permit Preliminary Submittal	X									
Class A/B Development Permit Final Submittal; Class A/B/C Subdivision Permit Preliminary & Final Submittal; & Class C/D Development Permit	X		X							
Infrastructure Permit	X	X	X	X	X	X	X		X	X
Building Permit (without Infrastructure Permit)	X	X		X		X		X		X
Right-of-Way Permit	X	X				X		X		X

*Method of Handling Traffic/ Traffic Control Plan

**Stormwater Management Plan

***Construction Management Plan

Table 2.2. Project Checklist Reference

Project or Permit Type	Checklist
Development/Subdivision Permit	Checklist 1: Site and Grading Plan Requirements
Infrastructure Permit for grading, drainage, utilities, streets, or sidewalks	Checklist 2: Civil Construction Drawings Requirements Checklist 3: Drainage Report Requirements Checklist 4: Traffic Study Requirements Checklist 6: Ownership & Maintenance Plan Requirements
Any land disturbance	Checklist 5: Stormwater Management Plan Requirements
Building Permit (without Infrastructure Permit)	Checklist 7: Building Permit (Without Infrastructure Permit) Requirements

2.3.1 Site and Grading Plans

Site and grading Plans are required to be submitted to the Engineering Division when a Subdivision or Development Permit is required by the Community Development Department. The preliminary site and grading Plans are required for preliminary Development Permit submittals. Final site and grading plans are required to be submitted with the final Development Permit submittal. Requirements for site and grading plans are listed in Checklist 1. Grading and site plans may be combined for small projects where less detail is needed to clearly understand the intent of the grading plan.

The Community Development Department lists Planning requirements for site plans in Title 9 of the Town Code. If the Applicant can satisfy the Engineering and Planning requirements on a single set, then only one site plan is required. If the Applicant cannot satisfy both sets of requirements on one set, then two submittals are required.

2.3.2 Civil Construction Drawings

Complete civil construction drawings are required for any project that includes public infrastructure. Public infrastructure includes roadways, sidewalks and trails, stormwater infrastructure, potable water infrastructure, sanitary sewer infrastructure, lighting, irrigation, fiber optic cable and conduit, other utilities, transit facilities, retaining walls, signage, and any other public improvements. Both a preliminary and a final submittal of civil construction drawings are required for the Infrastructure Permit (discussed later in this chapter). In general, the preliminary submittal of civil construction drawings shall be at least 60% complete while the final submittal shall be construction-ready and stamped by a professional engineer. For small projects that require an Infrastructure Permit, a single submittal is acceptable with prior approval from the Town Engineer.

Civil construction drawing requirements for most types of construction and grading are specified in Checklist 2, Civil Construction Drawing Requirements. The checklist is provided to guide the content and format of the construction drawings. The drawings must meet the minimum content standards so the Town can thoroughly review the design of the improvements and confirm the design is in accordance with these Standards and with all other applicable standards. Adherence to applicable design standards provides for the health, safety, welfare, and property of the Town and its citizens to be safeguarded and protected.

Depending on the scope of the project, the contents of one or more drawings specified by the checklist may be more efficiently shown on a single drawing. Required contents may be combined or separated as necessary to provide a clear and concise set of construction drawings that provides all the required information.

The design of improvements included in the construction drawings must be completed in accordance with these Standards. The plans will be reviewed for compliance and resubmittal will be required if any aspect of the design of the improvements is not in compliance with the applicable standards and criteria.

2.3.3 Drainage Reports

A drainage report is required for new public storm sewer infrastructure or for private storm sewers that connect to existing public storm sewer infrastructure. A drainage report is also required for private infrastructure if a site's impervious area increases by 0.1 acres or more from existing conditions, regardless of whether new infrastructure is constructed. ~~Both a preliminary and a final drainage report are required.~~ For small projects, an abbreviated drainage memo may be acceptable with prior approval from the Town Engineer. A drainage memo may also be required for commercial redevelopment that does not increase impervious area, but does disturb includes site disturbance of at least 0.15 acres or greater. In general, the preliminary drainage report shall be at least 60% complete while the final drainage report shall be accompanied by construction-ready drawings. Guidance on drainage and water quality design and the Town's drainage and water quality criteria are in Chapter 6 of these Standards.

Both a preliminary and a final drainage report are required. The preliminary drainage report shall be submitted with the final development and final Subdivision Permit applications and shall also meet the requirements of Section 9-1-18 of the Town Code. The final drainage report shall be submitted with the Infrastructure Permit. Requirements for drainage reports are specified in Checklist 3, Drainage Report Requirements. Chapter 6 of these Standards discusses design requirements for stormwater infrastructure within the Town.

2.3.4 Geotechnical Report

A Geotechnical Report is required for an Infrastructure Permit. The Building Department also requires documentation of the bearing capacity of the soils used for foundation design in accordance with the International Building Code (IBC) and the International Residential Code (IRC). The Town may review geotechnical reports and the associated subsurface explorations and analyses to check for slope stability or soil issues, but it shall not be the responsibility or liability of the Town to make an assessment of the soils. It shall be the responsibility of the applicant and their geotechnical engineer to make an assessment of any soil or slope stability issues. The Geotechnical Report shall generally contain the following findings and supporting data. Certain projects may not require all the items listed below depending on the scope of the work.

1. Relative density type and extent of material likely to be encountered.
2. Anticipated excavation issues and proposed solutions.
3. Location and extent of excavation.
4. Suitability of excavated materials for use as backfill or bedding.
5. Compaction characteristics of the soils.
6. Groundwater level and conditions.
7. Soils infiltration testing results if any infiltration facility is proposed.
8. Soils resistivity, moisture content, pH, degree of variation, presence of sulfates, and the likelihood of stray, direct currents.
9. Soil bearing capacity and foundation design recommendations.
10. Recommended pavement type and thickness, base course type and thickness, and any additional subgrade requirements.
11. Test holes to a depth of at least two feet below the subgrade of the proposed improvements; the spacing of test holes shall be as recommended by the geotechnical engineer to adequately define the subgrade.

2.3.5 Traffic Impact Study (TIS)

A Traffic Impact Study (TIS) may be required. Chapter 4 - Traffic Impact Studies of these Standards specifies when a TIS is required. TIS requirements are specified in Checklist 4 of Appendix B.

2.3.6 Method of Handling Traffic (MHT)

A Method of Handling Traffic (MHT) or Traffic Control Plan (TCP) prepared by a certified Traffic Control Supervisor (TCS) is required for work performed within the public right-of-way (ROW) that will impact traffic lanes, shoulders, or sidewalks. A full MHT shall be submitted to the Engineering Division that includes lane closures, vehicular and pedestrian detours, cones, barriers, signage, and any other traffic maintenance devices required. Lane closures, signage, and traffic patterns must meet MUTCD and CDOT requirements. Efforts shall be made to maintain at least one lane of traffic to the extent possible. When one lane cannot safely be maintained, the length and duration of the full road closure shall be minimized to the extent possible. See Chapter 3 of these Standards for additional requirements of when a ROW permit or MHT is required.

2.3.7 Stormwater Management Plan (SWMP)

A Stormwater Management Plan (SWMP) is required when the area disturbed during construction is one acre or more. Construction best management practices must be used to prevent erosion and control sediment. Permanent water quality best management practices are not included in the SWMP but are to be included in the civil construction drawings. Requirements for permanent water quality are specified in Chapter 6 of these Standards. Items required to be included in the SWMP are specified in Checklist 5 - Stormwater Management Plan Requirements of Appendix B. Construction Stormwater Standards are detailed in Section 6.11. See additional permitting requirements in Section 2.4 below for projects disturbing one acre or more.

2.3.8 Construction Management Plan (CMP)

A Construction Management Plan (CMP) is required for projects disturbing less than one acre during construction. Projects disturbing less than one acre, but part of a larger project or development disturbing one acre or more, will still require a SWMP to be submitted. The CMP must be developed to prevent erosion and control sediment. Permanent water quality best management practices are not included in the CMP but are to be included in the civil construction drawings. The CMP shall show the following at a minimum:

1. Best Management Practices (BMPS) to prevent erosion and control sediment from leaving site.
2. Revegetation notes or other final stabilization plans.
3. Construction fencing location.
4. Material and equipment staging locations.
5. Dumpster and portalet locations
6. Vehicle parking locations and construction access location.

2.3.9 Construction Specifications

The Town has adopted standard construction specifications that shall be used on all projects. Project special provisions that vary from the Town Specifications shall be included with the Infrastructure Permit application. For special conditions or construction types which are not addressed by the Town Specifications, the Applicant shall submit proposed specifications for the Town's review.

2.3.10 Subsurface Utility Engineering (SUE)

Colorado Senate Bill 18-167 amended Title 9, Article 1.5 of the Colorado Revised Statutes to improve safety by modifying the requirements associated with the location of underground utilities prior to construction and implementing an enforcement program associated with the new requirements. The new requirements must be met if a project meets all four of the following criteria:

1. Project involves a construction contract with a public entity, construction in the public ROW, infrastructure that will be dedicated to the Town, or other work as determined by the Town Engineer.
2. Project primarily involves horizontal construction and does not primarily involve the construction of buildings.
3. Anticipated excavation footprint exceeds two feet in depth and is at least a contiguous 1,000 square feet (excluding fencing and signing projects) or involves utility boring.
4. Project requires the design services of a licensed professional engineer.

If all the above criteria are met, subsurface utility engineering documentation shall be provided with the Infrastructure Permit application that includes:

1. Notification to 811 that there is an upcoming SUE required project.
2. Depiction of utilities on stamped plans in such a way that they meet or exceed ASCE 38 or provide documented reasons from a licensed professional engineer why they do not meet or exceed Quality Level B.
3. Meeting or exceed Quality Level A for underground facilities at the point of a potential conflict with a gravity fed system including sanitary and/or stormwater facilities.

Quality-level requirements for subsurface utility engineering vary by project phase and are as follows:

1. Project Planning – Quality Level D
2. Preliminary Design – Quality Level B
3. Final Design – Quality Level A

The above Quality Levels provide general guidance for project planning. Refer to Colorado Senate Bill 18-167 for exact Quality Level requirements. Quality Level A is generally required at potential conflicts for gravity fed utilities. Quality Level A may not be required in areas without any sanitary sewer, storm sewer, other potential utility conflicts, or grading conflicts. A Colorado licensed Professional Engineer must determine the appropriate Quality Level based on Colorado Senate Bill 18-167 and document the reasons why any facilities were not located to the particular Quality Level.

Definitions of the Quality Levels are as follows:

1. Quality Level D is the most basic level of investigation and includes verbal recollections and review of existing records such as as-built drawings, utility system drawings, permit logs, field sketches, site visit log books, old surveys, one-call marks, and prior SUE investigations by others.
2. Quality Level C includes surveying those utilities that are visible above ground and use of surface features that indicate subsurface alignment such as valve covers, fire hydrants, pull boxes, manholes, and telephone pedestals. These should be reconciled to ASCE Quality Level D records.

3. Quality Level B includes the use of geophysical methods to determine the existence and horizontal position of all subsurface utilities. Quality Level B can be assigned to a utility segment or subsurface feature whose existence and position are based upon geophysical methods combined with professional judgment and whose location is tied to the project survey datum. Quality Level B is sometimes referred to as designating.
4. Quality Level A requires precise mapping via exposure of the utility. It provides type, size, condition, and material of the utility. Quality Level A includes using nondestructive excavating equipment at critical points to determine the precise horizontal and vertical position, type, size, condition, material, and any other characteristics of underground utilities. The utility should be vertically and horizontally tied to the project datum. Quality Level A is sometimes called locating.

2.3.11 Permanent Survey Monumentation

Permanent survey monuments are required in accordance with Chapter 3 of these Standards. A brief narrative covering the procedures and pertinent information used to establish permanent monumentation must be submitted to the Town Engineer as part of the Infrastructure Permit. GPS survey data shall include a detailed description of the post processing procedure which was used to establish the monument. Permanent survey monuments shall be considered properly positioned and represented only after the Town Engineer has approved all survey procedures and calculations and has verified conformance to standards and specifications for Class 2 surveys or greater. If found to be deficient, the Land Surveyor submitting the final plat and documentation may be required to perform additional work to bring the monumentation into conformance, regardless whether the final plat is recorded or not.

Survey control points, permanent monumentation, and the basis of horizontal and vertical control shall be shown on all plans. Property corners and other survey monuments shall be shown on the plat in accordance with the Town Code.

2.3.12 Ownership and Maintenance Plan

An Ownership and Maintenance Plan (O&M Plan) is required for all detention and permanent water quality facilities. An example O&M Plan, including a template for required plan notes, is included as an attachment to this chapter. Checklist 6, O&M Plan Requirements, is also included as an attachment to this chapter. O&M plans may be required by the Town Engineer for other public or private infrastructure.

2.4 PERMITS

A development permit must be issued by the Community Development Department prior to the applicant applying for any of the permits listed below; an exception may be granted for projects consisting of work contained entirely within Town right-of-way. Any work within the Town must have at least one of the following permits before starting, and all three may be required depending on the nature of the work. Exceptions may be made for Class D minor permits; contact the Engineering Division prior to beginning work to confirm permitting requirements. Additional permits may be required in addition to the three permits listed below.

1. Infrastructure Permit
2. Building Permit
3. Right-of-Way Permit
4. Floodplain Development Permit

Additionally, work within 30' of a special flood hazard area (SFHA) will require a Floodplain Development Permit as part of the permitting process. Table 2.3 summarizes the types of permits that are required for different types of projects and the subsections below discuss each of these in more detail.

All applicable county, state, and federal permits must be obtained and submitted to the Engineering Division prior to the Town issuing the Infrastructure, Building, or Right-of-Way Permit.

Table 2.3. Project Permits

Project or Permit Type	Permit
Any infrastructure improvements	Infrastructure Permit
Any building construction, remodel, or addition	Building Permit
Any work within the public right-of-way	Right-of-Way Permit (ROW Permit)
Any work within 30' of a SFHA	Floodplain Development Permit

2.4.1 Infrastructure Permit

An Infrastructure Permit is required for projects that occur within public right-of-way, projects that disturb one acre or more, and for public & private developments that involve public roadways, sidewalks, trails, stormwater infrastructure, potable water infrastructure, sanitary sewer infrastructure, lighting, irrigation, fiber optic cable and conduit, [heated paver, asphalt, and concrete snowmelt systems](#), other utilities, stormwater management, transit facilities, retaining walls, signage, and any other improvements. If ~~storm sewer~~ infrastructure is being installed on private property and is being connected to public infrastructure, an Infrastructure Permit will be required. An Infrastructure Permit may also be required for other types of work at the discretion of the Engineering Division. An Infrastructure Permit may be obtained at the same time or prior to the Building Permit if a Building Permit is required. Refer to the permit process flow chart in the attachments to this chapter for the permitting process. The Infrastructure Permit application form is also included as an attachment to this chapter. The Engineering Division will review each Infrastructure Permit application and issue the Infrastructure Permit once the application is approved. If any work is proposed within existing Town right-of-way, a separate Right-of-Way Permit will be required in addition to an Infrastructure Permit.

[Work exempted from an infrastructure permit includes single-family homes with a building permit, driveway repaving, and minor work entirely within a right-of-way.](#)

A list of submittals required for the Infrastructure Permit is listed on the Infrastructure Permit Application form attached to this chapter.

2.4.2 Building Permit (without Infrastructure Permit)

If the Engineering Division determines that an Infrastructure Permit is not required, final construction plans shall be approved through a Town Building Permit. Refer to the Town Code for other Town Division submittal requirements. A Building Permit or Infrastructure Permit must be obtained prior to beginning any construction activities (including any staging, demolition, excavation, removals, or grading).

In cases where an applicant desires to begin demolition prior to a building permit or infrastructure permit, they shall contact the Building and Engineering Divisions for approval. Engineering will review these requests and will only allow a demolition permit if the associated site and grading work is minimal.

A checklist of Engineering Division submittals required for Building Permits (Without Infrastructure Permit) is listed in Checklist 7 at the end of this chapter.

2.4.3 Right-of-Way Permit

Any excavation or encroachment into the Town right-of-way requires a Town Right-of-Way Permit from the Public Works Department. The Right-of-Way Permit shall be obtained prior to starting any work within Town right-of-way. Right-of-way regulations are specified in Chapter 3. The permit application and guidance can be found at the Town of Breckenridge Public Works website.

A list of submittals required for the Right-of-Way Permit is listed on the Right-of-Way Permit Application form on the Town website.

2.4.4 Floodplain Development Permit

All work within a Special Flood Hazard Area (SFHA), often referred to as the floodplain, and within areas removed from the floodplain by the issuance of a FEMA Letter of Map Revision based on Fill (LOMR-F) must meet the requirements of the 2018 Breckenridge Flood Damage Prevention Ordinance. A Floodplain Development Permit is required for all work in these areas, regardless of whether a building is being constructed or redeveloped. Work includes, but is not limited to, subsurface and surface utilities, grading, changes to surfacing, infrastructure of any kind, and signage. The Floodplain Development Permit application is included as an attachment to this chapter.

If work in the floodplain will cause any increase in the regulatory floodplain elevation or any decrease in the regulatory floodplain elevation of more than 0.3 feet, a Conditional Letter of Map Revision (CLOMR) issued by FEMA is required. If a CLOMR is issued, the permittee must also submit a Letter of Map Revision (LOMR) to FEMA, and receive approval, once the work has been completed, for the work to be accepted by the Town. The CLOMR submittal and approval from FEMA is required prior to CO or final permit signoff.

A list of submittals required for the Floodplain Development Permit is listed on the Floodplain Development Permit Application form attached to Appendix B.

2.4.5 Additional Local Permits

Work within Summit County right-of-way requires a Summit County Right-of-Way Permit. The application for this permit and submittal instructions are available on the County website via an internet search for "Summit County ROW Permit." Other local permits include a Summit County Grading and Excavation Permit and Summit County Development Permits. Applicants shall review jurisdictional boundaries shown on the Summit County GIS website and determine if their property and adjacent road or the jurisdiction of Town of Breckenridge or Summit County.

2.4.6 State Permits

There are several state permits that may be required. A CDOT Utility/Special Use Permit is required for the installation of utilities and the performance of any other types of work within the state highway right-of-way. A CDOT Access Permit is required to construct or new access to a state highway or to modify an existing access to a state highway.

The Colorado Department of Public Health and Environment (CDPHE) issues several permits to maintain a high level of water quality during construction activities that include one or more acres of disturbance. The two most common permits are for stormwater discharges associated with construction activities and construction dewatering. Information on the various permits issued by the CDPHE and their applicability can be found via an internet search for "CDPHE construction permits."

The Applicant shall submit copies of all required state permits to the Town Engineering Division.

2.4.7 Federal Permits

In addition to the FEMA requirements for working on floodplains discussed above, the most common federal permit is the US Army Corps of Engineers Section 404 Permit. A 404 Permit is required to

discharge fill material into waters of the US. Waters of the US include tributaries, lakes, rivers, streams, creeks, and wetlands. The Applicant shall submit copies of all required federal permits to the Town Engineering Division.

2.5 EMERGENCY WORK

Emergency work is defined as work of an urgent nature to repair or mitigate damage that is creating an immediate hazard to the community, including hazards to the health, safety, and welfare of the Town, environment, or citizens. If emergency work is required, the Engineering Division shall be contacted immediately and all pertinent information shall be conveyed. The Engineering Division will expedite a review of the information and determine if the work qualifies as emergency work. If an emergency work determination is made, the Engineering Division will expedite the review process and may not require all submittals and reviews listed in this chapter. The permit process may be abbreviated, but permits shall still be required in most cases. The review process and required submittals will be determined on a project basis dependent on the nature of the hazard and the work.

2.6 ENCROACHMENT LICENSE AGREEMENTS

The Town does not generally allow private structures, landscaping, or other private improvements within Town right-of-way or easements. If the Town Engineer reviews and approves private improvements within the Town right-of-way or easement, a revocable encroachment license shall be submitted to the Town. The encroachment license agreement shall be acceptable in form and substance to the Town Attorney for the improvements extending into the right-of-way or easement and must be approved by the Town and executed prior to the issuance of a Building Permit, Infrastructure Permit, or Right-of-Way Permit. See Sections 10-2-1-2 and 11-6 of the Town Code for additional information on encroachment license agreements.

2.7 POST-CONSTRUCTION SUBMITTALS (SEE CHAPTER 8)

Post-construction inspections and documentation are discussed in Chapter 8.

CHAPTER 3 RIGHT-OF-WAY & EASEMENTS

TABLE OF CONTENTS

3.1	PURPOSE	1
3.2	WORK IN RIGHT-OF-WAY	1
3.3	ACCESS TO RIGHT-OF-WAY	1
3.4	RIGHT-OF-WAY RULES AND REGULATIONS	1
3.5	SNOW STORAGE	4
3.6	PERMANENT SURVEY MONUMENTS	4
3.7	RIGHT-OF-WAY WIDTHS	5
3.8	EASEMENTS	5
3.8.1	Access Easements	5
3.8.2	Drainage Easements	6
3.8.3	Utility Easements	6
3.8.4	Snow Storage Easements	6

3.1 PURPOSE

This chapter of the Engineering Standards establishes the requirements for public right-of-way (ROW) and easements. A Right-of-Way Permit is required whenever construction, encroachment during construction, installation, or disturbance is proposed within Town ROW. A Right-of-Way Permit is required to ensure utilities, roadway reconstruction, and other work is completed to Town specifications and to provide for public health, safety, and welfare. Examples of work requiring a Right-of-Way Permit are included below:

1. Utility work, including directional boring and drilling
2. Pavement cuts and installation of new roadway or sidewalk improvements
3. Installation of trails, landscaping, signs, lights, transit improvements, or any other surface or subsurface improvements
4. Traffic counts (vehicle or pedestrian) conducted in the ROW
5. Access changes for proposed or existing driveways and roadway accesses
6. Work outside of the ROW, but requiring parking, staging, or traffic control within the ROW
7. Installation of driveway culverts, swales, ponds, and storm sewer infrastructure

Replacement of driveway pavement shall not require a Right-of-Way Permit, provided the driveway cut width does not increase from existing width, no snow melt system is added to the driveway, and no culvert is being installed beneath the driveway.

ROW and easements shall be dedicated for public streets and other infrastructure as needed in accordance with current master plans and development approval requirements. Specific procedural requirements for ROW and easement dedication or vacation are listed in the Town Code. The purpose of this chapter is to provide more detail for completing work in the ROW and guidance on when an easement is required. See Titles 9 through 11 of Town Code for additional information on ROW and easements.

3.2 WORK IN RIGHT-OF-WAY

It shall be unlawful for any person, other than an officer or employee of the Town in the course of his or her employment, to make, cause, or permit any construction in, on, under, or within a public right-of-way of the Town unless such person first obtains a Right-of-Way Permit from the Town Engineer. All work in the ROW shall be performed in conformity with the permit and the terms and provisions of this chapter. For all work within the ROW, the contractor is responsible for obtaining utility locates and any other permits and approvals necessary to complete the work. Submittal requirements for a Right-of-Way Permit are specified in Chapter 2, Submittal Requirements & Permits. Any work performed in the ROW without a permit, work performed outside of allowable dates outlined below, or work not performed in accordance with these Standards is subject to fines, penalties, and enforcement as set forth in the Town Code.

3.3 ACCESS TO RIGHT-OF-WAY

Any new access or any modification of an existing access to a public street or Town ROW shall require a Town Right-of-Way Permit. A new access to a state highway, or a modification of an existing access to a state highway, requires a CDOT Access Permit. New access or modification of an existing access to a county road requires a Summit County Right-of-Way Permit. New access spacing shall meet the minimum requirements listed in Chapter 5 of these Standards.

3.4 RIGHT-OF-WAY RULES AND REGULATIONS

The sections below provide an overview of rules, regulations, and specifications for work in the right-of-way. See Town Code and Chapter 9 of these Standards for additional requirements for work within Town right-of-way.

- A. Work authorized by the Right-of-Way Permit shall be performed between the hours of 7:00 a.m. and 7:00 p.m., Monday through Friday (except holidays), unless the contractor obtains written consent from the Town Engineer to work earlier or later than the stated hours or on a weekend or holiday.
- B. Street pavement cuts will not be allowed between November 1 and April 30, except when:
 - 1. There is a public utility emergency with notification and approval by Town Engineer, or
 - 2. Special or unforeseen circumstances arise as determined by the Town Engineer.

If the Town Engineer approves a pavement cut between November 1 and April 30 due to one of the conditions above, a special provisions memo must be prepared and submitted to the Town Engineer to accommodate pavement patching during winter conditions. Pavement repairs completed during this period shall be considered temporary and be removed and replaced as soon as conditions permit after April 30.

C. TOWN OF BRECKENRIDGE 2018 DIG ONCE ORDINANCE

See Title 11, Chapter 9 of the Town Code for the TOWN OF BRECKENRIDGE 2018 DIG ONCE ORDINANCE. The purpose of this ordinance is to coordinate work in the right-of-way and to minimize the number of excavations and pavement cuts. If the Right-of-Way Permit applicant proposes utility work in the right-of-way, the Town may require the applicant to install additional conduit in the work area with the direct cost of the additional conduit installation to be paid by the Town.

- D. Work authorized by a Right-of-Way Permit shall meet the following conditions:
 - 1. Work shall be conducted in a manner which ensures the least possible obstruction and hazard to the traveling public. The permit holder shall provide for the safety and reasonable accommodation of the residents and users along the rights-of-way where work is being performed, and for the protection of persons and property at all times. The permit holder shall plan work so it does not create safety hazards or maintenance problems.
 - 2. An MHT or traffic control plan shall be submitted prior to approval of the Right-of-Way Permit in compliance with the MUTCD, CDOT S Standards, and these Standards. The plan shall be signed by a certified Traffic Control Supervisor. See the Right-of-Way Permit application for a full list of submittal requirements.
 - 3. The applicant shall provide all submittals, including the traffic control plan, at least 5 calendar days prior to the start of the scheduled roadway work. During the work, the permit holder shall notify the Town of any changes to the traffic control plan, schedule, closures, or any other changes at least 5 calendar days prior to implementing the closures. The permit holder shall provide advance signing and notify appropriate agencies of any road closures and detours at least 5 calendar days prior to actual road closure.
- E. All street pavement cuts shall meet the following conditions:
 - 1. Pavement cuts shall be mechanically cut to form a clean vertical edge. Final pavement cuts shall not be made until immediately prior to paving.
 - 2. Pavement cuts shall be a minimum width of two feet.
 - 3. Pavement cuts shall extend 12 inches minimum beyond the edge of trenching or excavation.

4. Pavement cuts shall be exactly perpendicular or parallel to the travel lane.
 5. Pavement cuts parallel to the travel lane shall not be located in wheel paths for vehicles or bicycles.
 6. If a pavement cut parallel to the travel lane exceeds 150 linear feet, the pavement for the entire lane width shall be milled or removed and overlaid.
- F. All street pavement patches shall meet the following conditions:
1. All excavations made in paved streets, sidewalks, or paths shall be completely restored within 15 calendar days of the pavement removal. In the event weather conditions preclude paving by permanent hot bituminous pavement or concrete, temporary repairs may be made by tamping and rolling into place cold mix asphalt.
 2. Pavement patch depth shall match the existing pavement depth or have a minimum depth of 4 inches, whichever is greater.
 3. Transverse joints on pavement patches shall be perpendicular to travel lane and shall be constructed using a transverse butt joint or tee patch detail.
 4. If the pavement patch is on a roadway which has been paved in the previous 36 months, then all patches shall be full lane width and shall be patched with infrared patching equipment. If a pavement patch exceeds 500 square feet, a "tee patch" detail may be used in place of an infrared patch.
 5. Joint lines and concrete control joints shall not be allowed in bicycle paths, unless joints are perpendicular to the direction of travel.
 6. The surface of the finished pavement shall be free from any depression exceeding three-sixteenths (3/16) inch in ten (10) feet as measured by a ten (10) foot straight edge measured in any direction or an automobile mounted recording profilometer. The pavement surface shall be flush with existing pavement and shall not be raised from existing pavement.
 7. Damaged pavement shall be repaired by appropriate methods as determined by the Town Engineer.
 8. Permit holder shall contract with a geotechnical engineering consultant to provide backfill density testing and pavement testing. Permit holder and tester shall confirm material testing meets Town specifications for compaction and pavement and submit all results to the Town.
- G. Utility work, potholing, and boring shall meet the following conditions:
1. Utility potholing shall be completed with non-destructive excavation methods.
 2. Utility potholes, geotechnical borings, and other subsurface exploration shall not be placed in wheel tracks of roadways, unless required to comply with SUE for a utility conflict point.
 3. Potholes and borings shall be backfilled with low strength flowable fill. Native material shall not be reused in the excavations.
 4. Pavement patching for potholes and borings shall meet the requirements above for pavement patches.
 5. Utility excavation, trenching, backfill, and compaction shall meet requirements of Chapters 5 and 8 of these Standards, the Town Standard Details, and private utility requirements.
 6. The minimum bury depth for any utility shall be 24 inches (measured from top of pavement/surface to top of utility).

5.7. The minimum trench width for any utility shall be 12 inches (measured at the narrowest section of trench).

6.8. Directional boring and drilling of utilities will be allowed with approval by Town Engineer. Directional boring requires a Right-of-Way Permit.

H. All work in the right-of-way shall meet the following additional conditions:

1. All disturbance in the right-of-way shall be repaired upon completion of work, including pavement, landscaping, utilities, irrigation, street lights, shouldering, signage, and striping.
 2. A financial guarantee (surety) shall be required for work within the right-of-way. The surety shall warranty and guarantee the right-of-way work for a period of two years after completion of improvements. See Chapter 8 for inspection requirements and see the Right-of-Way Permit application on the Town website for additional information on submittal and financial guarantee requirements.
- I. Additional requirements for coordinating construction activities within the public ROW are specified in the Right-of-Way Permit application, Chapters 8 and 9 of these Standards, and in the Town Code.

3.5 SNOW STORAGE

Snow storage areas shall be provided for all public rights-of-way. Snow storage areas shall be adequate to provide storage of average snowfalls from the months of November through April. Snow storage areas shall provide actual storage volumes of approximately 48 cubic feet per foot for each 12-foot lane of traffic. For a typical lane width, this equates to 9.6 square feet of snow storage required per linear foot of lane. Maximum snow storage height allowed will be 5 feet. Snow shall not be stored in locations that will limit sight distance at intersections in accordance with AASHTO design criteria. Consideration for extra snow storage areas at intersections and cul-de-sacs will be required. The Town Code provides additional guidance on internal site snow storage requirements.

Additional requirements for coordinating construction activities within the public ROW are specified in Title 11 Chapter 9 of the Town Code.

3.6 PERMANENT SURVEY MONUMENTS

Construction of infrastructure for all new subdivisions requires the installation of permanent survey monumentation. All external boundaries of all subdivisions, blocks, and lots shall be monumented with a permanent monument by a registered land surveyor in accordance with State of Colorado Revised Statutes. Any survey monuments established on dredge tailings by a land survey shall be solidly embedded in concrete per details approved by the Town Engineer and shall be in addition to the minimum standards for surveys set forth in the Colorado Revised Statutes. Additional requirements for the installation and documentation of survey monuments, as well as penalties for damaging survey monuments, are specified in the Town Code.

No point within the subdivision shall be more than one-half mile from a permanent survey monument. See the Town Code for additional spacing requirements. At least two survey control monuments or two corners or points on or near the perimeter of the subdivision traverse must be tied to, or monumented with, permanent survey monuments tied to the Town of Breckenridge survey network (currently under development). The location of permanent survey monuments showing ties to the network currently under development must be provided with the following:

1. Colorado State Plane Central Meridian
2. Delta Alpha and combined sea level and scale factor at the point or for the centroid of the parcel of the subdivided land

3. Vertical elevation in NAVD 88
4. Horizontal coordinates in NAD 83

Permanent survey monuments must be brass caps set in an acceptable base. Caps shall bear the registration number of the surveyor establishing the point and identifying letters or numbers approved by the Town Engineer. This information must be stamped permanently into the cap and must be shown on the final plat for which the survey is performed. Submittal requirements for permanent survey monuments are specified in Chapter 2.

3.7 RIGHT-OF-WAY WIDTHS

Minimum right-of-way widths for the various roadway classifications and sections are discussed in Chapter 5, Street Standards.

3.8 EASEMENTS

Easements shall be dedicated for all public utilities, roadways, drainage facilities, snow storage, sidewalks, shared use paths, trails, public retaining walls, public open space, and all other public improvements if they are not located within the public right-of-way. Easements shall be dedicated for the purpose of all activities associated with installing, operating, maintaining, repairing, and replacing the facility.

No new work or modifications within an easement may occur without approval granted through the Town development process. Trees and landscaping that might interfere with the operation or maintenance of, or access to, any facilities, either immediately after installation or in the future, shall not be located within an easement. Any landscaping or other improvements proposed in an easement shall be approved through a Town encroachment license. The Town is not liable for damage to any landscaping or other improvements located within the easement. No permanent structures shall be located within the easement.

Where easements are required during development, public easements shall be granted to the Town at no charge. Easements shall be granted through the subdivision plat process or other instrument acceptable to the Town Attorney.

The Town Engineer may require additional easements in addition to those listed in this section and may enforce additional requirements depending on the type of facility, location, and other factors specific to the improvements. The Town Engineer may require dedication of an easement during the Infrastructure Permit process.

Additional easement requirements are specified in Titles 9 through 12 of the Town Code.

3.8.1 Access Easements

Right-of-way shall be dedicated to the Town for all new roadways through the subdivision plat process. See Chapter 5 for minimum right-of-way widths for roadways. Where improvements are proposed to an existing roadway outside of the existing right-of-way, an easement is also required. Transit facilities, sidewalks, trails, and shared use paths shall be located within a public easement. Easement widths shall be sufficient to accommodate the facility, drainage, signage, and repair and maintenance of the

facility. The minimum width of the easement will be dependent on the facility and determined by the Town Engineer.

Access easements are required for private roads and driveways serving two or more adjoining lots. Access easements may also be required for fire and emergency access or for any other reason as determined by the Town Engineer.

Easements may be required which prohibit driveway or roadway accesses on the major road. Examples include roadway areas near curves, steep grades, limited sight distance, or other hazards.

3.8.2 Drainage Easements

Drainage easements shall be dedicated for all stormwater detention and permanent stormwater quality treatment facilities. Drainage easements are also required for all streams, channels, ditches, culverts, and storm sewers (if not in a general utility easement) conveying public drainage outside of right-of-way or conveying private drainage across two or more lots. The drainage easements shall be sufficient to allow for construction, operation, repair, and maintenance of the entire facility. The minimum drainage easement width shall be 20 feet.

While each property owner is required to maintain all facilities within the easements on his or her property, easements must be dedicated to allow the Town to maintain the facilities and invoice the owner for all costs incurred if the owner fails to complete the maintenance obligations. Chapter 6 includes maintenance requirements specific to permanent detention and water quality facilities.

3.8.3 Utility Easements

All public utilities not located within the public right-of-way shall be located within a public utility easement. Public utilities include, but are not limited to, water, sanitary sewer, storm sewer (if not in a drainage easement), electric, gas, and communication utilities. Easement widths shall be sufficient for the installation, operation, and maintenance of the utility. Easement width shall be dependent on type, number, and depth of utilities. The minimum utility easement width shall be 20 feet. Easements for shallow utilities may be reduced below 20 feet if installation, operations, and maintenance can be completed reasonably at a smaller width.

3.8.4 Snow Storage Easements

A minimum width of 10 feet shall be provided for snow storage along all roadways outside the shoulder. If the right-of-way does not provide adequate snow storage width, a snow storage easement shall be dedicated to meet the snow storage requirements of Section 3.5, or a 10' easement width, whichever is greater. Additional snow storage widths and easements may be required based on roadway classification, terrain, the presence or need for turnarounds, and roadway geometry. See Title 9 of the Town Code for internal site snow storage requirements. Easements shall be sized and located for reasonable access and use by snow removal equipment. No structures, trees, or other facilities that may impact the ability to store snow may be located within the snow storage easement.

CHAPTER 4 TRAFFIC IMPACT STUDIES

TABLE OF CONTENTS

4.1	PURPOSE	1
4.2	REFERENCE DOCUMENTS	1
4.2.1	Related Town Planning Documents	1
4.2.2	Traffic References	1
4.3	THRESHOLDS REQUIRING A TRAFFIC IMPACT STUDY	2
4.3.1	Study Not Required	2
4.3.2	Trip Generation Letter	2
4.3.3	Short-Term Traffic Impact Study.....	2
4.3.4	Long-Term Traffic Impact Study	3
4.4	TRAFFIC IMPACT STUDY REQUIREMENTS.....	3
4.4.1	Traffic Impact Study Submittals	3
4.4.2	Land Use Scenarios	3
4.4.2.1	Short-Term Traffic Impact Study.....	4
4.4.2.2	Long-Term Traffic Impact Study	4
4.4.3	Analysis Periods	4
4.4.4	Study Area.....	5
4.4.5	Multimodal	5
4.4.6	Impact Analysis	5
4.4.7	Existing Street and Access Analysis.....	6
4.4.7	Study Findings.....	6
4.4.8	Recommendations.....	6
4.4.9	Certification.....	7
4.5	TECHNICAL GUIDELINES.....	7
4.5.1	Data Collection	7
4.5.2	Trip Generation.....	8
4.5.3	Trip Distribution	9
4.5.4	Multimodal	9
4.5.5	Traffic Forecasts.....	11
4.5.6	Impact Analysis	11
4.5.7	Improvement Recommendations.....	12
4.5.8	Intersection Improvement Recommendations	12

LIST OF TABLES

Table 4.1. Monthly ADT Data Conversion Table	7
Table 4.2. Site Directness Ratio	10
Table 4.3. Bicycle Level of Traffic Stress (LTS)	10
Table 4.4. Bicycle LOS	11

LIST OF ATTACHMENTS - APPENDIX B

CHECKLIST 4 - TRAFFIC IMPACT STUDY

4.1 PURPOSE

The purpose of this document is to outline a standard format for preparing a Traffic Impact Study (TIS) in the Town of Breckenridge.

A Traffic Impact Study assesses the effects of a proposed development on the Town's transportation system. The study identifies if the transportation system can operate efficiently with the development, if there are existing conditions that need to be improved, or if improvements are required to mitigate site impacts.

The owner/developer of a project site is responsible for contracting a traffic consultant to assess project traffic impacts and for providing any necessary mitigation measures as part of the development, when required by Section 4.3 of these Standards.

The requirements listed in this document are applicable for all developments in the Town of Breckenridge. In addition to the requirements of this document, owners/developers with sites having access to or within the influence area of a State Highway (for example SH 9) must contact the Colorado Department of Transportation (CDOT) for specific requirements related to access permits, construction permits, or work in the CDOT right-of-way.

Development and installation of pedestrian systems which integrate with existing and future Town pedestrian systems and with the systems of adjacent developments is required. This will include the provision of sidewalks, where required, and the provision of pedestrian walkways pursuant to the Town trails plan.

It is the policy of the Town to require bicycle and pedestrian paths to be dedicated to the Town as a component of the town's alternative transportation network and to provide recreational opportunities. Subdivision proposals shall include, as a component of the required public improvements, a pedestrian and bicycle path system designed to preserve existing paths, integrate with existing improvements, and provide service appropriate to the character and magnitude of the proposed development.

The inclusion of or the contribution to a permanent nonauto transit system, designed to facilitate the movement of persons to and from Breckenridge or within the Town, is strongly encouraged. Nonauto transit system elements in the Town of Breckenridge include, but are not limited to, buses and bus stops, transit shelters, both public and private, gondola lifts, ski lifts, surface lifts, trams, bicycles, electric bicycles, and other alternative transit systems that have the primary purpose of providing access from high density residential areas or major parking lots of the Town to other destinations of the Town. Any development which interferes with the community's ability to provide nonauto oriented transportation elements is discouraged.

4.2 REFERENCE DOCUMENTS

Any new infrastructure or modifications to existing infrastructure and any new development plans shall be in accordance with the most current adopted version of the Town's Related Planning Documents. Traffic references used in the traffic impact study shall be the most current version available, unless otherwise authorized by the Town Engineer.

4.2.1 Related Town Planning Documents

See Chapter 1, Section 1.1 of these Standards.

4.2.2 Traffic References

1. ITE Trip Generation Manual, 10th Edition, Institute of Transportation Engineers, 2017
2. ITE Trip Generation Handbook, 3rd Edition, Institute of Transportation Engineers, 2017

3. Highway Capacity Manual, 6th Edition: A Guide for Multimodal Mobility Analysis, Transportation Research Board, 2016
4. State Highway Access Code, State of Colorado, March 2002
5. Manual on Uniform Traffic Control Devices, 2009 with Revisions 1 and 2, Federal Highway Administration, May 2012

4.3 THRESHOLDS REQUIRING A TRAFFIC IMPACT STUDY

A Traffic Impact Study may be required as part of the submittal documents for annexation, development plan, final development plan, rezoning, plat, reuse/remodel, or other development application. To determine whether a Traffic Impact Study is required, as well as the category of study, the applicant must first estimate the number of peak hour trip ends generated by the development. A vehicle that stops at a gas station, for example, results in two trip ends at the development: one entering trip and one exiting trip.

A Traffic Impact Study is required for any development, redevelopment, reuse, or remodel that increases peak hour traffic by more than 10 trips. Developments increasing commercial gross floor area by 1,000 square feet or the number of residential/lodging units by 10 may exceed this trip threshold. A Traffic Impact Study is also required where any of the following conditions exist:

1. The site increases peak hour traffic volume by more than 20% at a point of State Highway access
2. The site is part of a larger development
3. Site-specific traffic issues require evaluation, as so determined by the Town Engineer
4. Project study area includes an intersection with planned improvements such as:
 - a. South Park Ave/Main Street
 - b. Park Ave/Village Road
 - c. Park Ave/French Street
 - d. Park Ave/Airport Road
 - e. SH 9/CR 450
 - f. SH 9/Ridge Street

4.3.1 Study Not Required

A site expected to generate 10 or fewer trips per hour. Typical examples include single-family developments with fewer than 10 homes, a 5,000 square foot office, or a 2,000 square foot retail establishment (not including gas stations, restaurants, or the like).

4.3.2 Trip Generation Letter

A site expected to generate more than 10 and less than 25 trips per hour. Typical examples include single-family developments with fewer than 20 homes, an office of less than 6,000 square feet, or a retail establishment of less than 5,000 square feet (not including gas stations, restaurants, convenience stores, auto washes, or other services expected to generate more than 10 trips per hour).

In areas that have not been recently studied or located in an area with planned road improvements or identified potential lane additions, a Short-Term Traffic Study may be required.

4.3.3 Short-Term Traffic Impact Study

A site generating between 25 and 50 trips in the peak hour. The site will typically be developed in a single construction phase with anticipated completion in less than three years from the time of development plan approval. Short-term traffic studies shall be required to evaluate traffic conditions at year-of-opening, and 5 years post-development. Typical examples include single-family developments of approximately 30 homes, an office or retail establishment of 10,000 square feet.

4.3.4 Long-Term Traffic Impact Study

Development sites generating over 50 trips in the peak hour or sites that are developed in more than one phase. For phased development, a master traffic study will be prepared prior to the first phase of development and a build-out period not longer than 20 years should be assumed. All subsequent phases will need to prepare a trip generation letter comparing the proposed development with the development type and density projected for the site in the master study. The letter may need to include additional analysis if there is a significant difference between the original development concept and the newly proposed development.

In addition to meeting all the requirements for a short-term traffic study, a long-term traffic study shall evaluate traffic conditions 20-years post-development.

Typical examples include single-family developments with over 50 homes and an office or a retail establishment greater than 12,000 square feet.

The Town Engineer may require long-term traffic studies for developments smaller than the thresholds listed above, depending on the size, location, and type of development.

4.4 TRAFFIC IMPACT STUDY REQUIREMENTS

When a Traffic Impact Study is required it shall be included with the development application. Studies will not be accepted prior to development application. After the Town's initial review of the draft study, the traffic professional shall address Town comments and submit a final study for Town approval. The final Traffic Impact Study shall include the PE's stamp, date, and signature. The final Traffic Impact Study must be approved by the Town Engineer prior to Issuance of an infrastructure or building permit.

If the development application includes a proposal for an uncontrolled or mid-block pedestrian crossing, the traffic study shall include a pedestrian traffic analysis as described in Section 5.14.

Submit one PDF electronic copy of all final traffic impact studies to the Engineering Division.

For sites with access to or within the influence area of state highways, the applicant is also required to contact CDOT for requirements and to get approval for the project from CDOT.

<https://www.codot.gov/business/permits/accesspermits/regional-offices.html#Region2-3>

4.4.1 Traffic Impact Study Submittals

A checklist is provided in Chapter 2 of these Standards that delineates the requirements of the Traffic Impact Study. Not all study elements will be required for every traffic impact study. Content must be specific to the situation and determined based on professional engineering judgment. Where content is specific to a traffic impact study type, that is identified in the checklist.

4.4.2 Land Use Scenarios

Required land use scenarios for the short- and long-term traffic impact studies are summarized in the following:

4.4.2.1 *Short-Term Traffic Impact Study*

Year of Opening w/o Development: This scenario represents area land use as it presently exists. The purpose of this scenario is to identify existing deficiencies and to provide a baseline for comparison with the scenario that includes development.

Year-of-Opening w/Development: This scenario represents area land use as it is projected to exist upon year-of-opening of the development, plus the inclusion of the development. The purpose of this scenario is to identify traffic conditions as they are anticipated to exist with the development.

5-Year Horizon w/o Development: This scenario represents area land use as it is projected to exist at the study's horizon year (5 years), without the development. The purpose of this scenario is to identify anticipated transportation deficiencies and to provide a baseline for comparison with the scenario that includes development.

5-Year Horizon w/Development: This scenario represents area land use as it is projected to exist at the study's horizon year (5 years after year of opening) plus the inclusion of the development. The purpose of this scenario is to identify traffic conditions as they are anticipated to exist with the development upon full-build out.

4.4.2.2 *Long-Term Traffic Impact Study*

Year of Opening w/o Development: This scenario represents area land use as it presently exists. The purpose of this scenario is to identify existing deficiencies and to provide a baseline for comparison with the scenario that includes development.

Year-of-Opening w/Development: This scenario represents area land use as it is projected to exist upon year-of-opening of the development, plus the inclusion of the development. Only the parts of development expected to be complete upon opening year shall be included in the analysis. The purpose of this scenario is to identify traffic conditions as they are anticipated to exist upon the opening of the development.

5-Year and 20-Year Horizon w/o Development: These scenarios represent area land use as it is projected to exist 5 and 20 years after the opening year of the development if the development were not built. The purpose of these scenarios is to identify anticipated transportation deficiencies expected to occur regardless of the development, and to provide a baseline for comparison with the scenarios that include the development.

5-Year and 20-Year Horizon w/Development: These scenarios represent area land use as it is projected to exist 5 and 20 years after the opening of the development. The 5-year scenario will include the parts of the development expected to be complete 5 years after of year of opening, while the 20-year scenario will include the parts of the development expected to be completed 20 years after year of opening (typically this represents full build-out). These scenarios will be compared to the 5-year and 20-year horizon without development scenarios to assess the effects that the development will have on the traffic conditions.

4.4.3 **Analysis Periods**

Conceptually, the design hourly volume for transportation systems is based upon the 30th highest hour of the year. In other words, the traffic volumes used in the study should be sufficiently conservative to ensure that most of the time actual traffic conditions are anticipated to be less than those described in the traffic study. For this reason, traffic data taken off-peak must be factored to peak conditions as described in Section 4.5.1.

With respect to times-of-day, the most important time periods to analyze in the Town of Breckenridge are the weekday PM Peak hour, Saturday AM Peak Hour, and Saturday PM Peak Hour.

In addition to the peak hour, an analysis period should be completed for approximately the median hour in Breckenridge (the hour represent the average traffic volume on a non-peak hour). When comparing traffic conditions and proposed improvements, the peak hour and median hour shall be analyzed for LOS, safety, and other factors. One traffic solution may provide benefits at the peak hour, while a different solution provides benefits at the median hour, resulting in an analysis to compare the benefits and which solution is more favorable when considering all traffic conditions.

4.4.4 Study Area

The study area should include all intersections and access points that may experience a change in traffic operations due to the project. This typically includes all site access points, adjacent local intersections, and the nearest highway intersection(s) used by the generated trips to go to/from the site. If the generated trips are projected to increase a turning movement at a more distant intersection enough to potentially effect overall intersection operations, that intersection shall be analyzed as well.

4.4.5 Multimodal

The traffic study should consider not only potential impacts for motorized traffic, but also whether there are impacts to existing nonauto modes including pedestrian, bicycle, and transit. This section of the report should identify the potential for the project to generate nonauto traffic and to evaluate whether nonauto traffic can be accommodated by the existing environment.

In the multimodal analysis, the study should describe how the site provides opportunities for pedestrians, bicycles, and transit, and also include demand management strategies when relevant. The extent and type of existing and planned infrastructure required for multimodal connectivity to the site, such as sidewalks, trails, transit stops/routes, and alternative modes of transportation, should also be described. The multimodal Level of Service (LOS) for the site should be calculated as described in Section 4.5.4. Where multimodal LOS is not acceptable, the study should recommend on or off-site improvements that can be made to improve LOS. Off-site mitigation shall be consistent with street standards and planning documents referenced in Section 4.2.1.

4.4.6 Impact Analysis

This portion of the study evaluates the impacts that the traffic generated by the project will have on the community. In accordance with Town policy, developments which will generate a volume of vehicular trips which exceed or disproportionately consume the capacity of the external circulation system may have conditions imposed which address the need to provide sufficient traffic carrying capacity to meet this excess demand. This may include a requirement to either provide the necessary improvements at time of development or at some later date, including participating in Improvement Districts, if applicable.

Where the LOS falls below acceptable levels, mitigation will be required. Acceptable mitigation measures may include capacity and access improvements, signalization, signal operation improvements, street widening, additional connections, or other physical improvements. Where existing conditions prevent physical improvements (i.e., steep terrain, adjacent buildings, limited right-of-way, etc.), a project may be required to reduce density, implement transportation demand management (TDM) measures to minimize the demand for vehicle trips and encourage alternate mode use, and/or provide cash-in-lieu of the improvement as described in Section 4.5.7. The TDM strategies may include incentives for carpooling, transit ridership, enhanced bicycle or pedestrian facilities, provisions for telecommuting, or addition of use mixes to increase internal trips.

In addition to evaluating transportation facilities external to the development, the Traffic Impact Study shall include a discussion of the adequacy of the site accesses to accommodate projected site traffic. This may include but not be limited to a review of vehicle turning paths, stacking distances, and the design layout's ability to control speeds and provide safe and efficient circulation.

4.4.7 Existing Street and Access Analysis

This portion of the study shall evaluate the condition and configuration of the existing street providing access to the development. This section shall analyze the street access for all requirements of Chapter 5 of these standards. These requirements shall include, but are not limited to, intersection geometry, sight distance, roadway horizontal and vertical geometry, street widths, street classifications, adjacent access spacing, roadway drainage, vehicle & pedestrian lighting, signage, pedestrian route, transit access, acceleration lanes, deceleration lanes, and clear zone widths.

The Town Engineer may require improvements to existing streets, due to development impacts to the streets, increased demand on existing improvements, or existing streets serving new developments not meeting current standards. Improvements may include, but are not limited to, intersection improvements, sight distance improvements, street widening, adjustments to horizontal and vertical street geometry, drainage improvements, vehicle and pedestrian lighting, signage, pedestrian routes, acceleration lanes, deceleration lanes, clear zone widening, shoulder improvements, and transit improvements.

Existing streets providing access to a new development must be upgraded to current standards if both of the following conditions are met:

1. The existing street does not meet current Town of Breckenridge Engineering Standards.
2. The proposed development will increase the Average Daily Traffic (ADT) of the street by 25% or more.
3. Or as directed by the Town Engineer.

Existing streets must also be upgraded to current standards if a development changes the street classification. An example would be a development increasing the volume of a roadway from a local street to a collector.

4.4.7 Study Findings

This portion of the study provides an overview of the conclusions reached based upon the data and analysis performed and the professional engineering judgment of the author. It includes a factual restatement of the study's primary findings, including summaries of:

1. Development characteristics, including type and density of land use, hours of operation (if known), means of vehicular access, plan for implementation, and any other relevant data or information
2. Existing traffic conditions at study area intersections for each analysis period, including identified LOS, safety, or other operational deficiencies (auto as well as nonauto)
3. Development traffic generation, for peak hours as well as over an average weekday and weekend day for each development phase
4. Traffic impacts of the development, including identification of locations requiring mitigation to address existing or proposed LOS, safety, or other operational deficiencies
5. Extent to which study recommendations address development traffic impacts and existing or proposed deficiencies

4.4.8 Recommendations

Include a list of any improvements needed or proposed, noting who will construct and fund the improvements. Identify if right-of-way is available or is needed to construct the improvements.

Clearly identify study recommendations, including:

1. Proposed mitigation to address identified impacts
2. Other mitigation as identified
3. Improvements needed but not proposed by development

4.4.9 Certification

A short-term or long-term Traffic Impact Study shall be prepared under the responsible charge of a traffic engineer. A trip generation letter may be prepared under the responsible charge of any engineer familiar with procedures for using the *Trip Generation Manual* published by the Institute of Transportation Engineers. All traffic studies and letters shall be sealed and signed by a professional engineer licensed in the state of Colorado.

4.5 TECHNICAL GUIDELINES

4.5.1 Data Collection

The Town Engineer shall be notified at least five (5) calendar days in advance of the proposed locations, days of week and times of day that data will be collected. A Town Right-of-Way Permit shall be obtained prior to placing tubes, cameras, or any other equipment or materials in the right-of-way. Town staff will inform the applicant of any activities that may render the counts invalid such as school holidays, road work, local festivals, or other reasons, in order that the applicant may come up with an alternative plan. Tube counts are not permitted between Labor Day and Memorial Day and may otherwise only occur with prior approval of the Town Engineer.

New traffic counts shall be taken in locations where existing traffic counts are missing or over two years old. Intersection turning movement counts (a record of all vehicle movements including U-turns, left-turns, through movements, and right-turns) should capture the time periods expected to have the highest volumes, typically the weekday PM peak (4-6 PM), and the Saturday AM (8-10 AM) and PM (3-5 PM) peaks. If the changes proposed by the traffic study will have the greatest impact on traffic operations during a time period other than the typical peaks, or the highest overall network volume is expected to occur in a different time period, additional turning movement counts shall be collected during those periods. Turning movement counts shall include pedestrians and bicyclists.

Traffic volumes in Breckenridge are highly seasonal, with the winter and summer months traditionally having the highest volumes. Traffic counts shall be factored to reflect conditions typical to the month of January using the Town's ADT conversion table. This table was developed using CDOT Count Station Data for CO-9. To account for changing traffic patterns throughout the year, a separate factor shall be used for each time period (e.g., traffic counts taken during the AM and PM time periods on a Saturday in May would be multiplied by 2.37 and 2.04, respectively, to reflect volumes typically seen in January). Several types of developments, such as schools or athletic fields, often see peak volumes outside the network peak hours. If, for example, a school is being analyzed, the traffic counts shall be conducted during the school's arrival and dismissal time. If a traffic count is taken outside of one of the specific time periods shown in the table below, the counts shall be multiplied by the monthly average shown in the chart below. Continuing with the example of a school, a count taken between 2:00 and 3:00 PM on a weekday in April would be multiplied by 1.34 to approximate that same time period during a peak season (January) school day.

Table 4.1. Monthly ADT Data Conversion Table

Month	Saturday AM	Saturday PM	Weekday PM	Monthly Average
January	1.00	1.00	1.00	1.00
February	1.00	1.00	1.00	1.01

March	1.13	1.14	0.95	1.02
April	1.64	1.67	1.26	1.34
May	2.10	1.98	1.32	1.45
June	1.61	1.48	1.08	1.14
July	1.32	1.20	0.95	0.96
August	1.37	1.18	0.95	0.99
September	1.53	1.23	1.02	1.07
October	2.04	1.59	1.14	1.30
November	1.57	1.49	1.18	1.28
December	1.27	1.13	1.01	1.06

Per Highway Capacity Manual (HCM) recommendations, a peak hour shall be modeled for each time period analyzed. For studies containing multiple intersections, a system peak hour shall be selected when an intersection affects operations at adjacent intersections (e.g., coordinated signals, travel times runs, microsimulations). Individual peak hours should be used in networks where intersection operations have minimal effects on the operations of nearby intersections (e.g., stop-controlled intersections, non-coordinated signals, roundabouts). The selected peak hour should represent the hour with the worst traffic operations for the study area, typically the hour with the highest total traffic volume. If the primary focus of the traffic study is to analyze side street operations, or a critical movement whose peak may not coincide with the intersection peak (e.g., school, event hall), the selected peak hour should be based on that movement(s) highest volume, rather highest overall volume. A separate peak hour factor (PHF) shall be used for each intersection approach when possible. If the PHF is not available, a default of 0.92 shall be used. Section 4-3 of the HCM 6th Edition should be referenced for further clarification of the peak hour factor.

4.5.2 Trip Generation

Trip generation shall be calculated using the most recent version of the Institute of Transportation Engineers (ITE) Trip Generation Manual. Parts of the procedure discussed in this section cannot be completed with a ITE Trip Generation Manual older than the 10th Edition. For developments within downtown Breckenridge, the “dense multi-use urban” setting/location should be used, and for developments in more isolated locations, the “urban/suburban” setting/location should be used. If a land use option does not have a setting/location option, the default shall be used. The trip rate equation shall be used when provided, otherwise, the flat rate shall be used. The trip generation summary shall include weekday AM and PM data, as well as data for the Saturday peak period. If the exact land use of a development is not included in the ITE Trip Generation Manual, a comparable land use should be used. If the ITE Trip Generation Manual does not contain a comparable land use, other sources may be used, such as previous traffic studies or traffic counts at a similar development.

Capture trips are trips that visit multiple land uses in the same development during the same outing. In locations where this is a frequent occurrence, the number of capture trips shall be calculated and incorporated into the trip generation calculations to avoid double counting trips. Engineering judgment shall be used to determine whether a development will have capture trips (e.g. hotel & restaurant), or whether each land use will generate its own trips independently (e.g. office building & movie theatre). A spreadsheet tool which performs many of the required capture trip calculations can be downloaded in the Trip and Parking Generation section of the ITE website. Some of the land uses in the ITE Trip Generation Manual already account for capture trips, such as shopping centers or office parks with retail. In the cases where the land use from the Trip Generation Manual is mixed use, it is not necessary to calculate the number of capture trips.

Pass-by trips are defined as vehicles that stop at a development on the way to their destination without changing their originally planned route. Gas stations are an example of land uses with high

percentages of pass-by trips. While pass-by trips are added to the volume entering and exiting a site, they are not to be added to the traffic volume along the adjacent road, as they would have been traveling on that road anyway. If a development is expected to attract a high percentage of pass-by trips, a reduction factor should be applied to the generated trips on the adjacent roads. The reduction can be found in Chapter 10 of the ITE Trip Generation Handbook.

4.5.3 Trip Distribution

The distribution of site generated trips shall be based on existing turning movement data or link volumes on the adjacent roadways. In cases where trip distribution is expected to differ from the existing trip distribution through the network (e.g. if a school is located on the edge of the school zone, trips to and from the school will not follow the same directional patterns as network traffic), engineering judgment is to be used. If the trip generation calculations incorporate captured trips or pass-by trips, these assumptions shall be reflected in the trip distribution.

4.5.4 Multimodal

When evaluating operations at a signal with pedestrian crossings, the crossing times shall be compliant with the pedestrian clearance interval requirements outlined in the *Manual on Uniform Traffic Control Devices* (MUTCD). In a coordinated signal network, if there are two or more pedestrian crossings on one leg in an hour, the signal timings should be such that a pedestrian crossing will not force the signal out of coordination.

If the location of a development offers multimodal options of transportation (e.g., bus routes, bike paths/sidewalks, etc.), a portion of the trips generated from the site will likely use multimodal forms of transportation, thus reducing the number of vehicle trips generated. Selecting the appropriate setting/location in the ITE Trip Generation Manual (e.g., general urban/suburban, dense multi-use urban, center city core) will account for this. If a development is planned in an area with easy access to multimodal transportation, and the projected number of generated trips came from outside the ITE Trip Generation Manual without a multimodal factor, a multimodal reduction rate shall be used. These rates can be found in ITE Trip Generation Manual and reduce the number of vehicle trips by a factor that is specific to the location and the development, as some types of developments are more likely than others to generate multimodal trips. Prior to using the multimodal reduction rates, engineering judgment should be used to determine whether a development is in a location, and is the type of development, to generate multimodal trips. The use of a vehicle reduction rate shall be documented.

To fully account for the multimodal function of the transportation system, LOS beyond those calculations described in the *Highway Capacity Manual* shall be considered along development sites and for transportation facilities. New development shall have a minimum multimodal LOS C. LOS D – F shall not be acceptable. While LOS ~~D-C~~ is acceptable for multimodal LOS, site development should target the best LOS achievable. The site pedestrian and transit LOS shall be evaluated using a directness ratio, as follows:

$$D = (W + U)/C \quad (4.1)$$

Where:

- D = the site's directness ratio
- W = the total walking distance along a trail, public street, or sidewalk from the site's entrance or furthest building to the destination
- U = the distance along the walking route not designed for pedestrians. This includes areas where the pedestrian must walk in the street or shoulder, along unpaved or rough paths, paths less than 4 feet wide, and unmarked crossings of vehicular travel ways
- C = the straight-line distance from the site's entrance or furthest building to the destination

The directness ratio for residential or lodging sites will be measured to the nearest public school, park, or restaurant. For all other uses, the directness ratio will be measured to the nearest public multi-use trail or sidewalk. The directness ratio for Transit LOS will be measured to the nearest transit stop. The resulting LOS from the site directness ratio calculation is shown below. LOS is F where the walking distance exceeds ½ mile, regardless of the site directness ratio.

Table 4.2. Site Directness Ratio

Pedestrian and Transit Level of Service	Site Directness Ratio
A	≤ 1.2
B	$>1.2 - 1.4$
C	$>1.4 - 1.6$
D	$>1.6 - 1.8$
E	$>1.8 - 2.0$
F	>2.0 or walking distance greater than ½ mile

Bicycle LOS shall be evaluated by evaluating the Level of Traffic Stress (LTS) for each street or trail running along and internal to the site. LTS for each facility is rated from 1 to 5, with 1 meaning that there is low stress for cyclists and 5 meaning that it is a high stress environment. The road characteristics for each LTS is shown in the table below:

Table 4.3. Bicycle Level of Traffic Stress (LTS)

Level of Traffic Stress	Shared Lanes	Bike Lanes	Trails
1	2 lanes <2k ADT ≤ 25 mph	2-3 lanes ≤ 25 mph	Greenway
2	2 lanes 2-4k ADT ≤ 30 mph	2-3 lanes ≤ 30 mph	Sidepath (low ped volume)
3	2 lanes 4-6k ADT ≤ 35 mph	3-4 lanes ≤ 35 mph	Sidepath (high ped volume)
4	≥ 3 lanes > 6k ADT > 35 mph	> 4 lanes > 35 mph	
5	≥ 4 lanes > 6k ADT > 40 mph	> 4 lanes > 40 mph Bike lane < 4 ft	

Once LTS has been evaluated, the LOS will be determined by the length weighted average of the facilities along the site. For example, assume a particular site has a roadway bordering it on two sides. One of the roadways fronts 150-ft of the site and is a two-lane local road with 25 MPH speed limit and an Average Daily Traffic (ADT) of 1,500 vehicles per day. The other road fronts 100-ft of the site and is a four-lane collector with bike lanes and a posted speed of 30 MPH. The length weighted average LTS is:

$$[(150\text{-ft} \times 1) + (100\text{-ft} \times 3)] / (150\text{-ft} + 100\text{-ft}) = 1.8.$$

From Table 4.4 the bicycle LOS is C.

Table 4.4. Bicycle LOS

Bicycle Level of Service	Site Bicycle Level of Traffic Stress
A	1.0
B	>1.0 – 1.5
C	>1.5 – 2.0
D	>2.0 – 2.5
E	>2.5 – 3.0
F	>3.0

4.5.5 Traffic Forecasts

CDOT's Online Transportation Information System (OTIS) count stations shall be used when forecasting the background growth for state highways.

<https://dtdapps.coloradodot.info/otis>

The ITE Trip Generation Manual shall be used to calculate the number of generated trips, which will be added to the background growth. When projecting background growth on Town roads, if the road is a through street, the OTIS growth rate for SH 9 may be used. If the road is not a through street, background traffic growth should be based on the trip generation potential for any undeveloped land or known planned development along the local road in addition to the OTIS growth rate for SH 9. For the purposes of this section, "through" streets connect to other roadways and therefore may experience traffic volumes that originate from outside the street in question. If no development (or redevelopment) is expected along a local road, the background growth may be assumed to be zero.

4.5.6 Impact Analysis

Traffic analyses shall be conducted in accordance with procedures outlined in the Highway Capacity Manual, with the Level of Service (LOS) being the primary metric for evaluating intersection operations. LOS is a measure of the quality of traffic flow and ranges from LOS A (nearly ideal traffic conditions with very little delay for motorists) to LOS F (poor traffic conditions with long motorist delays). LOS C is typically considered a "good" traffic condition. LOS D or better conditions are typically desirable during peak traffic periods. A LOS of E or F during peak traffic periods is unacceptable for overall intersections; however, LOS E and F conditions are not uncommon for side street traffic movements at full movement, unsignalized intersections with high volume arterial roadways. In situations where a side street movement operates at LOS E or F, the volume to capacity (V/C) ratio shall be reported as well. If the side street is nearing or at capacity, mitigation measures shall be identified. The Town Engineer may require improvements to any street or intersection projected to operate at a LOS E or F, regardless of whether the movement is a side street. Additionally, the Town Engineer may require mitigation to any drop in LOS (e.g., a reduction from LOS A to LOS C).

A minimum of two future scenarios shall be modeled when assessing the impacts that a development or proposed roadway changes will have on traffic operations. A "w/o Development" scenario, analyzing traffic conditions without the changes proposed by the traffic study, will be compared to the "w/Development" scenario for the same year, analyzing traffic conditions with the proposed changes. If an intersection is expected to operate acceptably for the "w/o Development" scenario, but unacceptably for the "w/Development" scenario (e.g., a signalized intersection or roundabout operating at LOS E or F, or a stop-controlled intersection operating at LOS E or F as well as being near or at capacity), it is the responsibility of the developer to implement intersection improvements in order to ensure acceptable traffic operations at the intersections.

Short-term traffic studies shall be required to evaluate traffic conditions at year-of-opening and 5-years post-development. Long-term traffic studies shall evaluate traffic conditions at year-of-opening, 5-years post-development, and 20-years post-development. In addition, long-term traffic studies that include phased development shall evaluate traffic conditions at completion of each interim phase.

If an unsignalized intersection has high side street volumes, resulting in poor operational conditions, a signal warrant study shall be conducted in a manner consistent with procedures outlined in the MUTCD.

The need for auxiliary lanes on state highways shall be assessed in accordance with the State Highway Access Code requirements. Turning movements that meet the State Highway Access Code standards are required to have an auxiliary lane. If a movement does not meet the required volume, an auxiliary lane may still be installed, if deemed helpful to safety or traffic operations. On local roads, auxiliary lanes shall be installed in locations where they will provide a benefit to traffic operations or safety.

4.5.7 Improvement Recommendations

If the Town Engineer determines that the installation of a needed improvement is not feasible, a cash contribution determined based upon the magnitude of the development's impacts and the capital cost of the needed improvement shall be assessed. Feasibility shall be determined based on physical, schedule, and financial constraints, as well as consideration for other projects and proposed future improvements. The cash contribution shall be in lieu of the improvement and/or land dedications and in proportion to the impacts attributable to the development. A development's proportional share shall be determined by the percent of total trips triggering the need for an improvement that are made up of site generated trips (e.g., if there is a left turning movement of 14 vehicles per hour, warranting a left turn lane, and 7 of those trips are generated from the development, the developments share of the cost will be 50%). The higher percentage between the AM and PM peak hours will be used to determine the developments required contribution. A development's contribution towards a traffic signal will be determined by the percent of the total trips on the higher volume side street made up of development generated trips. If there is a free right turn lane, it may be excluded from the calculations. The higher percentage between the AM and PM peak hours will be used to determine the contribution.

Cash contributions shall be held by the town solely for the acquisition and improvement of transportation mobility (nonauto as well as auto) alternatives within the community. Because of the small size of the community, the provision of transportation mobility improvements anywhere within the Breckenridge Comprehensive Plan boundary shall be deemed to meet the needs of the proposed project.

4.5.8 Intersection Improvement Recommendations

If an intersection is forecasted to operate unacceptably and intersection improvements are required, the Town has a strong preference for the installation of roundabouts, mini-roundabouts, or other geometric treatments. If intersection improvements are required at an intersection identified in the 2017 Park Ave SH 9 Roundabout Modeling and Construction Feasibility Study, then the Developer will be required to construct improvements per the recommendations of that study.

Studies conducted by the Town and other agencies have identified many benefits of roundabouts, including:

- Roundabouts reduced injury crashes by 75 percent at intersections where stop signs or signals were previously used for traffic control (IIHS Study).
- Typical signalized intersections have 32 vehicle-to-vehicle conflict points and 24 vehicle-to-pedestrian conflict points. Typical roundabouts only have 8 vehicle-to-vehicle conflict points and 8 vehicle-to-pedestrian conflict points.

- Roundabouts are designed with geometric curves which force vehicles to reduce speeds through the intersection. At traffic signals, vehicles may speed up to “beat the light”, resulting in higher speeds and the potential for more serious collisions.
- Roundabouts often operate at a comparable or better level of service when compared to signalized or stop controlled intersections. Even at high traffic volumes, roundabouts permit traffic to continue moving instead of creating long stops and standing queues, as may be seen at signalized intersections.
- Roundabouts result in economic benefits for the Town, resulting in approximately \$10,000 of savings in maintenance and electrical costs when compared to a signalized intersection. Additionally, roundabouts do not suffer issues from power outages or malfunctioning due to weather.
- In many cases, roundabouts provide environmental and sustainability benefits by reducing stop and go conditions when compared to traffic signals and stop signs, resulting in less fuel consumption, vehicle wear, and improved air quality.
- Roundabouts provide aesthetic benefits by providing increased landscaped areas in intersections and providing a more natural aesthetic than traffic signals, helping to preserve and maintain the historic character of Breckenridge.

CHAPTER 5 STREET STANDARDS

TABLE OF CONTENTS

5.1	INTRODUCTION	1
5.2	OTHER STANDARDS	1
5.3	GENERAL DESIGN GUIDELINES	1
5.4	STREET CLASSIFICATION	2
5.4.1	Arterial	2
5.4.2	Major Collector	2
5.4.3	Minor Collector	3
5.4.4	Local	3
5.5	DESIGN CONTROLS	3
5.5.1	Design Vehicles	3
5.5.2	Design Speed	4
5.5.3	Right-of-Way Widths	4
5.5.4	Traffic Considerations	4
5.5.5	Capacity Considerations	5
5.6	DESIGN ELEMENTS	5
5.6.1	Sight Distance	5
5.6.1.1	Stopping Sight Distance	5
5.6.1.2	Sight Distance Measurement Criteria	6
5.6.1.2.1	Height of Driver's Eye	6
5.6.1.2.2	Height of Object	6
5.6.1.3	Sight Distance on Horizontal Curves	6
5.6.1.4	Sight Distance on Vertical Curves	7
5.6.1.5	Intersection Sight Distance	7
5.6.1.5.1	Sight Triangles	8
5.6.1.5.2	Approach Sight Triangles (Uncontrolled or Yield-Controlled Intersection)	8
5.6.1.5.3	Departure Sight Triangles (Stop Controlled Intersection)	8
5.6.1.5.4	Identification of Sight Obstructions within Sight Triangles	9
5.6.2	Horizontal Alignment	9
5.6.2.1	Traffic Calming	9
5.6.2.2	Horizontal Curves	10
5.6.2.3	Superelevation	10
5.6.3	Vertical Alignment	11

5.6.3.1	Terrain	11
5.6.3.2	Grades	11
5.6.3.3	Vertical Curves	11
5.6.3.4	Vertical Clearance to Obstructions	12
5.6.4	Cross Section Elements	12
5.6.4.1	Traveled Way	12
5.6.4.1.1	Cross Slope	12
5.6.4.1.2	Lane Widths	12
5.6.4.2	Shoulders	12
5.6.4.3	Roadside Design	13
5.6.4.3.1	Cut and Fill Slopes	13
5.6.4.3.2	Roadside Ditches	13
5.6.4.3.3	Clear Zone	13
5.6.4.3.4	Obstructions	13
5.6.4.3.5	Roadside Barriers	13
5.6.4.3.6	Retaining Walls	14
5.6.4.4	Curbs	15
5.6.4.5	Medians	15
5.7	INTERSECTIONS	15
5.7.1	Alignment and Profile	15
5.7.2	Corner Radii	16
5.7.3	Functional Intersection Area	16
5.7.4	Channelization	17
5.7.4.1	Islands	17
5.7.4.2	Medians	17
5.7.5	Auxiliary Lanes	17
5.7.5.1	Deceleration Lanes	17
5.7.5.1.1	Storage Length	18
5.7.5.1.2	Tapers	18
5.7.5.2	Acceleration Lanes	18
5.7.5.3	Two-way Left Turn Lanes	19
5.8	DEAD END STREETS (CUL-DE-SACS)	19
5.9	BRIDGES	19
5.10	ACCESS CONTROL AND MANAGEMENT	19
5.10.1	Private Access	19
5.10.1.1	Commercial	20

5.10.1.2 Residential	20
5.10.2 Access Management Principles	20
5.10.3 Access Changes	20
5.10.3.1 Number of Accesses	20
5.10.3.2 Location	20
5.10.4 Access Management Techniques	21
5.10.5 Sight Distance	21
5.10.6 Access Spacing	22
5.10.7 Access Width	22
5.10.8 Access Type	23
5.10.8.1 Curb Cut Driveway	23
5.10.8.2 Radius Driveway	23
5.10.9 Access Design Details	23
5.10.9.1 Access Profile	23
5.10.9.2 Access Geometry	23
5.10.9.3 Access Surfacing	24
5.11 PARKING AREAS (ON-STREET PARKING WITHIN RIGHT-OF-WAY)	24
5.11.1 On-street Parking	24
5.11.2 Parking Area Surfacing	25
5.11.3 Parking Grades	25
5.11.4 Parking Stall Requirements	25
5.11.5 Parking Construction Requirements	25
5.12 PEDESTRIAN AND BICYCLE FACILITIES	25
5.12.1 Pedestrian Facilities	25
5.12.1.1 Pedestrian Environmental Impact	26
5.12.1.2 Pedestrian Facility Widths	26
5.12.1.3 Pedestrian Pavement Thickness	26
5.12.1.4 Horizontal and Vertical Clearance	26
5.12.1.5 Sidewalk Widening	26
5.12.1.6 Slope	26
5.12.1.7 Sidewalk Shouldering	26
5.12.1.8 Sidewalk Stormwater	26
5.12.1.9 Sidewalk Alignment	26
5.12.1.10 Heated Sidewalks	27
5.12.1.11 Trail Connections	27
5.12.1.12 Pedestrian Bridges	27

5.12.1.13 Pedestrian Railings.....	27
5.12.1.14 Pedestrian Easements.....	28
~~All pedestrian facilities and trails not located within ROW shall be located within an access easement. Pedestrian facilities and trails shall have a 5-foot minimum distance from back of sidewalk/trail to edge of ROW/easement to accommodate drainage, signage, lighting, and utilities.....~~	
<u>Wh</u> 5.12.2 Bicycle & Shared-use Facilities	28
5.12.2.1 Shared-use Environmental Impact.....	28
5.12.2.2 Design Speed.....	28
5.12.2.3 Shared-use Facility Widths.....	28
5.12.2.4 Shared-use Pavement Thickness.....	28
5.12.2.5 Shared-use Horizontal and Vertical Clearance.....	28
5.12.2.6 Shared-use Widening.....	29
5.12.2.7 Shared-use Slope.....	29
5.12.2.8 Shared-use Shouldering.....	29
5.12.2.9 Shared-use Stormwater.....	29
5.12.2.10 Shared-use Alignment.....	29
5.12.2.11 Shared-use Bridges.....	29
5.12.2.12 Shared-use Railings.....	29
5.12.2.13 Shared-use Easements.....	29
5.13 ACCESSIBLE PEDESTRIAN DESIGN.....	30
5.13.1 ADA Accessibility Requirements, Standards, and Guidelines.....	30
5.13.2 Technical Requirements for Accessible Design.....	30
5.13.3 Curb Ramp Types.....	30
5.13.4 Curb Ramp Technical Requirements.....	31
5.13.4.1 Ramps.....	31
5.13.4.2 Landings and Turning Spaces.....	31
5.13.4.3 Cross Slopes.....	31
5.13.5 Detectable Warning Surfaces.....	31
5.13.6 Pedestrian Crossings at Controlled Intersections.....	31
5.13.6.1 Signalized Intersection Crossing Controls.....	31
5.13.6.2 Stop and Yield Crossing Controls.....	32
5.13.6.3 Roundabout Crossing Controls.....	32
5.13.7 ADA Curb Ramp Variance Process.....	32
5.14 PEDESTRIAN CROSSING CRITERIA FOR UNCONTROLLED OR MID-BLOCK CROSSINGS.....	32
5.14.1 Definitions.....	32

5.14.2 References	33
5.14.3 Pedestrian Traffic Analysis and Recommendations	33
5.14.3.1 Pedestrian Volumes and Delays.....	33
5.14.3.2 Crossing Treatment Criteria.....	34
5.14.3.2.1 Criterion A	34
5.14.3.2.2 Criterion B	34
5.14.3.2.3 Criterion C	34
5.14.3.2.4 Criterion D	35
5.14.4 Crossing Enhancement Eligibility Worksheet	35
5.14.5 Pedestrian Crossing Enhancements	36
5.14.5.1 Pavement Markings and Conventional Signs	36
5.14.5.1.1 Standard Continental Crosswalk Markings	36
5.14.5.1.2 High Visibility Markings	36
5.14.5.1.3 Advanced Yield or Stop Markings and Signs	36
5.14.5.1.4 Pedestrian Sign Assembly	37
5.14.5.2 Physical Geometric Treatments.....	37
5.14.5.2.1 Refuge Islands	37
5.14.5.2.2 Curb Extensions (Bulb-Outs)	37
5.14.5.2.3 Raised Crosswalks.....	37
5.14.5.3 Rectangular Rapid Flashing Beacon (RRFB)	38
5.14.5.4 Pedestrian Hybrid Beacon	38
5.14.5.5 Grade Separated Crossing	38
5.15 TRANSIT FACILITIES	39
5.16 PAVEMENT DESIGN	39
5.16.1 Soils Testing for Pavement Design.....	39
5.16.2 Flexible Pavement Design	40
5.16.3 Rigid Pavement Design	40
5.17 Traffic Control Devices	40
5.17.1 Street Name Signs	41
5.17.2 Stop Signs	41
5.17.3 Private Signage	41
5.17.4 Signage Requests	41
5.18 STREET LIGHTING.....	41
5.18.1.1 Equipment Type and Location	41
5.18.1.2 Positioning at Intersections.....	42
5.18.1.3 Roundabout Lighting.....	43

5.18.1.4 Light Pole Offset Distances	43
5.18.1.5 Underground Service	43
5.18.2 Pedestrian Lighting	43
5.18.3 Dark Sky Ordinance	43
5.18.4 Residential Areas	43
5.19 PRIVATE FACILITIES	43
5.19.1 Private Streets	44
5.19.2 Private Snow Melt Systems	44
5.20 UTILITIES	44
5.21 DESIGN CRITERIA TABLE BY STREET CLASSIFICATION	45

LIST OF TABLES

Table 5.1. Design Vehicles	4
Table 5.2. Right-of-Way Widths	4
Table 5.3. Stopping Sight Distance on Level Roadways	5
Table 5.4. Stopping Sight Distance on Grades	6
Table 5.5. Minimum Horizontal Curve Radius (Normal Crown)	10
Table 5.6. Minimum K Values for Vertical Curves	12
Table 5.7. Acceleration/Deceleration Lane Design Criteria	18
Table 5.8. Auxiliary Lane Storage Lengths	18
Table 5.9 Design Vehicle Selection for Access Sight Distance	21
Table 5.10 Access Spacing Requirements	22
Table 5.11 Access Width Requirements	22
Table 5.12 Crossing Enhancement Eligibility Worksheet	35
Table 5.13 Pavement Thickness Minimums	40
Table 5.14 Design Criteria by Street Classification	45

LIST OF FIGURES

Figure 5.1. Diagram Illustrating Components to Determine Sight Distance	7
Figure 5.2. Approach Sight Triangles at Intersections (Uncontrolled or Yield-Controlled) ...	8
Figure 5.3. Departure Sight Triangles at Intersections (Stop-Controlled)	9
Figure 5.4. Functional Intersection Area	17

LIST OF ATTACHMENTS – APPENDIX C

CROSSING ENHANCEMENT ELIGIBILITY WORKSHEET
BRECKENRIDGE TYPICAL SECTIONS

5.1 INTRODUCTION

Street design addresses safe and efficient movement of vehicles, pedestrians, bicycles, and transit while also incorporating landscaping, utilities, and storm drainage. Low impact drainage systems are encouraged where feasible. The street and trails network create multiple travel routes and minimize the distance required for pedestrians and bicycles to access primary activity sites. This section sets forth the minimum standards for street design and construction. Developers and engineers are encouraged to design above the minimum standards and in some cases due to site specific conditions the Town Engineer may require design above the minimum standards. The purpose and intent of this chapter is to provide safe travel for vehicles and pedestrians, efficient traffic flow which minimizes traffic congestion, and minimizes maintenance concerns.

[Chapter 5 also includes access management, which is the coordinated planning, regulation, and design of access between roadways and land development. It involves the systematic control of the location, spacing, design, and operation of accesses, median openings, interchanges, and street connections. Access management provides the means to balance good mobility along the street network with local access needs of businesses and residents. Implementation of access management principles and techniques on transportation networks can provide the following long-term benefits for highway users, communities, and businesses.](#)

These standards apply to the design, construction, and maintenance of both public and private streets, driveways, pedestrian paths, and on-street parking in the Town of Breckenridge. These standards also apply to all construction, whether completed by a private Developer or the Town of Breckenridge. All Town streets, whether new construction or upgrading of existing infrastructure, shall be built in accordance with these standards.

5.2 OTHER STANDARDS

A significant portion of the criteria used by the Town for Street Standards is taken from the 2018 edition of the American Association of State Highway and Transportation Officials (AASHTO) publication *A Policy on Geometric Design of Highways and Streets*. Throughout the rest of Chapter 5, this document will be referred to as the *AASHTO Green Book*. Where no requirement is given in this chapter, the newest additions of the following standards shall govern, unless otherwise approved by the Engineering Division:

1. AASHTO Green Book
2. AASHTO Roadside Design Guide
3. Manual of Uniform Traffic Control Devices (MUTCD)
4. CDOT Roadway Design Guide
5. CDOT Bridge Design Manual
6. CDOT Pavement Design Manual
7. CDOT Drainage Design Manual
8. United States Access Board (PROWAG and ADAAG)

Construction standards for street related improvements are outlined in Chapter [7-9](#) of the standards. Right of Way requirements for work within existing streets and Right of Ways are outlined in Chapter 3 of these standards. Off-street parking requirements are outlined in the Town Code.

5.3 GENERAL DESIGN GUIDELINES

The Town of Breckenridge is located in a mountainous valley with heavy annual snowfall. Due to the terrain, street design poses unique challenges to meet design requirements. The following guidelines shall be followed for designing in this unique environment:

1. Streets shall be designed to maximize southern exposure and minimize north facing or shaded areas, especially on steeper slopes.
2. Street grades shall be minimized to the extent possible, while also minimizing switchbacks and site disturbance.
3. Streets shall be designed to avoid impacting wetlands and other environmentally sensitive areas. Design shall minimize impacts to the environment.
4. Streets shall be designed to retain as many trees and vegetation as possible. Design shall strive to retain or create vegetative buffers between streets and adjacent properties.
5. Drainage in winter shall be considered and icing of roadways and pedestrian routes shall be considered in the design.
6. Impacts of snow and ice to striping, parking, signage, signal sensors and other improvements shall be considered in the design.

5.4 STREET CLASSIFICATION

Town streets are classified according to function. Functional classifications shall be established by the Town Engineer. The Town Engineer has the authority to make the determination for road classification. For planning purposes, the town uses the following functional categories to classify its roads.

5.4.1 Arterial

An arterial street is a high-capacity roadway. The primary function of an arterial street is to deliver traffic from collector streets to freeways or expressways and provide for travel through and between communities. These streets primarily serve through traffic, and access to adjacent property is limited.

An arterial street generally has the following characteristics:

1. Posted speed limit greater than or equal to 35 mph
2. 4-lane minimum width, plus additional turn lanes
3. 10,000 vehicles per day (vpd) expected minimum traffic volume when the land served by the arterial is fully developed
4. Limited access to adjacent parcels of land
5. No back-out drives are permitted

The only arterial street within the Town is Colorado State Highway 9. Since the Town has no existing or planned arterial streets, the design standards in this chapter will not cover their design. Consult the Colorado Department of Transportation Roadway Design Guide for design of arterial streets on the Colorado State Highway System.

5.4.2 Major Collector

A major collector street is a moderate-capacity street which serves to move traffic from local streets and minor collector streets to arterial streets. The major collector balances both through-travel needs and access to adjacent property favoring more access control and higher speeds.

A major collector street generally has the following characteristics:

1. Posted speed limit from 30 mph to 40 mph
2. Traffic volumes generally between 3,000 and 10,000 vehicles per day when the land served by the major collector is fully developed
3. Designed to handle traffic volumes loading from and onto local, other collector, and arterial streets

4. No back-out drives are permitted

Refer to typical section in Standard Details.

5.4.3 Minor Collector

A minor collector street is a low-to-moderate-capacity street which serves to move traffic from local streets and major collector streets to arterial streets. The minor collector balances both through-travel needs and access to adjacent property favoring a higher level of access and lower speeds than a major collector.

A minor collector street generally has the following characteristics:

1. Posted speed limit from 25 mph to 35 mph
2. Traffic volumes generally between 1,000 and 3,000 vehicles per day when the land served by the major collector is fully developed
3. Designed to handle traffic volumes loading from and onto local, other collector, and arterial streets
4. No back-out drives are permitted

Refer to typical section in Standard Details.

5.4.4 Local

A local street provides direct access from abutting properties to alley, major collector, minor collector, or arterial streets. While it provides for some through travel, the primary purpose is to provide access to individual properties.

A local street generally has the following characteristics.

1. Posted speed limit from 15 mph to 25 mph
2. Traffic volumes up to 1,000 vehicles per day
3. Designed for the safety of pedestrians, bicyclists, and the ease of access to adjacent parcels of land
4. Back-out drives may be permitted for single family homes and duplexes

Refer to typical section in Standard Details.

5.5 DESIGN CONTROLS

5.5.1 Design Vehicles

The street design shall accommodate the turning movements of the design vehicle as listed in Table 5.1 below. The design should allow the design vehicle to make turns at intersections without encroaching into the oncoming lanes. The need for vehicles greater than the design vehicle to turn into oncoming lanes shall be reviewed and the design modified if appropriate based on nearby land use or business operations. Existing, proposed, or potential future transit routes as determined by the Transit Superintendent shall be designed to accommodate the design transit vehicle. The design engineer shall confirm that any local fire district turning requirements are also met.

Table 5.1. Design Vehicles

Street Classification	Design Vehicle
Major Collector	Intermediate Semitrailer (WB-40)
Minor Collector	Intercity Bus (BUS-45)
Local	Single-Unit Truck (SU-30)
Transit Facilities	Intercity Bus (BUS-45)
Commercial Access	Single-Unit Truck (SU-30)*
Multi-family Residential Access	Single-Unit Truck (SU-30)
Single-family Residential Access	Passenger Car (P)

* Commercial accesses that routinely use vehicles larger than a SU-30 should select and appropriate design vehicles for the onsite operations.

Additional details on these and other design vehicles can be found in Chapter 2 of the *AASHTO Green Book*.

5.5.2 Design Speed

The choice of design speed is influenced principally by the character of terrain, roadway classifications, and traffic volume. A roadway in the valley floor justifies a higher design speed than a roadway through steep mountainous terrain.

The design speed for streets in the Town will generally be equal to the posted speed. Under certain conditions, the Town Engineer may require that a design speed exceed the posted speed. Refer to Section 5.2 for the posted speed ranges of each street classification.

5.5.3 Right-of-Way Widths

The width of right-of-way depends on the street cross section to be used, topography in the area, and other physical controls. It is important to acquire sufficient right-of-way to facilitate future widening and other improvements as traffic warrants.

Minimum right-of-way widths to be dedicated for street construction in the Town are listed in Table 5.2 below. These minimums may be increased where necessary to meet side slope requirements, roadside drainage ditch requirements, transit facilities, roundabouts, intersection improvements, and other considerations requiring additional public right-of-way for the street.

The minimum clearance from the right-of-way line to the catch point of a cut or fill slope should be 5 feet for all types of cross sections. When feasible, 10 feet of clearance should be provided. Restrictive easements may be provided in lieu of dedicated right-of-way if approved by the Town Council.

Table 5.2. Right-of-Way Widths

Street Classification	Minimum Right-of-Way Width (feet)
Major Collector	80
Minor Collector	70
Local	50

5.5.4 Traffic Considerations

The design of a street and its features should be based upon consideration of the traffic volumes and characteristics to be served. In urban areas, these characteristics usually are dominated by vehicular traffic demands, but the design should also consider pedestrian, bicycle, and transit uses. Information for all current and projected user modes should be considered jointly. Vehicular traffic volumes typically drive the need for street improvements and will affect the geometric design.

5.5.5 Capacity Considerations

The level of congestion that is considered acceptable for a street or intersection will vary. The Level of Service (LOS) is intended to characterize the operating condition of a street or intersection in terms of speed, travel time, freedom to maneuver, traffic interruptions, comfort, and convenience. The results of the LOS should be a key consideration in the design process. Consult Chapter 4 of this manual for more information regarding traffic considerations for street projects.

5.6 DESIGN ELEMENTS

The alignment of a street produces a great impact on the environment, the fabric of the community, and the street user. The alignment consists of a variety of design elements that combine to create a facility that serves traffic safely and efficiently, consistent with the facility's intended function. Principal elements of design include sight distance, horizontal alignment, superelevation, vertical alignment, and cross section elements.

5.6.1 Sight Distance

Sight distance is the length of roadway visible to a driver. Sight distance is required for safe and efficient operation of a vehicle on a highway. The path and speed of motor vehicles on streets are subject to the control of drivers whose ability, training and experience vary greatly. The available sight distance on a roadway should be sufficiently long to enable a vehicle traveling at or near the design speed to stop before reaching an object in its path.

5.6.1.1 Stopping Sight Distance

Stopping sight distance is the sum of two distances: (1) the distance traversed by the vehicle from the instant a driver sights an object necessitating a stop to the instant the brakes are applied, and (2) the distance needed to stop the vehicle from the instant the brakes application begins. These are referred to brake reaction distance and braking distance, respectively. Table 5.3 contains the stopping sight distances on level roadways based on design speed.

Table 5.3. Stopping Sight Distance on Level Roadways

Design Speed (mph)	Brake Reaction Distance (ft)	Braking Distance on Level (ft)	Stopping Sight Distance	
			Calculated (ft)	Design (ft)
15	55.1	21.6	76.7	80
20	73.5	38.4	111.9	115
25	91.9	60.0	151.9	155
30	110.3	86.4	196.7	200
35	128.6	117.6	246.2	250
40	147.0	153.6	300.6	305
45	165.4	194.4	359.8	360

The roadway grade has a significant effect on the braking distance due to gravity. The braking distances are longer for downgrades and shorter on upgrades compared to a level roadway. Table 5.4 contains the revised stopping sight distances based on grades that exceed an upgrade or downgrade of 3 feet rise or fall per 100 feet longitudinally, or 3%. For grades steeper than 9%, stopping sight distance shall be calculated using equations in the AASHTO green book.

Table 5.4. Stopping Sight Distance on Grades

Design Speed (mph)	Stopping Sight Distance (ft)					
	Downgrades			Upgrades		
	3%	6%	9%	3%	6%	9%
15	80	82	85	75	74	73
20	116	120	126	109	107	104
25	158	165	173	147	143	140
30	205	215	227	200	184	179
35	257	271	287	237	229	222
40	315	333	354	289	278	269
45	378	400	427	334	331	320

5.6.1.2 Sight Distance Measurement Criteria

Sight distance is the distance along a roadway throughout which an object of specified height is continuously visible to the driver. This distance is dependent on the height of the driver's eye above the road surface, the specified object height above the road surface, and the height and lateral position of sight obstructions within the driver's line of sight.

5.6.1.2.1 Height of Driver's Eye

For all sight distance calculations involving passenger vehicles, the height of the driver's eye is considered to be 3.50 feet above the road surface. For large trucks, including single-unit trucks and semi-trailers, the recommended value of a truck driver's eye height is 7.60 feet above the road surface.

5.6.1.2.2 Height of Object

For stopping sight distance calculations, a 2.00 feet object height is used. For intersection sight distance calculations, an object height of 3.50 feet is used.

5.6.1.3 Sight Distance on Horizontal Curves

For general use in design of a horizontal curve, the sight line is a chord of the curve, and the stopping sight distance is measured along the centerline of the inside lane along the curve. The value of the horizontal sight line offset (HSO) are determined by setting S, as shown in the diagrammatic sketch in Figure 5.1 and Equation 5.1, equal to the stopping sight distance (SSD). Alternatively, horizontal sight distance for existing conditions can be measured graphically using a computer automated drafting (CAD) program.

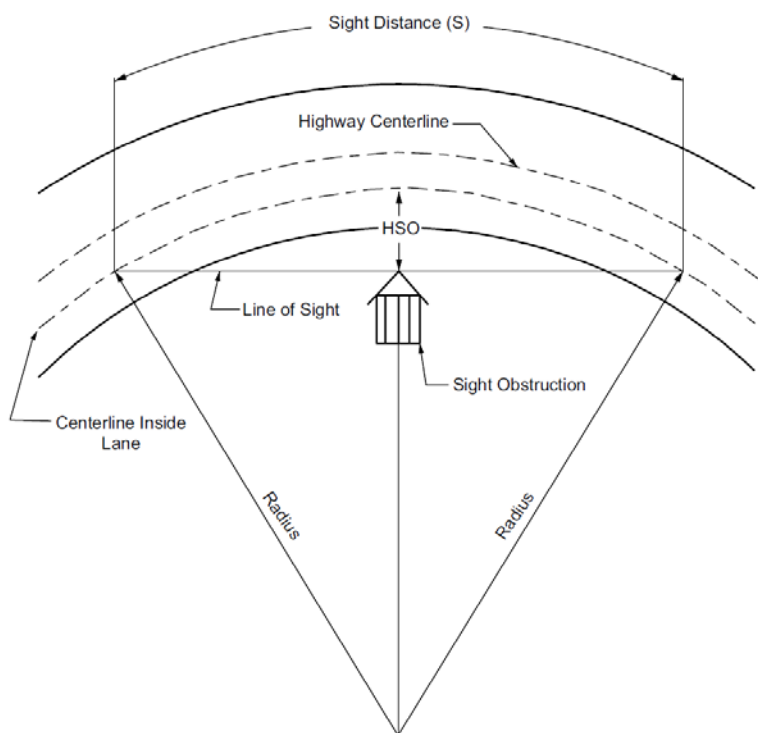


Figure 5.1. Diagram Illustrating Components to Determine Sight Distance

$$HSO = R \left[1 - \cos \left(\frac{28.65 S}{R} \right) \right] \quad (5.1)$$

Where:

HSO = horizontal sight offset (ft)

S = sight distance (ft)

R = radius of curve (ft)

5.6.1.4 Sight Distance on Vertical Curves

The controlling vertical curve design criteria found in Section 5.4.3.3 is based on sight distance. Vertical sight distance for existing conditions can be measured graphically using a computer automated drafting (CAD) program.

5.6.1.5 Intersection Sight Distance

Each intersection has the potential for several different types of vehicular conflicts. The possibility of these conflicts actually occurring can be greatly reduced through the provision of proper sight distances and appropriate traffic controls. The avoidance of conflicts and the efficiency of traffic operations still depend on the judgement, capabilities, and response of each individual driver.

Stopping sight distance is provided continuously along each roadway so that drivers have a view of the roadway ahead that is sufficient to allow drivers to stop. The provision of stopping sight distance at all locations along each roadway, including intersection approaches, is fundamental to intersection operation.

Mid-block or uncontrolled crosswalks shall meet minimum intersection sight distance requirements. Case B1 (Table 9-6 of AASHTO Greenbook) shall be used for minimum values.

5.6.1.5.1 Sight Triangles

Specified areas along intersection approach legs and across their included corners should be clear of obstructions that might block a driver's view of potentially conflicting vehicles. These specified areas are known as clear sight triangles. The dimensions of the legs of the sight triangles depend on the design speeds of the intersection roadways and the type of traffic control used at the intersection. These dimensions are based on observed driver behavior and are documented by space-time profiles and speed choices of drivers on intersection approaches. Two types of clear sight triangles are considered in intersection design—approach sight triangles and departure sight triangles.

5.6.1.5.2 Approach Sight Triangles (Uncontrolled or Yield-Controlled Intersection)

Each quadrant of an intersection should contain a triangular area free of obstructions that might block an approaching driver's view of potentially conflicting vehicles. The length of the legs of this triangular area, along both intersection roadways, should be such that the drivers can see any potentially conflicting vehicles in sufficient time to slow or stop before colliding within the intersection. Figure 5.2 shows typical clear sight triangles to the left and to the right for a vehicle approaching an uncontrolled or yield-controlled intersection.

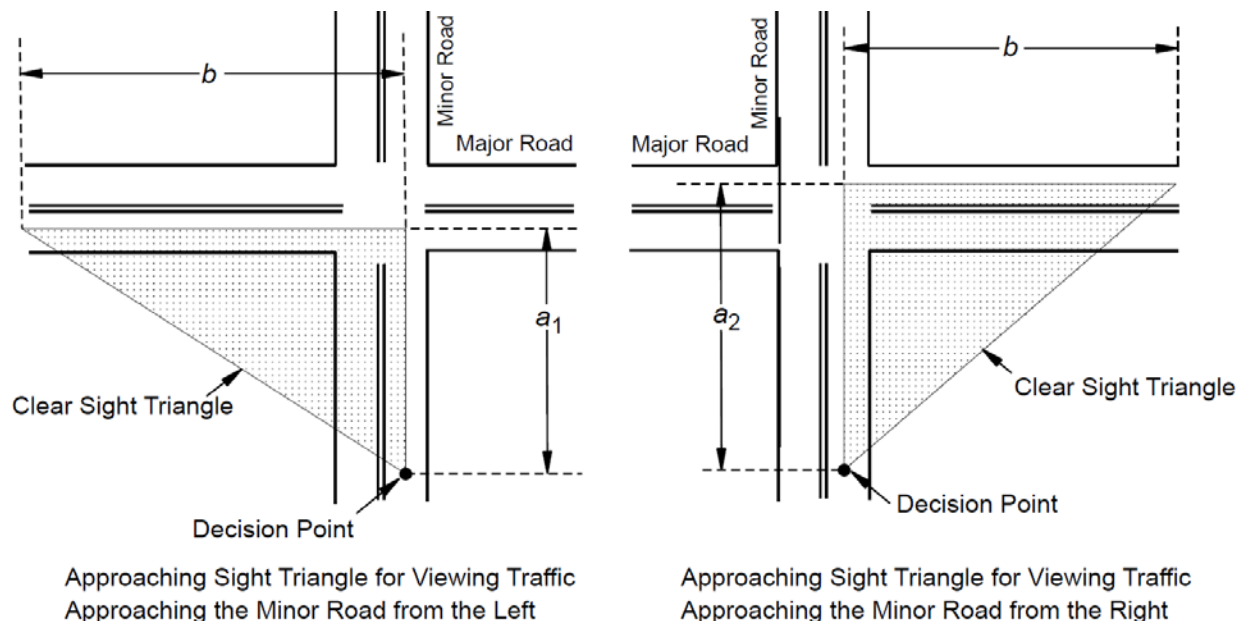


Figure 5.2. Approach Sight Triangles at Intersections (Uncontrolled or Yield-Controlled)

The length of the legs of the approach sight triangle shall be determined in accordance with the practices and standards established in Chapter 9 of the *AASHTO Greenbook*.

5.6.1.5.3 Departure Sight Triangles (Stop Controlled Intersection)

A second type of clear sight triangle provides sight distance sufficient for a stopped driver on a minor-road approach to depart from the intersection and enter or cross the major road. Figure 5.3 shows typical departure sight triangles to the left and to the right of the location of a stopped vehicle on the minor road. Departure Sight Triangles should be provided in each quadrant of each intersection approach controlled by stop or yield signs. Departure sight triangles should also be provided for some signalized intersection approaches.

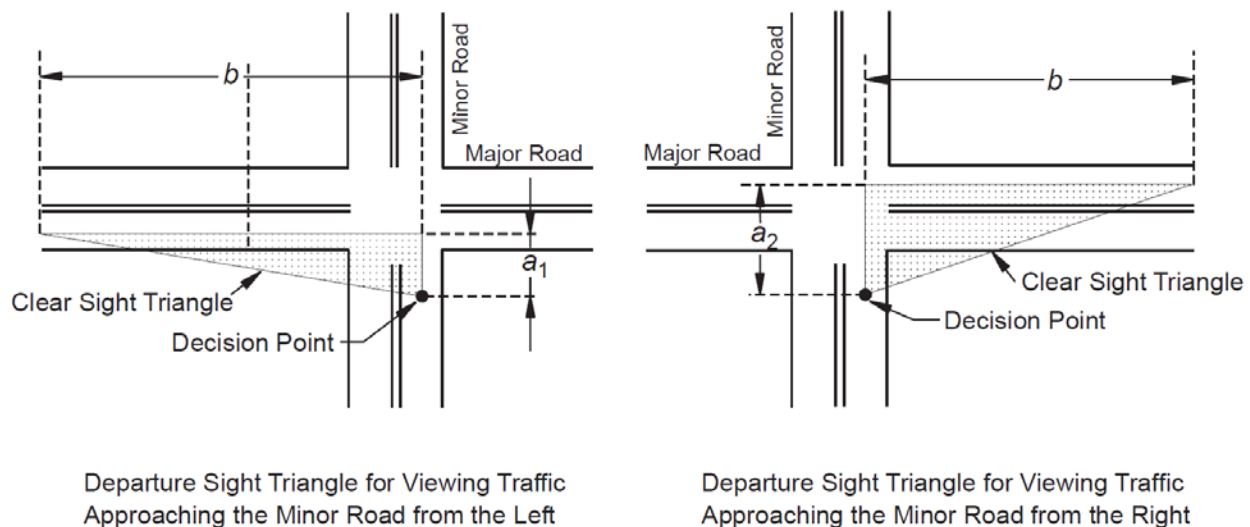


Figure 5.3. Departure Sight Triangles at Intersections (Stop-Controlled)

The length of the legs of the approach sight triangle shall be determined in accordance with the practices and standards established in Chapter 9 of the *AASHTO Greenbook*.

5.6.1.5.4 Identification of Sight Obstructions within Sight Triangles

The profiles of the intersection roadways should be designed to provide the recommended sight distances for drivers on the intersection approaches. Within a sight triangle, any object at a height above the elevation of the adjacent roadways that would obstruct the driver's view should be removed or lowered, if practical. Such objects may include buildings, parked vehicles, roadway structures, roadside hardware, hedges, trees, bushes, unmowed vegetation, tall crops, walls, fences, stored snow and the terrain itself. No objects or improvements shall be allowed over 3.5 feet tall within the sight triangles, with the exception of regulatory signs, signals, or street lights. If landscaping elements are proposed within the identified sight triangles, landscaping must be maintained so that it does not become an obstruction over 3.5 feet tall. Maintenance responsibilities must be agreed upon with the Town Engineer. Sight triangles shall be shown on all roadway and site design plans.

5.6.2 Horizontal Alignment

Street layout is designed to bear a logical relationship with the topography, connect to existing and planned area streets, and provide reasonable access to adjacent parcels. Street layout shall be designed to fit the context of the development and serve vehicle, pedestrian, transit, and bicycle users. Street layout shall avoid long, straight sections to minimize the potential for speeding.

5.6.2.1 Traffic Calming

ITE defines traffic calming as “the combination of mainly physical measures that reduced the negative effects of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users.” Local roads in residential neighborhoods shall be designed with traffic calming features. Intersection improvements and pedestrian crossing enhancements are encouraged for pedestrian safety. Major and minor collectors shall be analyzed for traffic calming and may require traffic calming features. Traffic calming encompasses a wide range of different features and methods; the appropriate features for a specific roadway is dependent on a variety of project specific features such as the design speed, traffic volume, development type, maintenance concerns, location within Town, and site constraints. The following hierarchy of traffic calming methods are listed in order from the generally most preferred method to the least preferred method.

1. Horizontal geometry (appropriate radius curves, chicanes, lane narrowing, and other geometry features to promote use of the roadway at the design speed)
2. Raised crosswalks at intersections
3. Intersection bulb-outs
4. Rectangular Rapid-Flashing Beacon or other light emitting hardware at pedestrian crossings
5. Roadway signage per MUTCD
6. Radar speed signs
7. Striping & thermoplastic markings
8. Median islands
9. Speed Humps

All traffic calming features shall be designed per MUTCD, ADA, and all other relevant standards. Features shall accommodate drainage and shall consider maintenance issues and effectiveness during winter conditions.

Traffic calming requests, studies, and design shall comply with the Town of Breckenridge Traffic Calming Policy, which may be obtained from the Engineering Division. Refer to Section 5.14 for traffic calming measures related to uncontrolled pedestrian crossings.

5.6.2.2 Horizontal Curves

Horizontal curve design should be based on an appropriate relationship between design speed, right-of-way, profile grades, and construction costs—and on their joint relationships with superelevation and side friction. Curves are not required when the delta angle (total central angle of the circular curve) is less than 1 degree. Curves should be at least 500 feet long for a central angle of 5 degrees, and the minimum length should be increased 100 feet for each 1 degree decrease in the central angle. The formula can be found in the *AASHTO Greenbook* and the CDOT M & S Standard Plans. Designers should use every effort to exceed the minimum curve radius when practical. Broken back, compound, spirals, or reverse curves are not recommended. Table 5.5 below gives the minimum horizontal curve radius for a normal crown of 2%. For superelevated roadways, refer to Section 5.4.2.3.

Table 5.5. Minimum Horizontal Curve Radius (Normal Crown)

Design Speed (mph)	Minimum Horizontal Curve Radius (ft)
15	50
20	110
25	200
30	335
35	510
40	765
45	1000

5.6.2.3 Superelevation

Local streets utilize standard crown sections and do not require superelevation. Superelevation may be considered on collector streets to address unique horizontal geometry, drainage, or grade issues. At intersections, grades of the minor street shall be warped to transition to the grades of the major street. If a street design requires the use of superelevation, factors controlling the use of

superelevation include climate conditions, terrain conditions, classification of the street, and the frequency of slow-moving vehicles on the roadway. In general, a lower rate of superelevation is used in urban areas. The maximum allowable superelevation rate is 6%.

The superelevation transition section consists of the superelevation runoff and tangent runoff sections. The superelevation runoff is the length of roadway needed to accomplish a change in outside lane cross slope from zero to full superelevation, or vice versa. The tangent runoff section is the length of roadway needed to accomplish a change in outside lane cross slope from normal cross slope rate to zero, or vice versa. Additional information pertaining to the lengths and use of transitions for simple and spiral curves can be found in the *AASHTO Greenbook*. Refer to *CDOT M Standard – Superelevation Streets* for design requirements.

5.6.3 Vertical Alignment

The design should take into consideration the impact the vertical grade has on the operation of the facility. Designers should consider stopping sight distance requirements for the given speed limit and the challenges of large cut-and-fill sections. Vertical curves are classified as either sag or crest curves. Typically, sag curves are controlled by nighttime driving conditions with headlight visibility restrictions, and crest curves are controlled by stopping sight distances. Vertical curves should be simple in application and should result in a design that is safe and comfortable in operation, aesthetically pleasing, and adequate for drainage—especially when a curb and gutter are used.

5.6.3.1 Terrain

Proposed roads shall follow the natural terrain of the existing area whenever possible.

5.6.3.2 Grades

Grade lines are typically controlled by topography and structure clearances, but very flat grade can be controlled by drainage considerations. Other factors that should be considered are street classifications, design speed, safety, and construction costs. A minimum value of 1.0% should be used for street sections with curbs and gutters. In certain conditions, 0.5% may be used. The designer should consider the ultimate design of the roadway, recognizing if a curb and gutter may be required in the future, and design for those conditions during the interim design. Grades 4% or steeper may require special consideration for drainage or erosion protection.

Maximum grades of streets shall not exceed 6%. Major collectors shall flatten to 2% slope for intersections and shall meet the requirements of vertical curves at the intersections. Minor collectors and local roads shall flatten to 4% slope at intersections and shall meet the requirements of vertical curves at the intersections.

5.6.3.3 Vertical Curves

When using combinations of horizontal and vertical curves, it is important to recognize the driver's perspective. Sharp horizontal curvature should not be introduced at or near the top of a pronounced crest vertical curve. If unavoidable, the horizontal curve should be made longer than the vertical curve to help minimize the driver's inability to perceive the horizontal change, especially at night (For further details, see *AASHTO Greenbook* and the *CDOT Roadway Design Guide*). The length of vertical curves can be determined by dividing the rate of vertical curvature by the grade change or algebraic difference in intersecting grades.

$$L = K/A \quad (5.2)$$

Where:

L = length of the vertical curve (ft)

K = rate of curvature

A = grade change (%)

A vertical curve is not required when a grade change or the algebraic difference is equal to or less than 0.2%. The preferred minimum length of a vertical curve is 300 feet. The allowed minimum is 3 times the roadway design speed. Table 5.6 below gives the minimum K values based on design speed.

Table 5.6. Minimum K Values for Vertical Curves

Design Speed (mph)	Minimum K Value (Crest)	Minimum K Value (Sag)
15	3	10
20	7	17
25	12	26
30	19	37
35	29	49
40	44	64

5.6.3.4 Vertical Clearance to Obstructions

Private overhead structures are not permitted in the public ROW and consideration of such structures shall be limited. Signal height clearances shall be per the current MUTCD. For other structures, there shall be a minimum 18-foot clearance on streets. For sidewalks and shared use paths, there shall be a minimum 10-foot clearance.

5.6.4 Cross Section Elements

5.6.4.1 Traveled Way

5.6.4.1.1 Cross Slope

Cross slope is necessary to ensure adequate drainage. The preferred value for a cross slope is 2% for paved streets. Undivided streets should have a normal crown that is a two-way cross slope, with the high point of the cross section located on the street centerline. Divided streets should have a cross slope on each side of the divide, with the high point of each section located where the pavement meets the median. Cross slopes of 2% are permissible on concrete roadways. Intersections of streets with curbs and gutters sometimes require the use of cross-pans for drainage. At these areas, the normal two-way 3% cross slope shall transition to a one-way slope adjacent to the cross pan, with a slope range of 1% to 2%. Cross-pans shall not be allowed on major collectors and are discouraged on minor collectors.

5.6.4.1.2 Lane Widths

Lane widths shall be 11 feet minimum asphalt width in the Town of Breckenridge historic district, and 12 feet minimum asphalt width outside of the historic district, [unless a variance is granted by the Town Engineer](#). The Breckenridge Historic District is defined in Title 9 of the Town Code and the "Breckenridge Handbook of Design Standards. The limits of the Historic District are shown on the Town's website. The curb, valley pan, or shoulder is not counted in the lane width dimension.

5.6.4.2 Shoulders

Shoulder width shall be 2 feet minimum of compacted aggregate base course plus 4 feet of recoverable zone with only grass vegetation (6-foot wide total clear zone).

Shoulder width for Major Collectors and Arterials shall 4 feet minimum of aggregate compacted base course plus 10 feet of recoverable zone with only grass vegetation (14-foot wide total clear zone).

5.6.4.3 Roadside Design

5.6.4.3.1 Cut and Fill Slopes

Cut and fill slopes for roadway embankment of 3:1 or flatter are preferred. Maximum cut and fill slopes shall be 2:1. Consideration should be given to snow removal problems and snow storage in slope design. It is considered advisable to use flatter slopes in cuts on the southerly side of the roadway where this will provide additional exposure of the pavement to the sun. Flatter slopes shall be considered to reduce erosion, maintenance costs, and to facilitate vegetation. If steeper slopes are needed, side slope material shall be evaluated based on drainage needs to determine appropriate material for stabilization of the slope. See Chapter 7 of these standards for further guidance on temporary and permanent stabilization measures.

The tops of all cut slopes shall be rounded where the material is other than solid rock. A layer of earth overlying a rock cut shall also be rounded.

5.6.4.3.2 Roadside Ditches

See Chapter 6 for Roadside ditch information and design.

5.6.4.3.3 Clear Zone

All fixed objects should be located outside the clear zone as defined in the *AASHTO Roadside Design Guidelines*. The design should provide a clear zone as wide as practical within constraints per the latest version of the *AASHTO Roadside Design Guidelines*. For low speed, low volume roadways a minimum clear recovery zone area of 7 feet in width shall be provided for roadways without curb and 2 feet in width for all roadways with curb.

5.6.4.3.4 Obstructions

Mailboxes, address monuments, landscaping, stone headwalls, and other objects shall not be located within the right of way. If any improvements are allowed in the ROW, an encroachment license shall be filed prior to issuance of permit.

5.6.4.3.5 Roadside Barriers

The installation of roadside barriers on embankments and adjacent to fixed objects may reduce the combined effect of severity and frequency of "run-off-road" type crashes. Roadside barriers reduce crash severity only when the overall severity of striking the guardrail is less than the severity of going down an embankment or striking a fixed object. They should not be installed if they are likely to create a greater hazard than running off the street. To the extent possible, streets shall be designed to eliminate the need for roadside barriers by eliminating obstructions, steep grades, and other hazards from the clear zone. Evaluating installation of roadside barriers shall consider crash experience, street objectives, functional classification of streets, design speed, traffic volume and type, street cross section, height of embankment, steepness of fill slope, horizontal curvature, gradient or profile conditions, street side conditions, climatic conditions, and degree of projected injury from traveling off the street. Special consideration shall be given to winter and icy conditions which might necessitate a roadside barrier that would not be needed under normal conditions. Refer to the *AASHTO Roadside Design Guide* for roadside barrier best practices. Refer to the *CDOT M Standards* for roadside barrier installation and construction requirements.

Guardrails and concrete barriers shall typically be colored brown and rails shall not be made of galvanized or reflective materials (reflector tabs and other reflective devices shall be installed per AASHTO and CDOT standards). Custom guardrails or barriers utilizing natural materials shall meet AASHTO and CDOT standards and be impact rated.

When roadside barrier is considered for installation, especially in extended lengths, provisions shall be made for adequate snow storage and removal. Flared end treatments are preferred over non-flared end treatments for snow removal operations.

5.6.4.3.6 Retaining Walls

Retaining walls and abutments are discouraged within the publicly maintained right-of-way. All designs of retaining walls, foundations, and abutments exceeding 48 inches in height (measured from finished grade) will require a sealed geotechnical design and a sealed structural design. Both designs will need to be prepared by registered professional engineers in the State of Colorado prior to the any approval of the retaining wall and abutment. Retaining wall and abutments retain earth with lateral support or at the end of a bridge span, respectively. The design of these structures depends upon type, function, and anticipated service life of retaining wall, earth pressure exerted on the wall by the retained backfill, geometry, strength and deformability of the ground, groundwater, and welling pressure in clay backfills. Four types of retaining wall systems are discussed in this section: conventional retaining walls and abutments, anchored walls, mechanically stabilized earth walls, and prefabricated modular walls.

Wall aesthetics shall be approved by the Town Engineer. Local Home Owner's Association (HOA) requirements may apply in certain instances.

Retaining walls needed to support private improvements shall not be located in the public right-of-way.

Full or partial height walls shall not be located closer than the outer edge of shoulder. When the top of the retaining wall is at the level of a roadway, the face of the parapet wall or rail shall be at least 4 feet from the edge of the traveled way.

1. **Conventional Retaining Walls and Abutments:** Conventional retaining walls and abutments are proportioned to provide stability against bearing capacity failure, overturning, and sliding. Retaining walls are discouraged within the public right-of-way. They will be allowed only when necessary to support public improvements. Design of conventional retaining walls and abutments shall satisfy the following loading factors:
 - a. Lateral earth and water pressures, including any live and dead load surcharges.
 - b. The weight of the wall.
 - c. Temperature and shrinkage effects.
 - d. Seismic loads.
2. **Anchored Walls:** Anchored walls provide additional lateral resistance with the use of anchors. Their design is based on the suitability of the subsurface soil and rock conditions. Design of anchored walls shall satisfy the following loading factors:
 - a. Lateral earth and water pressures, including any live and dead load surcharges.
 - b. The weight of the wall.
 - c. Seismic loads.
3. **Mechanically Stabilized Earth Walls:** Mechanically Stabilized Earth Walls (MSEW) are flexible composites of granular soil and tensile inclusions that behave as earth embankments with vertical or nearly vertical faces. MSEW are proportioned to provide stability against overturning

and sliding. Bearing pressure generally governs design. An MSEW should be used where substantial total and differential settlement is expected. This type of wall may also be used where conventional gravity, cantilever, or counterforted concrete retaining walls are considered. An MSEW shall not be used where utilities other than highway drainage are to be constructed within the reinforced zone or floodplain erosion or scour may undermine the reinforced fill zone or any supporting footing. An MSEW shall not be used where surface or groundwater contaminated by acid mine drainage or other industrial pollutants is present. Design of MSEWs shall satisfy the following loading factors:

- a. Lateral earth and water pressures, including any live and dead load surcharges.
 - b. The weight of the wall.
 - c. Seismic loads.
4. Prefabricated Modular Walls: Prefabricated modular walls employ soil-filled interlocking modules to resist earth pressures. Stability of modular walls depends upon the weight and strength of the fill soil. Each module level shall be investigated for sliding and overturning. A prefabricated modular wall may be used where conventional gravity, cantilever, or counterforted concrete retaining walls are considered. A prefabricated modular wall shall not be used on curves with radius less than 800 feet, unless the chord can be substituted with a series of chords, or where groundwater or surface runoff is contaminated with acid. Design of prefabricated modular walls shall satisfy the following loading factors:
- a. Lateral earth and water pressures, including any live and dead load surcharges.
 - b. The weight of the wall.
 - c. Seismic loads.
 - d. Earth pressure shall be computed on a plane surface where modules form an
 - e. irregular, stepped surface. K_a , used to compute lateral thrust, shall be computed based on the friction angle of the backfill behind the modules.

5.6.4.4 *Curbs*

Curb and gutter is required at the following locations:

1. On all streets in flat or rolling terrain within subdivision or any similar-type developments where high densities have been planned.
2. Where required by drainage, traffic, or public safety.
3. To replace existing curb.

Refer to the Street Standard Drawings for approved curb and gutter types.

5.6.4.5 *Medians*

Medians other than those listed within the street cross-sections are generally not permitted on new Town streets and must be approved by the Town Engineer. Medians shall be designed with plowable noses.

5.7 INTERSECTIONS

See Section 5.4.1.5 for intersection sight distance requirements.

5.7.1 **Alignment and Profile**

Streets must intersect one another at 90-degree angles or as close to 90 degrees as the topography allows. Angles less than 90 degrees must be approved by the Town Engineer. Angles less than 80 degrees are not permitted. Intersecting streets shall remain perpendicular for a minimum of 50 feet from the intersection.

In general, grades for intersecting roads should be as flat as possible to provide for storage platforms and sight distance. Grades shall not exceed 2 percent across a pedestrian access route (PAR) if the intersection is controlled by a stop sign or yield condition. Grades exceeding 2% across a PAR are permissible at signalized intersections or uncontrolled intersection legs, but every effort should be made to minimize the grade to meet 2%. Approach grades greater than 4 percent should be avoided. Grades that may need to be steeper to accommodate cases where the existing terrain does not allow for flatter intersections must be approved by the Town Engineer.

Parking shall not be located within 20 feet of an intersection.

5.7.2 Corner Radii

Radii of 15 to 25 feet are adequate for passenger vehicles. These radii may be provided at minor cross streets where there is little occasion for trucks to turn or at minor intersections where there are parking lanes. Where the street has sufficient capacity to retain the curb lane as a parking lane for the foreseeable future, parking should be restricted for appropriate distances from the crossing.

Radii of 15 feet or more at minor cross streets should be provided on new construction and on reconstruction where space permits.

Radii of 20 feet or more at major cross streets should be provided where feasible so that an occasional truck can turn without too much encroachment.

Radii of 30 feet or more should be provided where large truck combinations and buses turn frequently. Longer radii are also desirable where speed reductions would cause problems.

Curb radii should be coordinated with crosswalk distances or special designs to make crosswalks safe for all pedestrians. Designs which can minimize the corner radii for pedestrians and passenger vehicles, while still allowing trucks to make turning movements, are encouraged. Examples include truck blisters, rollover curb, and eliminating any structures or other objects behind the curb but within the truck radius.

5.7.3 Functional Intersection Area

Functional intersection area is the area upstream and downstream of an intersection where intersection operation and conflicts influence driver behavior, vehicle operations, or traffic conditions. Separation of access points should not be less than the functional area of the intersection.

The upstream distance is a combination of the storage length, deceleration and taper length, and the perception-reaction distance required for the speed of the segment. The downstream distance is measured as either acceleration length or decision sight distance. Providing acceleration length allows vehicles to accelerate to normal speed without conflict. Providing decision sight distance allows drivers to pass through an intersection before considering potential conflicts at the next intersection. Functional intersection area is demonstrated below in Figure 5.4.

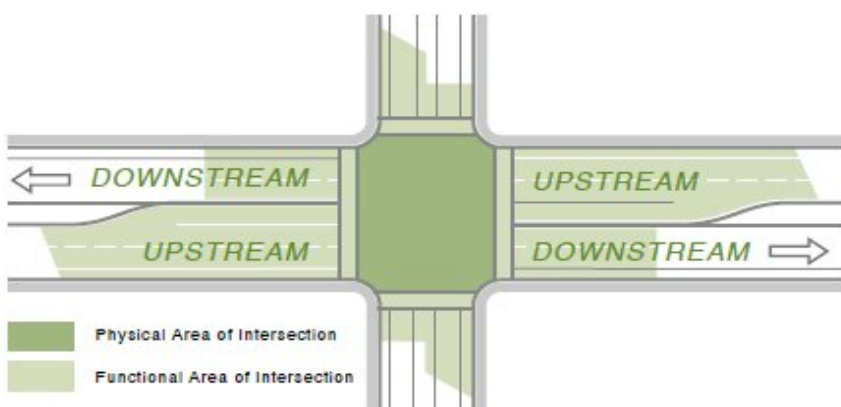


Figure 5.4. Functional Intersection Area

5.7.4 Channelization

5.7.4.1 Islands

Islands are generally not permitted on new Town streets, and must be approved by the Town Engineer. Exceptions are made for roundabouts. Islands shall be designed with plowable noses.

5.7.4.2 Medians

Medians are generally not permitted on new Town streets and must be approved by the Town Engineer. Exceptions are made for roundabouts. Medians shall be designed with plowable noses.

5.7.5 Auxiliary Lanes

Auxiliary lanes are useful in maintaining the safety, traffic flow, and operation of a roadway or access. When auxiliary lanes are required by the Town or warranted by information obtained during the development review process, the applicant is responsible for design, installation, and any purchase of right-of-way to accommodate the required lane width. Auxiliary lanes are required when unique location factors (e.g., roadway speed and traffic density, access volume, the volume of commercial trucks, the influence of nearby accesses, existing auxiliary lanes close to the proposed access, nearby traffic control devices, available stopping sight distance, and other topographic or roadway design factors) exist that determine the need for auxiliary lanes. Auxiliary lanes are required to mitigate specifically identified and documented locations with safety and operation issues.

5.7.5.1 Deceleration Lanes

A left deceleration lane, [also called a left-turn lane](#), with storage length plus taper length, is required for any access with a projected peak hour left ingress turning volume greater than 25 vph. If the posted speed is greater than 40 mph, a deceleration lane and taper is required for any access with a projected peak hour left ingress turning volume greater than ~~10-15~~ 15 vph. The taper length will be included within the deceleration length. [A left deceleration lane is not required when the opposing projected peak hour traffic volume is less than 150 vph.](#)

A right deceleration lane, [also called a right-turn lane](#), with storage length plus taper length, is required for any access with a projected peak hour right ingress turning volume greater than 50 vph. If the posted speed is greater than 40 mph, a right turn deceleration lane and taper is required for any access with a projected peak hour right ingress turning volume greater than 25 vph. The taper length will be

included within the deceleration length. [A right deceleration lane is not required when the advancing projected peak hour traffic volume is less than 400 vph.](#)

5.7.5.1.1 Storage Length

The storage length for an auxiliary lane can be determined by the information summarized in Table 5.7. These lengths are based on the average length of a passenger vehicle and the estimated turning vehicles per hour. Estimated lengths for buses, larger trucks, and recreational vehicles must be determined and submitted to the Town for review. The basis for designing the length of required storage is to provide sufficient length for vehicles to queue within the lane without affecting other movements. Table 5.8 provides the required storage lengths for stop-controlled and signal-controlled intersections. If the Department of Public Works determines that meeting the required storage length is impractical or will result in an unsafe condition, the minimum storage length shall be based on the mean arrival rate. But in no case shall the minimum auxiliary lane length be less than 50 feet.

Table 5.7. Acceleration/Deceleration Lane Design Criteria

Posted Speed Limit (mph)	25	30	35	40	45
Deceleration length (ft)	180	250	310	370	435
Acceleration length (ft)	N/A	190	270	380	550
Transition taper (ratio)	7.5:1	8:1	10:1	12:1	13.5:1
Straight taper (ratio)	15:1	15:1	20:1	30:1	45:1

Table 5.8. Auxiliary Lane Storage Lengths

Turning vehicles per hour	<30	30-59	60-100	>100
Minimum required storage length (ft)	25	40	50	100

5.7.5.1.2 Tapers

Auxiliary lanes typically consist of one or more of the following: transition taper, full width auxiliary lane, and storage length. The use of these components varies based on the type of access, through street classification, and site-specific conditions (grades). To determine the required acceleration and deceleration lane and transition taper length, see design criteria presented in Table 5.7. The length of the required transition taper is determined by multiplying the distance offset by the transition taper ratio value associated with the posted speed. The beginning and ending point of all tapers shall be rounded.

Transition tapers: The purpose of a transition taper is to provide sufficient length for a vehicle to accelerate or decelerate to the appropriate speed and merge into and out of the through traffic lanes without disrupting traffic flow. The length of a transition taper is calculated by multiplying the width of the lane by a standard ratio. The beginning and ending point of all tapers shall be rounded.

Redirect or straight tapers: Redirect tapers shall be used where an exclusive turn lane, median, or other redirection of vehicles is necessary and where redirection of the flow of traffic is necessary to accommodate the exclusive turn lane or median. If the redirect taper would result in a horizontal curve design deficiency for the through movement, the horizontal curve shall be corrected. Redirect tapers should be designed as straight tapers with the beginning and ending points rounded.

5.7.5.2 Acceleration Lanes

Acceleration lanes are required at any access with a project peak hour right turn volume of greater than 50 vph and a posted speed of 40 mph or greater. The purpose of an acceleration lane and

transition taper is to provide sufficient length for a vehicle to accelerate to the appropriate speed and merge into the through traffic lanes without disrupting traffic flow. Table 5.7 above provides the required acceleration lane and transition taper lengths by design speed. Acceleration lane lengths shall be adjusted for a grade of 3% or more. The total length of the acceleration lane includes the values of both the lane and transition taper. Shorter acceleration lanes are not permitted, as they are not used properly by most of the traveling public.

5.7.5.3 Two-way Left Turn Lanes

Two-way left turn lanes should be used sparingly. Two-way left turn lanes may be considered on arterial roadways in areas where several low-volume commercial accesses are closely spaced. Two-way left turn lanes shall be 12-16 feet wide.

5.8 DEAD END STREETS (CUL-DE-SACS)

Dead-end streets are discouraged and shall be avoided unless topographic or other unique site constraints limit construction of interconnected streets. The design of cul-de-sacs will be reviewed following the Street Standard Drawings. Any public street or private street that dead ends shall terminate in a cul-de-sac. All cul-de-sacs shall include signage within fifty feet of the inlet indicating that the street is a dead-end street.

5.9 BRIDGES

Bridges, arch culverts, and other structures shall be designed per the CDOT Bridge Design Manual and AASHTO standards. Bridges shall be designed to accommodate the full lane widths, shoulders, curbs, sidewalks, ROW widths, and other improvements detailed in this chapter. Future development and improvements shall be considered when designing bridges. Pedestrian bridges shall exceed the width of the pedestrian route it is serving and shall be 8' minimum width for shared use paths and 12' minimum width for shared use paths.

See Town of Breckenridge Open Space and Trail standards for requirements on bridges for soft surface trails.

See Chapter 6 of these standards for hydrologic requirements of bridge structures.

5.10 ACCESS CONTROL AND MANAGEMENT

An access is defined as a privately owned connection to a Town street or right-of-way and may also be referred to as [an access road or driveway](#). [A Town, County, or CDOT owned roadway is not classified as an access](#). Establishing access criteria and the application of access management techniques is highly desirable on public streets. Effective access management enhances the capacity and safety of a street and preserves those elements as the corridor develops further. While access to adjacent properties are required, the Town should attempt to limit the number of access points and their locations, especially on intersection approaches.

5.10.1 Private Access

Private accesses service ~~three-four~~ or less single-family homes ~~or~~, one multi-family property, or one commercial property. An access serving five or more homes shall be classified as either a public or private street and not an access (see Section 5.19.1). Private accesses are not owned, maintained, or plowed by the Town. They are the sole responsibility of the property owner. A private access that serves multiple lots shall be located in an easement or common area. The easement or common area width shall accommodate the access width, drainage, construction requirements (slopes, etc.), snow storage, and other appropriate design elements. Cross parcel access easement shall not be less than 30 feet wide. Private access design shall also incorporate International Fire Code (IFC), Red, White,

and Blue Fire Department, and development code parking lot design requirements, which are listed those respective standards and codes.

5.10.1.1 Commercial

A commercial private access ~~road~~ is the ~~internal access drive system~~ paved vehicle access route for a commercial lot or development and may include the access ~~drives~~ driveways, and parking areas that serve the development.

5.10.1.2 Residential

A residential private access ~~road~~ is the ~~internal access drive system~~ paved vehicle access route for four or less single-family homes, two duplexes, one triplex, or a multi-family development and may include the access ~~drives~~ driveways, and parking areas that serve the development. An access to multiple duplexes or townhomes shall be a public road.

5.10.2 Access Management Principles

~~Access management is the coordinated planning, regulation, and design of access between roadways and land development. It involves the systematic control of the location, spacing, design, and operation of accesses, median openings, interchanges, and street connections. Access management provides the means to balance good mobility along the street network with local access needs of businesses and residents. Implementation of access management principles and techniques on transportation networks can provide the following long-term benefits for highway users, communities, and businesses.~~

5.10.45.10.2 Access Changes

Access changes on Town of Breckenridge streets will typically require a Town Development Permit and a Right of Way permit. Access changes on State Highway 9 will require a CDOT access permit. Access changes on a Town Street (not directly located on a State Highway), but increasing traffic at the nearest State Highway 9 intersection by at least 20%, will also require a CDOT access permit.

5.10.415.10.2.1 Number of Accesses

Only one access shall be provided per lot for safe ingress and egress. Where topographic or other site conditions exist, shared access between lots may be required.

Additional accesses may be approved off local streets that meet the minimum spacing requirements shown in Table 5.9. Accesses for a collector or arterial street frontage wherein a traffic impact study demonstrates a need for a second access based on traffic volumes, unique site or constraints or site requirements that generates the need for the second access; No feasible design alternatives are available to eliminate the need for a second access. Additional accesses may be allowed if required per IFC code requirements, or for large commercial developments. If an additional access is allowed, the second access shall be added from the minor street. Access from the major street shall be limited to the greatest extent possible.

Where an existing access is required to be removed, the owner is required to remove the driveway, the driveway connection to the public road, driveway apron, and other associated driveway improvements. Where the access crosses a sidewalk, owner will be required to remove the driveway cut and construct curb across the access. Owner will also be required to add any landscaping or block vehicle access with grading, landscaping, or other obstructions.

5.10.425.10.2.2 Location

Access shall be from the lowest classification street. Lots with alley frontage shall have access from the alley only. When sites adjacent to an alley redevelop, propose a significant remodel or addition, or

add a secondary unit, accesses and parking on an adjacent street shall be removed and access shall be solely from the alley. Accesses on a cul-de-sac shall be located to provide room for snow storage and shared access may be required. Exception: where there is an existing garage served by the street that shall remain without changes, the street access can remain to serve the garage. If feasible that access should be upgraded to meet current standards.

One driveway shall be allowed per lot unless otherwise permitted by the Town Engineer. Circular driveways, consisting of two curb cuts onto a street, are not permitted. [A second driveway access is only allowed when required by IFC or RWB fire requirements.](#)

All intersection and driveway accesses shall intersect the roadway at a ninety-degree angle.

No backout movements shall be permitted on arterial, major collectors, and minor collectors. Driveways on minor collector streets and above shall have internal circulation provided to allow turnaround movements within the driveway.

One-way accesses are discouraged.

Access location shall be configured to optimize sight distance, separation from adjacent intersections and driveways, and grade at the intersecting road (avoid steeper portions of adjacent roadway).

Commercial or multi-family residential accesses may not be allowed on roadway grades exceeding 6%. On roads exceeding 6%

5.10.55.10.3 Access Management Techniques

Several access management techniques may be used to implement best management practices. Techniques include, but are not limited to the following:

1. Consolidate access by reducing the number of access points that serve a single property or by providing joint access for multiple properties at or near a shared property line.
2. Connect adjacent properties to provide circulation between properties and increase access opportunities for multiple properties.
3. Define driveways to provide clear identification of entrance and exit locations.
4. Locate access to a side street (local road) instead of a major road (arterial or collector) to reduce vehicle conflict on the major road.

5.10.65.10.4 Sight Distance

Sight distance at accesses must comply with Chapter 9 of the *AASHTO Greenbook*. Table 5.9 identifies the appropriate design vehicle to be used for sight distance calculations. Where existing objects obstruct the AASHTO sight distance for single family or duplex homes, the sight distance triangle may be reduced from 14 feet to 10 feet from the edge of the roadway.

Table 5.9 Design Vehicle Selection for Access Sight Distance

Land Uses Served by Access	Design Vehicles (for sight distance calculations)
Residential (Non-School Bus Route)	Passenger Cars, Pickup Trucks
Part of Any School Bus Route Regardless of Land Use	No Less Than Single Unit Trucks
Office	Single Unit Trucks

Recreational	Single Unit Trucks
Commercial/Retail	Multi-Unit Trucks*
Industrial	Multi-Unit Trucks*
Municipal Streets & County Roads	Multi-Unit Trucks*
Agricultural Field Approaches <1 Per Day	Single Unit Trucks

*If Less Than 2 Multi-Unit Truck Trips Per Day (Average), Use Single Unit Truck

5.10.75.10.5 Access Spacing

Table 5.10. provides access spacing requirements based on street classification. [Access spacing and offset requirements shall be measured from the edges of the nearest curb returns or pavement radii terminations.](#)

Table 5.10 Access Spacing Requirements

Design Element	Street Classification of Road being accessed by Driveway			
	Arterial	Major Collector	Minor Collector	Local
Minimum Street Intersection Spacing Offset between Street Intersections	¼ ½-Mile	1000' ¼ Mile	500' ¼ Mile	300'
Offset between adjacent Major Access Driveways (≥100 trips per day)	300'	150'	100'	50'
Offset between adjacent Minor Access Driveways or one Major Access Driveway and one Minor Access Driveway (<100 trips per day)	150'	75'	50'	30'
Offset between Major or Minor access and street intersection	300'	150'	100'	50'

5.10.85.10.6 Access Width

Table 5.11 provides access width requirements.

Table 5.11 Access Width Requirements

Layout Parameters	Residential-1 Unit	Residential-2 Units	Residential-3-4 Units	Residential (Multi-Family Greater than 4 units)	Residential Private Street	Commercial or Industrial Private Access

Minimum Width	12'	12'	12'	12'	24'	12'
Maximum Width (Includes flared pavement radius at edge of roadway)	20'**	20'**	24'	24'	24'	32'*
Pavement Return Radius	0'-5'	0'-5'	0'-10'	0'-10'	10'-20'	10'-20'
Maximum Slope (Centerline)	8%	8%	8%	8%	6%	8%

*Utilization of maximum width shall be approved by the Town Engineer.

**Maximum width shall include pavement return radius

5.10.95.10.7 Access Type

5.10.9.15.10.7.1 Curb Cut Driveway

In general, if there is a pedestrian sidewalk path along the roadway where an access is proposed, the sidewalk shall continue across the driveway. Refer to the Street Standard Drawings for curb cut driveway requirements and details. Exceptions can be made when the single unit and multi-unit truck peak hour volume is greater than 5.

5.10.9.25.10.7.2 Radius Driveway

A radius driveway is defined as an access with curb ramps and without a continuous sidewalk across the access. Radius driveways shall be designed in accordance with intersection requirements of this chapter. With a radius driveway, access radii shall be per Table 5.11. If the design vehicle intended to use the access daily is a single-unit exceeding 30 feet, multi-unit, or another vehicle requiring a larger radius, the minimum turn radius accommodating this design vehicle shall be used. Access radii shall allow safe maneuvers without intrusion into adjacent highway travel lanes. In instances where multiple larger vehicles are likely to oppose each other at the access, the radii should be adequate to accommodate both vehicles without conflict. Radius shall balance vehicle access while also promoting slowing of vehicles. Smaller radii should be used where an access crosses a pedestrian route to encourage slower speeds.

5.10.105.10.8 Access Design Details

5.10.10.15.10.8.1 Access Profile

Driveways shall match the roadway cross-slope for the first five feet, shall not exceed 4% for the following 15 feet, and shall not exceed 8% for the remainder of the driveway.

If a pedestrian access route crosses the driveway, the driveway cross-slope shall be a maximum of 2% for the width of the pedestrian access route (minimum 4 feet wide).

5.10.10.25.10.8.2 Access Geometry

Driveways shall meet adjacent streets, alleys, or driveways at a ninety degree angle and remain perpendicular for a minimum of 10 feet from the intersection. Driveways shall have a minimum inside

turning radius of 26 feet and outside radius of 38 feet for fire department access, unless an alternate fire access is provided.

5.10.10.35.10.8.3 *Access Surfacing*

All accesses shall be paved. Pavement placement shall occur prior to issuance of certificate of occupancy or sooner if required to meet Fire Department or utility requirements. All accesses serving more than four units or lots shall be maintained in proper working condition to prevent potholes and overall surface deterioration. All access and parking areas shall be paved with asphalt, concrete, recycled asphalt, or other all-weather drivable surface approved by the Town Engineer. Access flexible pavement sections shall match the roadway pavement section for a minimum of 10 feet from the edge of the traveled way. Concrete accesses shall either terminate 4 feet from the edge of asphalt on Public Streets with a 3-inch thick minimum asphalt apron constructed between the concrete access and the public street., or concrete can be placed to the edge of asphalt if it is even with or 1 inch lower than the top of asphalt and an expansion joint is provided between the asphalt/concrete interface.

Asphalt pavement shall be a minimum of 3" asphalt on 4" aggregate base course between the roadway and edge of right of way.

5.10.8.4 *Access Drainage*

Any access connecting to a road with curb and gutter or valley pans shall have a concrete cross-pan installed across the driveway. Any access connecting to a road with an existing road side ditch shall have an 18 inch culvert installed beneath the driveway. The roadside ditch shall be re-graded as needed from the ends of the culvert until the ditch daylights at a 1% slope. Where an access is added to the downhill side of a road and there is no curb, valley pans, or ditches on the existing road, the access may be exempted from the cross pan and culvert requirement.

5.10.9 *Access Maintenance*

An access does not typically require an encroachment license in the right-of-way. The access and all associated improvements (pavement, culvert, cross pan, flared end sections) shall not be owned or maintained by the Town. All ownership, maintenance, and replacement work shall be the responsibility of the owner. The Town is not liable for any damage incurred by the Town or others to driveway improvements within the right-of-way. The Town shall not be responsible for any damage caused by snow removal, Town vehicles, maintenance, or any other causes. The Town shall have the right to work on the access improvements within the right-of-way as required, such as clearing sediment from culverts and connecting to the access pavement when re-paving the public road, but the Town shall be under no obligation to complete any repair or maintenance.

5.11 PARKING AREAS (ON-STREET PARKING WITHIN RIGHT-OF-WAY)

Section 5.11 sets minimum standards for on-street parking. ~~See Development Code for off-street parking requirements.~~ See Chapter 3 of Title 9 of the Town Code for off-street parking requirements.

5.11.25.11.1 *On-street Parking*

On-Street Parking shall be provided as shown within the street classification cross sections. On-street parking may be provided along streets when approved as part of the ~~Land Development~~ permit approval ~~process~~. All eligible on-street parking areas shall be clearly depicted on a plan. Such parking areas shall not conflict with any turning movements or obstruct access to any street, sidewalk, crosswalk, alley, access, or fire hydrant. ~~To accommodate on-street parking, a credit toward satisfying minimum off-street parking requirements shall be granted can be considered for any development that creates additional on-street parking spaces along a public street through the elimination of existing curb cuts or driveways. See the Development Code for detailed parking requirements based upon existing land use.~~

5.11.35.11.2 Parking Area Surfacing

All parking areas shall be paved with asphalt, concrete, recycled asphalt, or other all-weather drivable surface approved by the Town Engineer.

5.11.45.11.3 Parking Grades

Parking areas shall have a maximum grade of 4% and a minimum grade of 1%. ADA parking spaces shall have a maximum grade of 2% in any direction.

5.11.55.11.4 Parking Stall Requirements

Minimum parking stall size requirements are described below. Parking shall not encroach onto sidewalk, bike lanes, or other pedestrian facilities.

1. The minimum stall size shall be 18 feet long by 9 feet wide for 90 degree or angled parking. Actual striping dimensions shall be adjusted for angled parking to fit the minimum stall size.
2. Parallel parking: 25 feet long by 8 feet wide. Parallel parking stall at the end of a block may be reduced to 20 feet. Accessible parallel parking spaces shall be located near a curb ramp and shall be in an area that is not obstructed by trees or other objects behind the curb.
3. Accessible parking: 18 feet long by 8 feet wide, with a 5- to 8-foot accessibility lane (8 feet is required for van parking). An ADA accessible route shall be provided from the ~~the- accessible handicap~~ stalls to the businesses being served or the nearest pedestrian route. ADA parking space location, frequency, slopes, and other requirements shall meet PROWAG standards.

5.11.65.11.5 Parking Construction Requirements

Construction of on street parking shall meet all standards and specifications of the adjacent street, including pavement thickness, compaction, and other construction specifications. See Chapter 9 of these standards for additional construction requirements.

5.12 PEDESTRIAN AND BICYCLE FACILITIES

Increasing congestion and mode conflict is accompanied by growing public awareness of the need of safe and convenient multi-modal facilities to promote alternative transportation and healthy lifestyles. This section provides for the design of pedestrian, bicycle and transit facilities that play a key role in providing improved accessibility, mobility, and transportation system continuity.

This section shall be used in combination with the AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities, AASHTO Guide for the Development of Bicycle Facilities, CDOT Roadway Design Guide (Chapters 12 and 14), Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG), and ADA Accessibility Guidelines (ADAAG) for the design and installation of all pedestrian and bicycle facilities. Where no requirement is given, the current edition of the design standards listed above shall govern.

Section 5.12 applies to both public and private streets. Internal circulation (outside of right-of-way or private street) for individual single family homes or duplexes, and other private development, as determined by the Town Engineer, may be exempted from the requirements of 5.12.

5.12.1 Pedestrian Facilities

All local, minor collector, and major collector roads shall have a minimum of one sidewalk. Town Engineer may require additional sidewalks, shared use paths, and other pedestrian facilities. Sidewalks and other pedestrian facilities shall be installed per the Town's Sidewalk Master Plan, these standards, and as determined by the Town Engineer.

5.12.1.1 Pedestrian Environmental Impact

Sidewalks shall be designed to fit the existing topography and vegetation and minimize site disturbance, removal of vegetation, and disturbance to sensitive environmental areas.

5.12.1.2 Pedestrian Facility Widths

Sidewalks shall be a minimum of 5 feet wide for local roads. Major and minor collector pedestrian facilities shall be a minimum of 6 feet wide.

Soft surface trails intended for ADA accessibility shall have a minimum width of 4 feet wide.

5.12.1.3 Pedestrian Pavement Thickness

Concrete sidewalks shall be a minimum of 5 inches thick. Sidewalks within a driveway shall be a minimum of 6 inches thick and reinforced with welded wire reinforcement. Sidewalks crossing a driveway with heavy commercial loading shall be a minimum of 8 inches thick. All concrete sidewalk pavement shall be placed on a minimum thickness of a 4 inch aggregate base course layer.

5.12.1.4 Horizontal and Vertical Clearance

Sidewalk vertical clearance shall be a minimum of 8 feet. Sidewalk horizontal clearance shall be 3 feet preferred and 2 feet minimum. No structures or other objects shall extend into the clearance offsets.

5.12.1.5 Sidewalk Widening

When a sidewalk is required to be widened, the widening must be a minimum width of 4 feet or more. If the required added width is less than 4 feet, the existing sidewalk shall be removed and reconstructed to the required width.

5.12.1.6 Slope

The minimum cross slope of a sidewalk is 1% and the maximum cross slope is 2%, measured perpendicular to the sidewalk or path alignment. The cross-slope shall generally be towards the roadway, unless drainage facilities are provided behind the sidewalk. The maximum running slope for sidewalk not aligned with a roadway is 5%. If the sidewalk is aligned with the roadway, the sidewalk may match the slope of the roadway. See Section 5.13 of this chapter for ADA requirements of sidewalks and curb ramps. Sidewalks shall be accessible and shall have directional curb ramps.

5.12.1.7 Sidewalk Shouldering

Sidewalks shall have a compacted aggregate base course shoulder of 1-foot minimum width. The shoulder shall be sloped at a minimum of 1% away from the sidewalk. Landscaping may extend to the edge of the sidewalk only if the area is graded at 1%, grass or plantings are selected that do not cause maintenance issues, and the landscaping does not extend horizontally into the landscaping. Short grasses are typically the only landscaping allowed in the shoulder area.

5.12.1.8 Sidewalk Stormwater

Sidewalk shall be designed to handle runoff and provide positive drainage away from the sidewalk, typically towards the roadway. Obstructions shall not be placed at the edge of the sidewalk which obstruct stormwater flow. Low points in the sidewalk should be avoided to the extent possible due to ponding and freezing conditions in the winter.

5.12.1.9 Sidewalk Alignment

Standalone sidewalks and trail connections are encouraged in developments where their additions provide a shorter connection for pedestrians. Sidewalk alignments shall strive to provide the shortest distances between locations in order to promote efficiency of pedestrian transportation and to prevent pedestrians from walking outside the sidewalks.

5.12.1.10 Heated Sidewalks

This section only applies to heated sidewalks located within the Town right-of-way. For private snow melt systems, see Section 5.19.2 of this chapter [and section 9-1-19-33A and 33R of the Town Code](#). Heated sidewalks located within Town right-of-way shall be designed by a Colorado licensed Professional Engineer. Heated sidewalks shall be designed with the following requirements:

- Snowmelt systems shall be hydronic snowmelt systems designed to produce a minimum of 125 BTU/SF and hydronic tubing loops shall be a maximum of 300 linear feet, unless an alternate design of acceptable performance is submitted by a Professional Engineer.
- Manifolds shall be located in traffic rated boxes placed outside of the concrete pavement.
- Concrete shall be a minimum of 5" thick.
- High PSI (60 psi) board insulation shall be placed beneath sidewalks which do not receive heavy traffic loads. In areas are expected to experience heavy truck traffic, astrofoil or other non-compressible insulation shall be placed beneath pavement.
- Welded wire mesh or other reinforcement shall be installed in traffic areas.
- Cold joints, where heated pavement meets non-heated pavement, shall be filled with backer rod and sealant to limit moisture infiltration.
- Heated pavement shall be doweled or connected by other means to non-heated pavement to minimize differential settlement and prevent trip hazards. Doweling is not required adjacent to curb, buildings, walls, or other locations that are not within the pedestrian path.
- Heated pavement shall be graded with a cross-slope and shall not drain onto non-heated pavement, creating any icing or safety hazards. Drainage shall be directed to an inlet, swale, drywell, or other approved connection point.

5.12.1.11 Trail Connections

Soft surface trail connections are encouraged and shall be installed per the Breckenridge [Trails-Open Space and Trails Master Plan](#) and as required by the Town Engineer. Soft surface trails provide connections to existing trails, open spaces, parks, and other community destinations for pedestrians, bicyclists, and other non-motorized uses. Soft surface trails shall be designed and installed to limit grading impacts, tree removals, and other disturbance. Additional design and install details shall be coordinated and approved by the Town of Breckenridge Open Space and Trails [Department/Division](#).

5.12.1.12 Pedestrian Bridges

Pedestrian bridges shall be a minimum width of 8 feet. Pedestrian bridges on the Blue River Rec Path shall be a minimum of 14 feet. Pedestrian railings shall be provided along bridges. See Chapter 6 for hydrologic requirements of pedestrian bridges. Pedestrian bridges on the Blue River Rec Path or bridges being maintained by the Town shall be designed to accommodate a 20 TON design vehicle. All pedestrian bridges shall be designed for the snow loads per Breckenridge Building Code. See Open Space and Trail standards for bridge requirements serving soft surface trails.

5.12.1.13 Pedestrian Railings

Hazards located near a sidewalk shall require a pedestrian railing or other barrier at the edge of the path. Examples of hazards include 2:1 slopes and vertical drops exceeding 30 inches.

5.12.1.14 Pedestrian Easements

All pedestrian facilities and trails not located within ROW shall be located within an access easement. Pedestrian facilities and trails shall have a 5-foot minimum distance from back of sidewalk/trail to edge of ROW/easement to accommodate drainage, signage, lighting, and utilities.

5.12.2 Bicycle & Shared-use Facilities

Bicycle & Shared-use facilities shall be installed per the Breckenridge [Open Space and Trails Master Plan](#), Sidewalk Master Plan, and by the direction of the Town Engineer, and any other applicable requirements. Bicycle facility design shall follow the AASHTO Guide for the Development of Bicycle Facilities, current edition and the CDOT Roadway Design Guide for Bicycle and Pedestrian Facilities. Sight distance, vertical geometry, and horizontal geometry shall meet the requirements of AASHTO and CDOT.

For this chapter, the term shared-use will apply to both shared-use facilities and bicycle facilities.

5.12.2.1 Shared-use Environmental Impact

Shared-use paths shall be designed to fit the existing topography and vegetation and minimize site disturbance, removal of vegetation, and disturbance to sensitive environmental areas.

5.12.2.2 Design Speed

The design speed for shared-use paths on grades of 4% or less shall be 20 mph. The design speed for sections of shared use-paths exceeding 4% shall be 30 mph. For shared-use paths near intersections, underpasses, or other hazards where traffic calming is warranted, a lower design speed may be submitted to the Town Engineer for approval.

5.12.2.3 Shared-use Facility Widths

Shared use paths shall be at least 10 feet wide; the Blue River Recreation Path shall be at least 14 feet wide. Underpass widths shall be at least 14 feet wide.

5.12.2.4 Shared-use Pavement Thickness

Concrete shared-use paths shall be a minimum of 5 inches thick. Shared-use paths within a driveway shall be a minimum of 6 inches thick and reinforced with welded wire reinforcement. Shared-use paths crossing a driveway with heavy commercial loading shall be a minimum of 8 inches thick. Longitudinal joints in the concrete shall not be allowed in shared use paths. Transverse joints shall be sawcut and shall not be tooled.

Asphalt pavement for shared-use paths shall be a minimum of 3 inches thick and placed in two lifts. Asphalt shared-use paths within a driveway shall be a minimum of 4 inches thick.

All concrete sidewalk pavement shall be placed on a minimum thickness of a 4 inch aggregate base course layer.

Concrete and asphalt pavements for shared use paths shall be designed by a professional engineer licensed in the state of Colorado.

5.12.2.5 Shared-use Horizontal and Vertical Clearance

Shared-use paths shall have a minimum vertical clearance of 10 feet. Shared-use paths shall have a minimum horizontal clearance of 3 feet from the edge of pavement. No structures or other objects shall extend into the clearance offsets.

5.12.2.6 *Shared-use Widening*

When a shared-use path is to be widened or a pavement cut is planned, the full width of pavement shall be removed and replaced. No longitudinal joints will be allowed in concrete or asphalt shared-use paths.

5.12.2.7 *Shared-use Slope*

The minimum cross slope of a shared-use path is 1% and the maximum cross slope is 2%. The maximum running slope for a shared-use path not aligned with a roadway is 5%. If the shared-use path is aligned with the roadway, the sidewalk may match the slope of the roadway. See Section 5.13 of this chapter for ADA requirements of curb ramps. Shared-use paths shall be accessible and shall have directional curb ramps.

5.12.2.8 *Shared-use Shouldering*

Shared-use paths shall have a compacted shoulder with a minimum width of 2 feet wide. The shoulder shall be sloped at a minimum of 1% and a maximum of 16% away from the shared-use path.

5.12.2.9 *Shared-use Stormwater*

Shared-use path design shall consider runoff and provide positive drainage away from the path. Obstructions shall not be placed at the edge of the path which obstructs stormwater flow. Low points in the path should be avoided to the extent possible due to ponding and freezing conditions in the winter.

5.12.2.10 *Shared-use Alignment*

Standalone shared-use paths and trail connections are encouraged in developments where their additions provide a shorter connection for pedestrians. Shared-use alignments shall strive to provide the shortest distances between locations in order to promote efficiency of pedestrian transportation and to prevent pedestrians from walking outside the sidewalks.

5.12.2.11 *Shared-use Bridges*

Shared-use bridges shall be a minimum width of 10 feet. Bridges on the Blue River Rec Path shall be a minimum width of 14 feet. Pedestrian railings shall be provided along bridges. See Chapter 6 for hydrologic requirements of pedestrian bridges.

5.12.2.12 *Shared-use Railings*

Hazards located within the clear zone of the shared-use path shall require a pedestrian railing or other barrier at the edge of the path. Examples of hazards include 2:1 slopes, vertical drops exceeding 30 inches, and structures in the clear zone.

5.12.2.13 *Shared-use Easements*

All shared-use facilities and trails not located within ROW shall be located within an access easement. Pedestrian facilities and trails shall have a 5-foot minimum distance from back of shared-use path/trail to edge of ROW/easement to accommodate drainage, signage, lighting, and utilities.

Where outside of the ROW, the bicycle facility shall be in a public access easement of sufficient width to allow for repairs to the facility, accommodate any drainage, and allow for installation of any required signs.

All arterial and collector street cross sections include bike lanes on both sides of the street or a shared use path. The minimum width of the bike lanes is 5 feet.

Bicycle lanes on streets without on-street parking shall be at least 5 feet wide, exclusive of the curb pan, or 6.5' from the face of any curb. On existing streets where on-street bike lanes are being added and available right-of-way or improvements space is restricted, the width of the bicycle lane may be reduced to at least 5 feet wide, inclusive of the curb pan. Bicycle lanes on streets with on-street parking shall be at least 5 feet wide, exclusive of the parking lane, or 13 feet from the face of any curb. On existing streets where on-street bike lanes are being added and available right-of-way or improvements space is restricted, the width of the bicycle lane may be reduced to at least 4 feet wide, exclusive of the parking lane, or 12 feet from the face of any curb.

5.13 ACCESSIBLE PEDESTRIAN DESIGN

Curb Ramps on sidewalks shall be designed to comply with *Public Rights-of-Way Accessibility Guidelines* including detectable warnings. Where feasible separate ramps shall be provided for each crossing direction. Where site constraints prohibit separate ramps, a single multidirectional ramp may be used. Refer to *CDOT M & S Standard Plans* for ramp details. The standard detectable warning shall be cast iron, natural finish plates or approved equal.

5.13.1 ADA Accessibility Requirements, Standards, and Guidelines

The ADAAG and the PROWAG are not requirements of the ADA but serve as the standards and guidelines by which compliance of the law is measured. Generally, the ADA law requires:

1. New construction to be accessible
2. Alterations to existing facilities that are within the scope of a project to provide accessibility to the maximum extent feasible
3. Existing facilities that have not been altered shall not deny access to persons with disabilities

All new construction projects where a pedestrian demand is exhibited shall incorporate appropriate pedestrian facilities that are accessible to persons with disabilities. New construction projects have the ability to mitigate constraints through good planning and design practices. Project budget or limited scopes are not an acceptable reason to fail to provide compliant accessible facilities during new construction.

5.13.2 Technical Requirements for Accessible Design

The pedestrian access route (PAR) is a continuous and unobstructed path of travel provided for pedestrians with disabilities within or coinciding with a pedestrian circulation path.

The continuous width of the PAR shall be 5 feet minimum, exclusive of the curb. Where a pedestrian access route makes a 90-degree turn, it should be widened to 5 feet to accommodate the continuous passage of a wheelchair (i.e. pedestrian design vehicle). If the clear width of the PAR is less than 5 feet, passing spaces shall be provided at a maximum of 200-foot intervals. If passing spaces are provided, they shall be 5 feet by 5 feet minimum. The clear width of a pedestrian refuge island shall be 5 feet minimum.

Pedestrian facilities shall have a maximum running slope of 5%. If the grade of the roadway is steeper than 5%, then running slopes are permitted to match the grade of the roadway.

Pinch points should generally be avoided. Pinch points within the PAR shall not be less than 34 inches in width and not exceed 24 inches in the direction of pedestrian travel.

5.13.3 Curb Ramp Types

See the Street Standard Details for approved curb ramp types.

5.13.4 Curb Ramp Technical Requirements

5.13.4.1 Ramps

Curb ramps shall have a maximum running slope of 8.33%. The running slope of a curb ramp is measured in the center of the ramp run in the direction of pedestrian travel. If the surrounding terrain requires a ramp to chase grade, the ramp is required to be no longer than 15 feet, regardless of the resulting slope.

5.13.4.2 Landings and Turning Spaces

Landings and turning spaces allow users to maneuver on and off the curb ramp and are required at the top or bottom of a curb ramp. Turning spaces are required at the top of a perpendicular curb ramp and at the bottom of a parallel curb ramp. The maximum running slope and cross slope of landings and turning spaces shall be 2.0%. At mid-block crossings or locations without yield or stop control, the cross slope of the turning space can equal the street or highway grade. Turning spaces shall be 4 feet by 4 feet minimum. If the turning space is constrained by a vertical element on one or more sides, provide 5 feet in the direction of the street crossing.

When the profile of the roadway being crossed has an excessive slope, the curb ramp cross slope should be transitioned slowly to the turning space. The transition shall be spread evenly over the length of the curb ramp. See Curb Ramp Standard Details.

5.13.4.3 Cross Slopes

Cross slopes of all pedestrian facilities shall be a minimum of 1% and shall not exceed 2%.

5.13.5 Detectable Warning Surfaces

Detectable warning surfaces shall be made of untreated steel plates. Brick pavers are not permitted for detectable warnings. See CDOT M-Standards for Curb Ramps for detectable warning requirements.

5.13.6 Pedestrian Crossings at Controlled Intersections

Refer to Section 5.10 for Pedestrian Crossings at uncontrolled or mid-block crossings.

5.13.6.1 Signalized Intersection Crossing Controls

If an intersection under signal control has sidewalks, then marked crosswalks should be provided. In urbanized areas pedestrian signals are recommended at all intersections where sidewalks are provided on the approaches to a signalized intersection. STOP lines shall be placed a minimum of 4 feet in advance of the crosswalks. Consideration may be given to providing advance right turn STOP lines to improve the visibility of pedestrians coming from the motorist's left.

Pedestrian push buttons shall be accessible to pedestrians via an accessible pedestrian route in compliance with the ADA.

The draft PROWAG requires that whenever pedestrian signals are installed, accessible pedestrian push buttons be installed. Push buttons shall be connected to a fully-accessible pedestrian signal that complies with the *2009 MUTCD with amendments*, with the ability to enable or disable accessible features. The Town Engineer will decide on which functions to activate at each accessible pedestrian crossing on a case-by-case basis.

At intersections with high volumes of pedestrians, consideration should be given to restricting the right turn on red movement.

5.13.6.2 Stop and Yield Crossing Controls

At a minimum, marked crosswalks should be provided wherever a sidewalk crosses a street under stop or yield control. STOP or YIELD lines shall be placed a minimum of 4 feet in advance of the crosswalks.

5.13.6.3 Roundabout Crossing Controls

Requirements for roundabout crossings shall reference the latest version of *NCHRP Report 672 – Roundabouts: An Informational Guide* and the PROWAG.

5.13.7 ADA Curb Ramp Variance Process

It can be impractical to make facilities fully compliant with the standards due to existing site constraints. Improvements at locations can be deemed “Technically Infeasible” when sound engineering judgement is exercised. When full compliance is deemed technically infeasible, facilities being altered should be made accessible to the maximum extent practicable. If a site cannot meet accessibility standards, the proper documentation procedures should be followed.

Examples of site constraints that may make it technically infeasible to make a facility fully compliant include:

1. Adjacent development or buildings that would need to be moved or altered to make a facility fully compliant.
2. Required improvements that would alter the status of a Historic property.
3. Drainage that could not be maintained if an area is made fully accessible.
4. Underlying terrain that would require significant expansion of the project scope to achieve full compliance. An example would be altering a roadway profile to make the cross slope of a crosswalk fully compliant.

Project scope, not cost, should determine when existing constraints make an item technically infeasible.

To submit a curb ramp variance, the Town's Variance Request Form must be completed and signed by a licensed professional engineer documenting why the curb ramp was deemed technically infeasible and every effort was made to design the curb ramp to meet ADA compliance. The request will be reviewed by the Town Engineer, and once approved, will be filed with the Town in the instance that an ADA complaint is received by the Town.

5.14 PEDESTRIAN CROSSING CRITERIA FOR UNCONTROLLED OR MID-BLOCK CROSSINGS

The purpose of Section 5.14 is to serve as a policy to determine where uncontrolled pedestrian crossings should be located, and how to improve existing uncontrolled pedestrian street crossings within the Town.

5.14.1 Definitions

Uncontrolled pedestrian crossings are defined as:

1. Legal crossings that are located at an intersection without a traffic signal
2. Legal crossings without STOP or YIELD signs.

Mid-block crossings are defined as crossings that do not occur at an intersection and are marked to indicate that the location is a legal crossing.

Crossings can be marked with traffic control markings or unmarked with no traffic control markings present.

5.14.2 References

The newest versions of the following references shall be used for guidance in determining location, design elements, and requirements:

1. *The Manual on Uniform Traffic Control Devices 2009 Edition* including Revisions 1 and 2.
2. *Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations (FHWA, 2018)*.
3. *NCHRP Research Report 841 Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments (2017)*.
4. *Evaluation of R1-6 Gateway Treatment Alternatives for Pedestrian Crossings: Follow-Up Report (Roadway Safety Institute, 2017)*.
5. *TCRP Report 112 / NCHRP Report 562 Improving Pedestrian Safety at Unsignalized Crossings (2006)*.
6. *CDOT Roadway Design Guide, Chapter 14 (2018)*
7. *CDOT Standard Plan S-614-14 for Rectangular Rapid Flashing Beacon requirements (hard-wired only)*

References listed above can be utilized in instances where this document does not specifically include requirements or guidance on a particular topic.

5.14.3 Pedestrian Traffic Analysis and Recommendations

An engineering study should be performed at the discretion of the Town Engineer before a crosswalk is installed at a location away from a traffic signal or an approach controlled by a STOP or YIELD sign. If a pedestrian crossing is part of a development application, then a traffic study may also be required as described in Chapter 4 and the traffic studies may be combined. The engineering study shall be stamped by a professional engineer. The following steps are required as part of the Pedestrian Traffic Analysis:

1. Complete the worksheet shown in Table 5.12. If worksheet result is yes, proceed with developing the Pedestrian Traffic Analysis. If the worksheet result is no, no additional analysis is required.
2. Include number of lanes, presence of a median, distance from adjacent signalized intersections, average daily traffic (ADT), posted or statutory speed limit (85th-percentile or mean speed), crash history, geometry of the location, possible consolidation of multiple crossing points, availability of street lighting, and any other factors deemed appropriate by engineering judgement.
3. Provide pedestrian volumes and delays (see Section 5.10.3.1)
4. Crossing treatment recommendations based on criteria and sound engineering judgement (see Section 5.10.3.2)
5. Conclusion of results.

5.14.3.1 Pedestrian Volumes and Delays

Pedestrian volumes and delays will typically involve AM, mid-day, and PM peak hours. Locations near schools may only require two hours of data collection (AM and PM peak hours corresponding to school opening and closing times). All pedestrian volumes should include and differentiate between pedestrians and bicyclists and should note separately the number of young, elderly, and/or disabled

pedestrians. For locations where school crossing traffic is anticipated, the volume of student pedestrians (school age pedestrians on their way to/from school) should also be separately noted.

Whenever possible, pedestrian and bicycle volumes should be collected in the appropriate season when volumes may be close to or at their peak. Counts should be scheduled at a time when nearby businesses are open. If school traffic is an issue, the counts should be scheduled on school days when classes are in session. Given the potential fluctuation in pedestrian traffic from day to day, it may be necessary to collect up to three days of data to determine if an enhanced pedestrian crossing treatment is warranted as follows:

1. Collect pedestrian data on day one. If the minimum pedestrian volume threshold (20 pedestrians per hour accounting for a 1.33 multiplier used if vulnerable populations are present) is exceeded, no further pedestrian data collection is needed. If the threshold has not been exceeded, but at least 50% of the minimum pedestrian volume was observed, proceed to a second day of data collection.
2. Collect pedestrian data on day two. If the minimum pedestrian volume threshold is exceeded, no further pedestrian data collection is needed. If the threshold has not been met but again the volume is at least 50% of the minimum threshold, proceed to a third day of data collection.
3. Collect pedestrian data on day three. If the minimum pedestrian volume still has not been met, then no marked pedestrian crossing treatment is warranted by pedestrian crossing volume.

Pedestrian delays should be measured using procedures from the latest version of the Highway Capacity Manual.

5.14.3.2 *Crossing Treatment Criteria*

The following criteria shall be used in determining if crossing treatments are to be considered and shall be used to complete the worksheet shown in Table 5.12. If a crossing treatment should be considered, Section 5.10.5 shall be used to determine what type(s) of treatment is/are appropriate.

5.14.3.2.1 Criterion A

When vehicle volume is less than 5,000 vehicles per day or the average vehicle speed does not exceed 10 mph over the posted speed, crosswalk enhancements will be considered when there is a crossing pedestrian volume of at least 20 pedestrians per hour. When vehicle volume is greater than or equal to 5,000 vehicles per day or the average vehicle speed is 10 mph greater than the posted speed limit, crosswalk enhancements will be considered when there is a crossing pedestrian volume of at least 10 pedestrians per hour. A multiplication factor of 1.33 can be applied to the hour pedestrian volume if the volume consists of vulnerable populations (children, elderly, persons with disabilities, etc.). See lines (1) through (3) of Table 5.12.

5.14.3.2.2 Criterion B

Crosswalks enhancements will be considered when they could directly service or are adjacent to an existing shared-use path or trail, park, school, hospital, senior center, recreation center, library, or other facility with sensitive populations as determined by the Town Engineer. The minimum hourly pedestrian volume criterion may be waived if this criterion is satisfied. See line (4) of Table 5.12.

5.14.3.2.3 Criterion C

Crosswalk enhancements will be considered in locations where there are greater than 1 non-motorized (vehicle to pedestrian or vehicle to bicycle) crashes within the last 3 years. The minimum hourly pedestrian volume criterion may be waived if this criterion is satisfied. See line (5) of Table 5.12.

5.14.3.2.4 Criterion D

If criterion A, B, or C is met, the location must then also meet the following criteria:

1. The minimum stopping sight distance is available and free from obstructions. The minimum stopping sight distance shall be calculated using intersection sight distance per Section 5.6.1.5.
2. The crossing should match the grade of the existing roadway. More detail regarding maximum roadway grade can be found in Section 5.4.3.2.
3. The distance to the nearest existing marked or controlled crosswalk is at least 300 feet. If an existing marked or controlled crosswalk is within 300 feet, care should be given to direct pedestrian traffic to said crosswalk.
4. The existing roadway shall have a maximum slope of 6% in the downhill direction for a minimum distance of 200 feet. If the slope exceeds 6%, a crossing will not be allowed or the road must be re-graded to reduce the slope.

See lines (6) through (9) of Table 5.12.

5.14.4 Crossing Enhancement Eligibility Worksheet

The following table shall be used to determine if an uncontrolled or mid-block crossing is eligible for enhancement. A blank version of this worksheet can be found in Appendix E to assist with documentation of location decisions at the discretion of the Town Engineer.

Table 5.12 Crossing Enhancement Eligibility Worksheet

Criterion	Line	Criteria	Value	Eligibility Requirement
A	(1)	Average daily vehicle traffic	#	See (5)
	(2)	Mean vehicle speed differential from posted speed limit	#	See (5)
	(3)	Number of pedestrians per hour	#	See (5)
	(4)	Does the location serve a vulnerable population (children, elderly, persons with disabilities, etc.)?	Yes/No	See (5)
	(5)	Adjusted number of pedestrians per hour	#	If (4) is Yes, then value = (3)*1.33, otherwise value = (3) Eligibility Requirement: When (1) < 5,000 or (2) < 10, then ≥ 20 When (1) ≥ 5,000 or (2) ≥ 10, then ≥ 10
B	(6)	Does the location directly serve or is adjacent to one of the following: Existing shared-use path or trail; park; school; hospital; senior center; recreation center; library?	Yes/No	If Yes, then (5) eligibility requirement is waived
C	(7)	Number of non-motorized crashes in the last three years	#	If ≥ 6, then (5) eligibility requirement is waived
D	(8)	Is the minimum stopping sight distance available (see Section 5.6.1.5)?	Yes/No	Eligibility Requirement: Yes

	(9)	Will the crossing match the existing roadway grade or less?	Yes/No	<i>Eligibility Requirement: Yes, cannot be greater</i>
	(10)	Distance to nearest existing marked or controlled crossing (feet)	#	<i>Eligibility Requirement $\geq 300'$</i>
	(11)	Is the maximum grade of the roadway 6% or less in the downhill direction for a minimum 200' distance?	Yes/No	<i>Eligibility Requirement: Yes, or the road can be re-graded to meet</i>
	(12)	Eligible for Treatment?	Yes/No	<i>Yes = Criterion A, B, or C is met and Criterion D is met</i>

If eligible for treatment, see Section 5.10.5 for applicable crosswalk enhancements.

5.14.5 Pedestrian Crossing Enhancements

Once a determination has been made that a pedestrian crossing enhancement is recommended at a particular location, several design treatments can be considered.

Roadway traffic calming treatments should be considered in conjunction with pedestrian crossing enhancements as a means to enhance the effectiveness of one another. See Section [5.6](#) for more information on traffic calming treatments.

5.14.5.1 Pavement Markings and Conventional Signs

NCHRP Research Report 841 Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments (2017) states, "Recent research has found no safety benefit associated with various types of crosswalk markings, and the inappropriate use of marked crosswalks alone (without other substantial safety measures) can increase crash risk for pedestrians." This shall be considered when choosing to implement crosswalk markings at uncontrolled intersections or mid-block locations.

5.14.5.1.1 Standard Continental Crosswalk Markings

Standard continental crosswalk markings are pavement markings rectangular in shape. They shall be a minimum of 6 feet long and 1 to 2 feet wide. The alignment of the markings shall connect the curb ramps and be oriented so that they are parallel with the direction of travel. Markings shall be recessed into the pavement placed so that they avoid the anticipated vehicle wheel path to improve longevity of the markings. They can be spaced 1 to 5 feet apart. Crosswalk markings are to be used in conjunction with appropriate signing as defined in this section, because research shows that markings alone do not improve pedestrian crash rates. Decorative crosswalk markings are not recommended. Crosswalk markings shall be made retroreflective with glass beads or other approved methods. See Chapter 9 for construction requirements.

5.14.5.1.2 High Visibility Markings

High Visibility Markings are wider pavement markings that can be applied in the area of a crossing if the area is unlit and peak pedestrian traffic volumes occur during unlit times.

5.14.5.1.3 Advanced Yield or Stop Markings and Signs

Advanced yield or stop markings and signs may be used in conjunction with a crosswalk marking on major collector roadways with speeds of 40 mph and where placement of advanced markings and signs does not conflict with other intersections or traffic control. Refer to Section 3B.16 of the MUTCD for further standards and guidance.

5.14.5.1.4 Pedestrian Sign Assembly

The following list includes pedestrian signing options that should be utilized in combination with pedestrian markings listed in section

1. Pedestrian Crossing Sign Assembly (W11-2 with W16-7P) - shall be used in combination with crosswalk marking treatment. Sign structure shall be mounted at the roadside in accordance with MUTCD 2C.50.
2. Yield/Stop Here for Pedestrians Signs (R1-5) - may be used in conjunction with a crosswalk marking, advanced yield or stop markings, and a typical pedestrian crossing sign assembly on roadways with multiple lanes. Refer to Section 2B.11 of the MUTCD for further standards and guidance.
3. In-Street Pedestrian Crossing Signs (R1-6) - may be used when pedestrian crossing volumes are greater or equal to 20 pedestrians per hour OR when the mean vehicle speed at the crossing location is 5 mph greater than the posted speed limit. This treatment shall be used in conjunction with a crosswalk marking, a pedestrian crossing sign assembly, and a roadway centerline marking.

5.14.5.2 Physical Geometric Treatments

The following physical roadway geometric treatments can be considered to provide additional crossing safety and visibility as approved by the Town Engineer. Refer to the Town of Breckenridge's *Traffic Calming Policy* for additional treatment information regarding coordination and design considerations.

5.14.5.2.1 Refuge Islands

Refuge islands provide a space in the center of the traveled way for pedestrians to rest as they wait to cross each direction of vehicular travel independently. Refuge islands should be considered at pedestrian crossing locations on roads where one or both directions of travel are high volume, and see the most benefit with four or more lanes of traffic and speeds of 35 mph or greater. They can be paired with additional crossing enhancements provided in this section. Refuge islands shall be a minimum 10 feet wide from back of curb to back of curb. They shall be designed to allow for positive drainage and for adequate snow removal around the island and be ADA compliant. If the installation of a refuge island requires a shift in the traveled way, appropriate lane transition rates shall apply for the redirection of traffic around the island. Delineation markers may be required for snow removal activities.

5.14.5.2.2 Curb Extensions (Bulb-Outs)

Curb extensions extend the pedestrian sidewalk and curb out into the shoulder or parking lane of the roadway to reduce the crossing distance. This reduces the amount of time that pedestrians need to cross the traveled way, and provide additional space for curb ramps. They also can assist in reducing speeds of vehicular traffic. Curb extensions should allow for a minimum 11-foot travel lane. Curb extensions shall be designed to allow for positive drainage and for adequate snow removal around the extension. Delineation markers may be required for snow removal activities.

5.14.5.2.3 Raised Crosswalks

Raised crosswalks are ramped speed tables placed at mid-block crossing locations that assist with driver visibility of pedestrian crossings. They also provide traffic calming benefits. Raised crosswalks shall be flush with the sidewalk it is connecting on either side of the crossing, and shall be a minimum of 10 feet wide. They can be considered on minor collector and local roadways with a speed of 30 mph or less. Raised crosswalks shall generally be 6" tall, wings shall be 8% max, cross slopes shall be 2% maximum and meet ADA requirements, and storm sewer inlets shall be installed on the uphill side of the crosswalk. Raised crosswalks shall be designed to allow for positive drainage, and noise

considerations should be made prior to proposing a location. Delineation markers may be required for snow removal activities.

5.14.5.3 Rectangular Rapid Flashing Beacon (RRFB)

RRFBs should be used sparingly and are typically only installed when other crossing enhancements have proven ineffective. An RRFB may be installed when all of the following criteria are met:

1. Marking and signing enhancements in Section 5.10.5.1 have been implemented but a perceived or actual pedestrian/vehicle conflict issue still persists
2. Pedestrian crossing volumes are between 60 and 160 pedestrians per hour
3. Crosswalk length from curb to curb is greater than 32 feet.
4. Roadway speeds are between 30 mph and 45 mph, or mean vehicle speed at the crossing location is 5 mph greater than the posted speed limit.
5. Roadway volume is greater than 6,700 vehicles per day.

The RRFB treatment is a combination of signing, markings and pedestrian activated strobe and feedback devices at uncontrolled pedestrian crossings. Refer to CDOT Standard Plan S-614-14 for requirements. RRFBs shall be hard-wired. Solar is not permitted. Signing for the RRFB typically includes advance PEDESTRIAN WARNING signs (W11-2) with AHEAD supplemental plaques (W16-9p), and PEDESTRIAN WARNING signs (W11- 2) with down arrow supplemental plaques (W16-7p). Pavement markings include yield lines. The pedestrian activated treatments would be the W11-2 signs with built in rectangular strobe flashers. Additionally, pedestrian visible strobes and a recorded message inform pedestrians when the crossing is activated and instruct them to wait for motorists to yield. The R1-5 (YIELD HERE TO PED) shall be placed so that it does not restrict motorists' visibility of the RRFB at the crosswalk. For the placement of advance stop lines and advance warning signs, refer to the MUTCD. High visibility crosswalks are to be used with the RRFB crossing treatment. Timing of the flashing beacon should allow for pedestrians to scan for motorists, step from the side of the road and completely cross the street. Depending upon pedestrian volumes, 5 to 10 seconds should be provided for pedestrians to scan for gaps and enter the roadway. For areas with very high pedestrian volumes (more than 10 pedestrians crossing simultaneously), additional startup time should be provided. A minimum of 3.5 feet per second crossing speed should be assumed for pedestrians.

A median refuge area should be considered, refer to Section 5.10.5.2.1.

5.14.5.4 Pedestrian Hybrid Beacon

Pedestrian hybrid beacons are not generally recommended in the Town of Breckenridge. This treatment may be applied if all of the following criteria are met:

1. Warrants and guidance from Chapter 4F of the MUTCD deem a PHB may be appropriate, and
2. Written approval has been given by the Town Engineer.

5.14.5.5 Grade Separated Crossing

A grade separated crossing treatment is typically applied for roadways meeting one of the following requirements:

1. Posted speeds greater than 40 mph, crossing lengths greater than 48 feet, and average daily traffic volumes greater than 10,000 vehicles per day
2. When removing sight distance obstructions is not feasible
3. The majority of users are expected to be non-traditional pedestrians (skiers, snowboarders, bicyclists, skateboards, etc.)

4. The proposed crossing is within CDOT ROW and the pedestrian volume exceeds 60 pedestrians per hour
5. Pedestrian volumes exceed 200 pedestrians per hour.
6. An at-grade crossing is expected to cause traffic impediment along the roadway and lower the LOS of the roadway.

Within CDOT ROW, new crossings with pedestrian volumes exceeding 60 pedestrians per hour will require a grade separated crossing. If the pedestrian volume is less than 60 pedestrians per hour, the Town Engineer will review the proposed crossing and determine if an at-grade crossing will be allowed.

Prior to implementing a grade separated crossing, additional study should be performed to determine if other at-grade solutions may be preferable. Written approval from the Town Engineer is required for all grade separated crossings.

Grade separated crossings shall generally be designed for ADA compliance, include physical barriers to prevent at-grade crossing, light enhancements inside the crossing, and include pedestrian routes entering and exiting the crossing which are intuitive and natural routes for pedestrians resulting in high compliance of use.

5.15 TRANSIT FACILITIES

Streets shall be designed to accommodate transit facilities where transit routes are identified during the development process. Transit facilities, including transit stops, waiting areas, transit shelters, and other transit improvements are encouraged and may be required as determined by the Town Engineer. Transit stops shall be located to minimize impact on through traffic, provide efficient arrival and departure for the transit vehicle, and bear a logical relationship to the population served. New transit stops and facilities shall be connected to the adjacent developments via sidewalks and trails.

Where required by the Town Engineer, transit stops shall be located where direct pedestrian access is provided from the street and adjacent sidewalk or surrounding area to the stop. Transit stops shall include a paved waiting area with a direct connection to the adjacent sidewalk. As each site is unique, the waiting area dimensions shall be determined by the Town Engineer.

Bus pull outs shall be located on the downstream side of an intersection wherever possible designed to provide a 30-foot loading area per bus and a 3:1 exiting taper. The pavement in the bus pull out lane shall be designed per a pavement evaluation report to account for the expected bus traffic; minimum concrete thickness of 10 inches shall be provided. Bus pullouts shall be per the standard detail and shall be a minimum of 10 feet wide, 40- to 60-foot long tapers with a 50-foot minimum radius and 2% cross slope.

5.16 PAVEMENT DESIGN

This section provides the criteria used for the design of pavements and will ensure adequate strength and durability to carry the predicted traffic loads for the design life of each project. The street pavement design evaluation shall be established for each project in a geotechnical report following the latest *CDOT M-E Pavement Design Manual*. The pavement design will be based on a Design Equivalent Single Axle Loads (ESAL) which is determined on average daily traffic count (ADT), vehicle classification, traffic equivalence load factors, traffic growth rate, design period, and lane factor. Private streets and accesses may be asphalt, concrete, or other impervious surface approved by the Town Engineer. Sidewalks and bus pullouts shall be concrete.

5.16.1 Soils Testing for Pavement Design

To design pavements for approval and acceptance by the Town, sampling and testing must be performed under the direct supervision of a registered Professional Engineer to evaluate the soil

characteristics. Samples shall be taken at least 5 feet below proposed subgrade (10 feet on arterial roadways) at spacing of 250 feet or less, unless specified by a geotechnical engineer. Test holes shall properly evaluate all changes in soil character. Samples shall be taken at the minimum depth which will serve as subgrade for new street construction.

When joining to an existing paved street, cores of the existing pavement and base structure shall be made and analyzed to determine whether overlayment is feasible or reconstruction is necessary.

5.16.2 Flexible Pavement Design

Flexible pavements shall be designed, installed, constructed, maintained and repaired in accordance with these standards and with the latest editions of the *CDOT M-E Pavement Design Manual* and Standard Specifications for Road and Bridge Construction or the AASHTO Guide for the Design of Pavement Structures. In the event of discrepancies between these standards and the referenced publications, the more stringent shall take precedence.

A minimum of four inches of aggregate base course (ABC) shall be used as a base on roadways. If the design truck traffic is greater than 500 trucks per day, a minimum of six inches of ABC shall be used as a base. The minimum pavement thickness for all roadways shall be four inches. However, each roadway pavement section proposed in the Town shall be designed per a geotechnical report to determine actual recommended thickness and pavement mix. The minimum pavement thickness shall be per Table 5.13 below. These values only provide preliminary minimum values; the final pavement thickness shall be designed per the geotechnical report.

Table 5.13 Pavement Thickness Minimums

Street Type	Min. Asphalt Depth (Inches)	Min. Class 6 Aggregate Base Course Depth (Inches)
Private Roadway	4	4
Local	4	4
Minor Collector	5	6
Major Collector	6	6

The minimum lift thickness of flexible pavement shall be 1.5 inches and the maximum lift thickness shall be three inches.

5.16.3 Rigid Pavement Design

Rigid pavements shall be designed, installed, constructed, maintained and repaired in accordance with these standards and with the latest editions of the *CDOT M-E Pavement Design Manual* and Standard Specifications for Road and Bridge Construction or the AASHTO Guide for the Design of Pavement Structures. In the event of discrepancies between these standards and the referenced publications, the more stringent shall take precedence.

Rigid pavement shall have a minimum ABC thickness of six inches and a minimum concrete pavement thickness of seven inches.

5.17 Traffic Control Devices

Traffic control device designs shall be prepared by a Colorado licensed professional engineer experienced in traffic engineering. The designs shall be prepared in accordance with the latest version of the *Manual on Uniform Traffic Control Devices (MUTCD)*.

Striping plans are required for Collectors and Arterials, but may not be required for local subdivision streets. However, sign plans are required for all subdivisions. All signing and striping plans shall conform to the most current edition of the *MUTCD*. All traffic control devices shall be fabricated and installed in accordance with the *MUTCD*. Permanent signage and striping shall be complete and in place before any new roadway is opened to the public for use.

5.17.1 Street Name Signs

New streets in the Town of Breckenridge shall be named by the Town of Breckenridge in accordance with Town and Summit County naming procedures. The Town and County GIS Departments shall be used to ensure that each street name is unique and does not match or closely resemble another street name in the Town of Breckenridge or within Summit County.

Street name signs are required at the intersections of all public and private (serving four or more units) streets. Driveways serving three or less units may not install street name signs in the right of way.

Street name signs shall be fabricated to match existing Town of Breckenridge street signs. Color, size, font, and dimensions of the signs shall match existing Town street signs. The Town of Breckenridge Streets Department shall be consulted for street sign specifications.

5.17.2 Stop Signs

Stop signs or other traffic control devices shall be installed at the intersections of all public and private streets (access serving four or more units) and shall meet *MUTCD* requirements. Stop signs are not required at driveways serving three or less units.

5.17.3 Private Signage

No private signage shall be permitted within the ROW. No private signage shall be permitted on private property which attempts to direct traffic or parking. Business name signs and address signs may be installed outside of the ROW per requirements in the Town Code.

5.17.4 Signage Requests

Requests for additional signage for traffic calming, speed limit signs, children playing signs, parking signs, and other signage will be considered based on *MUTCD* standards, proximity to other signage, and local conditions. However, additional signage can create "signage clutter", a term for a condition when there is too much competing signage along a street causing driver confusion, reduced effectiveness of signage, distraction, and decreased aesthetics of a street. The Town of Breckenridge approves signage at that minimum level required to provide for safe and efficient travel of vehicles of pedestrians.

~~5.19.18~~ STREET LIGHTING

The purpose of streetlight installations shall be to illuminate the public traveled ways to a level that provides for the safe passage of public traffic, both vehicle and pedestrian. Arterial and Collector streets shall require street lighting at intersections. Pedestrian lighting will be required near all sidewalks, pedestrian routes & facilities, crosswalks, and transit facilities. All fixtures, poles, and designs will be reviewed and approved by the Engineering Division and the power provider.

~~5.19.1-15.18.1.1~~ Equipment Type and Location

~~The Town's standard Newport fixture, Providence Fixture, or Promenade Fixture shall be installed depending on the location within the Town. Typically, Newport fixtures are installed in the historic district, Providence fixtures are installed outside the historic district, and Promenade fixtures are~~

~~installed at critical intersections along SH 9. The Town Engineer will determine the appropriate light fixture depending on the location of the development. Typical spacing of light poles is 75 feet along pedestrian routes. Light pole spacing may be reduced to 110 feet along local road sidewalks. In residential areas, along a portion of road without a sidewalk, street light spacing may be further reduced to 300 feet. Typical pole height is 9 feet tall along pedestrian routes and 12 feet tall at intersection and crosswalks. The photometric analysis shall be completed to determine exact spacing, location, and pole height at all crosswalks and intersections. The type of area should also be considered when determining the equipment type and location. The Town staff can provide additional guidance on the type of illumination equipment that is required depending on the location of the project. Standard details for foundations, poles, fixtures, and luminaires are included in the standard details attached to Chapter 9 of these Standards.~~

The Town's standard Providence Fixture or Promenade Fixture shall be installed depending on the location within the Town. The Providence Fixture is the typical fixture installed in the Town, while the Promenade fixture is typically reserved for SH 9 and critical intersections or crosswalks. The Welsbach fixture (also called a Newport fixture) is installed in various locations within the Historic District of Breckenridge. No new Welsbach (Newport) fixtures will be installed unless a variance is granted by the Town Engineer. The Town Engineer will determine the appropriate light fixture depending on the location of the development. Standard details for foundations, poles, fixtures, and luminaires are included in the standard details attached to Chapter 9 of these Standards.

All new fixtures shall be dark sky compliant and shall have the capability to be automatically dimmable. All new street lights shall meet the following requirements:

1. Fixtures shall be certified dark sky compliant by the International Dark-Sky Association.
2. Fixtures shall be automatically dimmable. Fixtures in residential areas shall be programmed to dim at 10 pm and commercial areas shall be programmed to dim at 2:30 am. Fixtures at intersections and crosswalks shall have the capability to dim, but shall be programmed to remain and the same lumens throughout the night (no dimming).
3. New streets and development shall be designed to have a maximum 50,000 lumens/acre in commercially zoned areas and a maximum of 25,000 lumens/acre for residentially zoned areas. Area with traffic safety concerns, major collector roads, roundabouts, high pedestrian areas, crosswalks, and other areas of safety concern as determined by the Town Engineer shall be exempted from the maximum lumen requirements.
4. Light pole spacing shall be 75 feet along pedestrian routes. Light pole spacing may be reduced to 110 feet on roads classified as Local. On residential local roads without a sidewalk, street light spacing may be reduced to 300 feet. Light pole spacing may be modified for safety concerns or guidance from a photometric analysis.
5. Pole height shall be 9 feet tall along pedestrian routes and 12 feet tall at intersections and crosswalks. Pole height may be further increased for safety concerns with a photometric analysis.
6. Lights shall meet all requirements of Title 9, Chapter 12 (Exterior Lighting Regulations) and all other dark sky compliance regulations.
7. Photometric analysis (if determined necessary by Town Engineer).
8. Additional requirements as determined by the Town Engineer due to vehicle or pedestrian traffic, safety concerns, intersections, or other reasons.

~~5.19.1.25.18.1.2~~ *-Positioning at Intersections*

In general, the nighttime visibility of a pedestrian or hazardous object within an intersection is enhanced by increased contrast between the object and the surrounding street area. Street lights at intersections are required to be placed on the upstream side of the intersecting street, as viewed by a motorist approaching the intersection in the lane directly beneath the luminaries. The positioning of light standards at intersecting streets shall be up to two street lights per corner of intersection, depending on street geometry and crosswalk location.

5.19.1.35.18.1.3 *Roundabout Lighting*

Lighting columns should be arranged around the perimeter of the roundabout in a simple ring, with the lights equidistant from the center and from each other. Lighting should extend at least 197 feet back along each approach road. Mounting height should be uniform throughout the intersection and not less than on any approach road. The minimum illuminance required should not be less than the highest level of lighting for any of the approach roads. Lights near roundabouts shall not be located closer than 6 feet from the face of curb and shall not be located in the center of median islands.

5.19.1.45.18.1.4 *Light Pole Offset Distances*

Distance behind back of walk for local streets shall be at least 3 feet and must be within easements or right-of-way on Local residential streets. For Collector and Arterial streets, the light must be offset at least 3 feet from the back of curb and provide a clearance space between the light pole and edge of walk that equals or exceeds the required sidewalk width.

5.19.1.55.18.1.5 *Underground Service*

Street lighting shall be installed with underground electric service on all newly developed dedicated public streets in the Town. The Developer is responsible for coordinating with the appropriate utility company all aspects of design and installation. Junction boxes and other structures shall not be installed in sidewalks, curbs, or curb ramps.

5.19.25.18.2 **Pedestrian Lighting**

Install street lighting behind sidewalks where sidewalks attached to the curb are used. For sidewalks detached from the curb, install street lighting with a minimum of 3 feet clearance from back of curb to roadway side of support pole and 3 feet clear from all walks. All bridge underpasses, where vehicles, pedestrians, bicyclists, or equestrians may be present, shall require lighting.

Lighting for trails should be evaluated based on safety and the type of trail. Lighting will generally be required for primary trails at primary trailheads, underpasses, mid-block crossings. Where sidewalks and trails are located near or adjacent to streets, lighting shall be coordinated with street lighting requirements.

5.19.35.18.3 **Dark Sky Ordinance**

The Town has adopted an exterior lighting policy generally adhering to a Dark Sky Ordinance. See *Exterior Lighting Regulations* in Title 9, Chapter 12 of the Town Code.

5.19.45.18.4 **Residential Areas**

Street lights shall be shielded with house side shields or other measures to minimize light shining on residential areas.

5.205.19 **PRIVATE FACILITIES**

Private streets, alleys, and accesses are typically utilized by an individual, group of individuals, or private business to access private property. It is the responsibility of the private landowner to maintain the private facility.

5.20.15.19.1 Private Streets

A private street is an access serving ~~five~~four or more units or lots. Private streets are discouraged because they create a cost burden to residents. Private streets shall meet the same design standards as public streets. Private streets are not owned, maintained, or plowed by the Town. They are the sole responsibility of the property owner. A private street requires the approval of a variance request form by the Town Engineer.

5.20.25.19.2 Private Snow Melt Systems

~~Driveway-Private~~ heated pavement systems, also called snowmelt systems, shall terminate at the property line with no components located in the right-of-way. See section 9-1-19-33A and 33R of the Town Code for additional regulations. The following requirements shall be met for snowmelt systems:

1. Infrastructure permit shall be submitted for any private snowmelt system (even if located entirely on private land).
2. The snowmelt system shall stop 5 feet from the edge of a public roadway or 1 foot from the back of public sidewalk.
3. Drainage from the snowmelt system shall be captured on the premises and shall not drain across public pedestrian facilities or roadways. The drainage shall be designed to infiltrate or runoff without freezing. Examples include heated trench drains and inlets to storm pipes and drywells. Drywells shall be designed appropriately to infiltrate all runoff. Drainage shall not drain across public pedestrian facilities or roadways.

If the Town Engineer allows the snow melt system to encroach into the right-of-way, the following conditions shall be met in addition to the conditions above:

1. A separate mechanical zone shall be dedicated for the portion of the snowmelt system within the right-of-way
- ~~2. The snowmelt system shall stop 5 feet from the edge of roadway or at the back of sidewalk~~
- ~~3. Drainage from the snowmelt system shall be captured and shall not drain across pedestrian facilities or roadways~~
- ~~4.2.~~Expansion joint material shall be installed at the edge of heated concrete
- ~~5.3.~~A revocable encroachment license agreement, acceptable in form and substance to the Town Attorney for the components of the system extending into the ROW, must be approved by the Town and executed prior to the issuance of building permit
- ~~6.4.~~Other requirements as determined by the Town Engineer to reduce the impacts of the snow/melted interface

5.215.20 UTILITIES

Utilities in ROW shall be located to minimize roadway disturbance. Utility lines shall be located to minimize the need for future adjustment and shall consider future extensions of the street system. Utility structures above grade shall be placed in easements outside of the ROW, or as close to the edge of the Right of Way as possible, and at least 6 feet from the edge of roadway and 3 feet from the edge of sidewalk. Utilities shall be buried a minimum of 2 feet below finished grade. Utility rings and covers within pavement areas shall be 0.25 to 0.50 inches below top of pavement. Manholes, valves, junction boxes, and other structures shall not be located in curbs or sidewalks.

Utilities shall typically be installed in the roadway shoulder to avoid pavement removal. If the utility must be placed beneath pavement, the utility should be installed at the center or at the edge of travel lanes. Utilities shall not be placed beneath wheel paths of roads. Utilities shall not be located in drainage swales. Utilities shall be installed to meet all applicable standards and requirements for bury

depths, offsets, crossings, separation, and insulation. Utility crossings shall be perpendicular to street and pavements cuts shall be perpendicular to roadway. Pavement patches shall extend 1' minimum beyond trench and edge of patch shall not be located within wheel paths. See Chapter 3 of these standards for additional trenching and patching details.

All utilities (including storm sewer) shall be electronically locatable for the entire length of the utility. All wires and cables shall be buried in rigid conduits and backfilled with warning tape placed 1 foot above the conduits. Utilities and utility structures shall be located outside of ROW and within utility easements where feasible.

5.225.21 DESIGN CRITERIA TABLE BY STREET CLASSIFICATION

Table 5.14 Design Criteria by Street Classification

Street Classification						
	Major Collector					
	Minor Collector					
				Local		
Posted Speed	40 mph	35 mph	30 mph	25 mph	20 mph	15 mph
Design Speed	40 mph	35 mph	30 mph	25 mph	20 mph	15 mph
Min. Horizontal Curve Radius (normal crown)	770'	510'	350'	200'	110'	50'
Min. Tangent Between Curves	150'	150'	100'	50'	20'	20'
Max. Super Elevation	6%	6%	6%	N/A	N/A	N/A
Cross-slope	2%	2%	2%	2%	2%	2%
Minimum Stopping Sight Distance	305'	250'	200'	155'	115'	80'
Min. Grade	1%	1%	1%	1%	1%	1%
Max. Grade	6%	6%	6%	6%	6%	6%
Min. K-Crest	44	29	19	12	7	3
Min. K-Sag	64	49	37	26	17	10

CHAPTER 6 STORMWATER STANDARDS

TABLE OF CONTENTS

6.1	PURPOSE	1
6.2	OTHER STANDARDS	1
6.2	SUBMITTALS	1
6.3	RAINFALL.....	1
6.3.1	Rainfall Intensity	1
6.3.2	Rainfall Distribution.....	2
6.3.3	Design Storms	2
6.4	RUNOFF	2
6.4.1	Approved Hydrologic Methods.....	3
6.4.2	Subwatershed Sizing	3
6.4.3	Rational Method	3
6.4.3.1	Runoff Coefficient	3
6.4.3.2	Time of Concentration	4
6.4.3.3	Limitations and Considerations.....	6
6.4.4	SCS Method	6
6.4.4.1	SCS Method - Rainfall	6
6.4.4.2	SCS Method – Curve Number	6
6.4.4.3	SCS Method – Time of Concentration	8
6.4.4.3.1	Sheet Flow	8
6.4.4.3.2	Shallow Concentrated Flow	8
6.4.4.3.3	Open Channel Flow	9
6.4.5	Hydrograph Development and Routing Models	10
6.4.5.1	HEC-HMS.....	10
6.4.5.2	EPA SWMM.....	10
6.4.5.3	CUHP	11
6.4.6	FEMA Flows	11
6.5	OPEN CHANNELS	11
6.5.1	Open Channel Hydraulics.....	11
6.5.1.1	Uniform Flow	11
6.5.1.2	Critical Flow	13
6.5.1.3	Gradually Varied Flow	14
6.5.1.4	Rapidly Varied Flow.....	14

6.5.2	Open Channel Design	15
6.5.2.1	Channel Selection Factors.....	15
6.5.2.2	General Design Guidelines.....	15
6.5.2.3	High Gradient Channels	16
6.5.2.4	Ecological Channel Design Guidelines	17
6.5.2.5	Revegetation	18
6.5.3	Roadside Ditch Design	18
6.6	STREETS AND ROADSIDE CONVEYANCE.....	20
6.6.1	Allowable Flow Depth and Spread.....	21
6.6.2	Minimum and Maximum Grades.....	22
6.6.3	Cross Street Flow	22
6.6.4	Calculations	22
6.6.4.1	Streets with Curb and Gutter	22
6.6.4.2	Streets with Roadside Ditches.....	22
6.7	STORM DRAIN SYSTEMS	23
6.7.1	Storm Drain Design Criteria.....	23
6.7.1.1	Construction Materials	23
6.7.1.2	Pipe Size	23
6.7.1.3	Horizontal and Vertical Alignment.....	24
6.7.1.4	Utility Crossings	24
6.7.1.5	Inlets and Manholes.....	25
6.7.1.6	Capacity and Velocity	25
6.7.2	Storm Drain Hydraulics.....	26
6.7.2.1	Manual Calculations	26
6.7.2.2	Computer Model Calculations.....	27
6.7.2.2.1	Rational Method	27
6.7.2.2.2	Bend and Lateral Loss Coefficients	27
6.7.3	Inlet Hydraulics	27
6.7.3.1	Introduction.....	28
6.7.3.2	Inlet Capacity.....	28
6.7.3.3	Continuous Grade Condition	28
6.7.3.4	Sump Condition	28
6.7.3.5	Inlet Spacing.....	28
6.7.3.6	Inlet Grates	29
6.7.4	Design of a Storm Drain System	29
6.7.4.1	Preliminary Design.....	29

6.7.4.2	Final Design.....	30
6.8	CULVERTS AND BRIDGES.....	30
6.8.1	Culvert Design Standards.....	30
6.8.1.1	Materials and Structural Design.....	31
6.8.1.2	Minimum Size	31
6.8.1.3	Allowable Headwater	31
6.8.1.4	Roadway Overtopping	32
6.8.1.5	Velocity and Outlet Protection	32
6.8.1.6	Headwalls, Wingwalls, and End Sections	33
6.8.1.7	Grates	33
6.8.1.8	Location and Alignment	33
6.8.2	Bridge Design Standards.....	33
6.8.2.1	Bridge Sizing	34
6.8.2.2	Hydraulic Analysis	34
6.8.2.3	Inlet and Outlet Configuration	34
6.8.2.4	Scour Analysis and Countermeasures.....	34
6.8.2.5	Structural Design	35
6.8.3	Culvert Hydraulics	35
6.8.3.1	Inlet Control Calculation.....	36
6.8.3.2	Outlet Control Calculation.....	36
6.8.3.3	Evaluation of Results	38
6.8.3.4	Outlet Velocity Calculation	39
6.8.3.5	Computer Applications.....	39
6.8.4	Design Examples.....	39
6.8.4.1	Crossing Culvert Analysis Example	39
6.8.4.2	Private Driveway Culvert Design Example	41
6.9	DETENTION.....	42
6.9.1	Applicability.....	42
6.9.2	Detention Facility Design.....	43
6.9.2.1	Historic Flow Rates.....	43
6.9.2.2	MHFD-Detention.....	44
6.9.4	Snow Storage in Detention Ponds.....	45
6.9.5	Maintenance	45
6.9.6	Detention and Water Rights.....	45
6.9.7	Jurisdictional Dams	46
6.10	PERMANENT WATER QUALITY	46

6.10.1 Planning Principles	46
6.10.2 Applicability	47
6.10.3 Treatment Facility Types	48
6.10.4 Design Criteria	48
6.10.4.1 Tributary Offsite Area	48
6.10.4.2 Right-of-Way Restrictions	48
6.10.4.3 WQCV Storage and Release	48
6.10.4.3.1 Effective Imperviousness	50
6.10.4.3.2 Design Volume and Bypass Capacity	50
6.10.4.3.3 Detention	51
6.10.4.4 Infiltration	51
6.10.4.5 Proprietary Structures	52
6.10.4.6 Treatment in Series	52
6.10.5 Designing for Inspection and Maintenance Requirements	53
6.10.5.1 Access	53
6.10.5.2 Forebays	54
6.10.5.3 Stockpile Areas	54
6.10.5.4 Extended Detention Basins	54
6.10.5.5 Infiltration Facilities	54
6.10.5.6 Proprietary Structures	54
6.10.5.7 Ownership and Maintenance Plan and Agreement	54
6.11 CONSTRUCTION STORMWATER MANAGEMENT	56
6.11.1 Applicable Codes and Permits	56
6.11.2 Applicability within the Town	56
6.11.3 Stormwater Management Plan Requirements	57
6.11.3.1 SWMP Report	57
6.11.3.2 SWMP Plans	58
6.11.3.3 SWMP Specifications	58
6.11.4 SWMP Submittal, Inspection, & Maintenance	58
6.11.4.1 SWMP Submittal Requirements	59
6.11.4.1.1 Initial SWMP Plan	59
6.11.4.1.2 Interim SWMP Plan	59
6.11.4.1.3 Final SWMP Plan	59
6.11.4.1.4 SWMP Details	60
6.11.4.2 SWMP and CSMP Inspection	60
6.11.4.3 SWMP Maintenance	60

6.11.4.4 SWMP Adequacy.....	60
6.11.5 Temporary BMPs.....	60
6.11.5.1 Vehicle Tracking	61
6.11.5.2 Sediment Basins.....	61
6.11.5.3 Check Dams	61
6.11.5.4 Materials Storage and Stockpiles	62
6.11.5.5 Temporary Stabilization and Winterization	62
6.11.5.6 Erosion Blanket.....	63
6.11.5.7 Control Measure Specifications and Details	63
6.11.6 Construction Site Inactivity	63
6.11.7 Final Stabilization	63

LIST OF TABLES

Table 6.1. Intensity-Duration-Frequency Data	2
Table 6.2. 6-Hour Rainfall Depths for SCS Type II Distribution	2
Table 6.3. Land Use Imperviousness	4
Table 6.4. Runoff Coefficient Equations	4
Table 6.5. NRCS Conveyance Factors, K	5
Table 6.6. Runoff Curve Numbers	7
Table 6.7. Runoff Curve Numbers for Arid and Semiarid Rangelands	8
Table 6.8. Manning's Roughness Coefficients for Channels	13
Table 6.9. Factors to Consider for Channel Design.....	15
Table 6.10. Ecological Channel Design Advantages and Disadvantages	17
Table 6.11. Allowable Velocity and Froude Number for Roadside Ditches	19
Table 6.12. Maximum Allowable Flow Depth and Encroachment.....	21
Table 6.13. Maximum Allowable Manhole Spacing	25
Table 6.14. Manhole Sizing	25
Table 6.15. Manning's Roughness Coefficients for Storm Drain Conduits	26
Table 6.16. Applicable Culvert Standards.....	31
Table 6.17. Allowable Headwater	32
Table 6.18. Bridge Scour Design Standards.....	35
Table 6.19. Inlet Control Nomograph Selection	36
Table 6.20. Culvert Entrance Loss Coefficients, K_e , for Outlet Control Calculations	37
Table 6.21. Outlet Control Nomograph Selection	38
Table 6.22. Drain Time Coefficients for WQCV Calculations.....	49
Table 6.23. Recommended Inspection and Maintenance Schedule.....	55

LIST OF FIGURES

Figure 6.1. Average Velocities for Shallow Concentrated Flow	9
Figure 6.2. Ditch Check Schematic.....	20
Figure 6.3. Reduction Factor for Gutter Flow.....	23
Figure 6.4. Private Driveway Culvert Example Ditch Geometry.....	41
Figure 6.5. Map of the Average Runoff Producing Storm's Depth	50

LIST OF ATTACHMENTS – APPENDIX D

CULVERT DESIGN FORM

CULVERT DESIGN FORM EXAMPLE

TREATMENT TRAIN EXAMPLE CALCULATION

FACT SHEET: SUBSURFACE INFILTRATION FACILITIES

6.1 PURPOSE

The purpose of this Chapter is to set forth design standards and criteria for storm drainage infrastructure so there is reasonable degree of assurance that the health, safety, welfare, and property of the Town and citizens may be safeguarded and protected through the proper control and drainage of stormwater, the water quality of the Blue River and its tributaries will be protected, and there will be a certain uniformity in performance with respect to design and construction of drainage facilities.

Additionally, the Town of Breckenridge's mountain environment is known for steep grades, wetland areas, perennial streams, reservoirs, and the Blue River. This unique environment and topography results in grading, slope stability, stormwater runoff contamination, and phosphorus contamination concerns. This chapter establishes standards to safeguard public health and safety, protect environmentally sensitive areas, and protect the water quality of the Blue River, its tributaries, and Dillon Reservoir.

The design Standards presented herein are intended to aid in the design of stormwater infrastructure and outline the minimum standards required.

6.2 OTHER STANDARDS

The Mile High Flood District (MHFD), formerly known as the Urban Drainage and Flood Control District (UDFCD), has developed detailed permanent water quality design guidance and criteria in Volume 3 of the *Urban Storm Drainage Criteria Manual* (USDCM). This document is referenced extensively in this section and provides extensive discussion on the topic of stormwater quality treatment. When used for design, the most recent version shall be referenced as the MHFD continually updates Volume 3 of the USDCM based on performance and maintainability of the treatment facilities discussed.

6.2 SUBMITTALS

An Infrastructure Permit is required for all construction projects involving storm drainage infrastructure. Requirements for an Infrastructure Permit are summarized in Chapter 2. Other submittals may be required in accordance with Chapter 2 or as determined by the Town Engineer.

6.3 RAINFALL

A rainfall analysis was completed for the Town of Breckenridge using the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 data. The equations and data in this section are based on this analysis. A detailed memo regarding the evaluation of NOAA Atlas 14 is available from the Town upon request.

6.3.1 Rainfall Intensity

Equation 6.1 shall be used to calculate rainfall intensity for a given time of concentration or to develop intensity-duration-frequency curves for runoff analysis using the Rational Method as discussed in Section 6.4.

$$I = P_1 \frac{40.81}{(t+7.63)^{0.881}} \quad (6.1)$$

Where:

I = rainfall intensity (in/hr)

P_1 = 1-hour rainfall depth (in), see Table 6.1

t = storm duration, time of concentration (min)

Rainfall intensities as a function of storm duration and recurrence interval are provided in Table 6.1. This table was developed using Equation 6.1. The values in Table 6.1 are subject to revision and users of these Standards are encouraged to check for updates.

Table 6.1. Intensity-Duration-Frequency Data

Return Period	P_1	Peak Rainfall Intensity for Storm Duration (in/hr)				
		5-min	10-min	15-min	30-min	60-min
2-year	0.546	2.39	1.78	1.43	0.91	0.54
5-year	0.749	3.27	2.44	1.96	1.25	0.75
10-year	0.939	4.10	3.06	2.45	1.57	0.94
25-year	1.23	5.37	4.01	3.21	2.05	1.23
50-year	1.49	6.51	4.85	3.89	2.49	1.48
100-year	1.76	7.69	5.73	4.60	2.94	1.75
500-year	2.5	10.92	8.14	6.53	4.17	2.49

6.3.2 Rainfall Distribution

The 6-hour rainfall depths provided in Table 6.2 shall be used to develop a 6-hour SCS Type II rainfall distribution for runoff analyses that use hydrographs as discussed in Sections 6.4.4 and 6.4.5.

Table 6.2. 6-Hour Rainfall Depths for SCS Type II Distribution

Return Period	6-hour Rainfall Depth (in)
2-year	0.859
5-year	1.070
10-year	1.28
25-year	1.61
50-year	1.89
100-year	2.21
500-year	3.07

6.3.3 Design Storms

The objectives of establishing the minor and major design storms are to minimize inconvenience, protect against recurring minor damage, reduce maintenance costs caused by the minor storm, and eliminate substantial property damage and loss of life caused by the major storm. The goal is a functional drainage system at a reasonable cost. The storm drainage system may include streets, curb and gutter, roadside ditches, inlets, storm sewers, open drainageways, culverts, and detention facilities. In the Town of Breckenridge, the minor storm is the 10-year event and the major storm is the 100-year event.

6.4 RUNOFF

The hydrologic analysis of a site shall be based on the proposed land use for that site, as opposed to existing conditions. Calculation of contributing runoff from offsite upstream areas shall be based on the existing land use and topography. Flows specified in the Flood Insurance Study, Town of

Breckenridge (2011) shall be incorporated in the analysis where applicable and with the approval of the Town Engineer.

6.4.1 Approved Hydrologic Methods

All hydrologic methods have limitations and should be used only for appropriate scenarios. Accepted hydrologic methods are the Rational Method, the Soil Conservation Service (SCS) Dimensionless Unit Hydrograph Method, and the SCS Runoff Method. The last two methods are referred to collectively herein as the SCS Method developed by the Natural Resource Conservation Service (NRCS). The Rational Method may be used for watersheds of 90 acres or less and when only peak flows, as opposed to a hydrograph, are required for design (e.g., pipes, culverts, inlets). The SCS Method may be used for watersheds of any size or when hydrograph routing is required for design (e.g., detention ponds and volume-based water quality facilities). Information on the computer models that may be used to develop and route hydrographs is included later in this section.

6.4.2 Subwatershed Sizing

Determination of peak runoff at any downstream design point is affected by the size, number, and characteristics of the upstream subwatersheds within the overall drainage basin. Typically, the more homogenous each of the subwatersheds is, the more accurate the calculated peak flow is when compared to analysis of a single, larger watershed. Recommended guidelines are:

1. For an overall watershed of up to 100 acres, the maximum subwatershed size should be approximately 20 acres. Delineation should be conducted so that imperviousness, slope, and land use are similar for each subwatershed.
2. For an overall watershed over 100 acres, increasingly larger subwatersheds may be used provided the land use and surface characteristics within each subwatershed are homogeneous. In addition, the subwatershed sizing should be consistent with the level of detail needed to determine peak flow rates at various design points within the larger watershed.

6.4.3 Rational Method

The Rational Method uses Equation 6.2 to determine a peak runoff rate based on drainage area, rainfall intensity, and imperviousness. Imperviousness is represented by a coefficient, C.

$$Q = CIA \quad (6.2)$$

Where:

Q = peak rate of runoff (cfs)

C = runoff coefficient

I = rainfall intensity (in/hr)

A = drainage area (acres)

The rainfall intensity is given by Equation 6.1 or Table 6.1 based on the design storm and storm duration, which is assumed to be equal to the total time of concentration to the design point being analyzed. Determining values for the runoff coefficient, C, is discussed in the section below.

6.4.3.1 Runoff Coefficient

The runoff coefficient is based on land cover and soil classification. Soils are classified by the NRCS as belonging to Hydrologic Soil Group A, B, C, or D. The Hydrologic Soil Group(s) present at a site can be found using the Web Soil Survey tool available via an internet search for *NRCS Web Soil Survey*. Types of land use and their typical corresponding imperviousness are summarized in Table 6.3. Composite imperviousness should be obtained for each subwatershed that is not completely homogenous. The runoff coefficient, C, can then be calculated using the equations in Table 6.4. The

coefficients are dependent on the Hydrologic Soil Group, composite imperviousness, and the return period of the design storm. The values below are approximations of average imperviousness for typical land uses. If a development's land use does not match a land use in the table below, or if the development's imperviousness does not match the values in the table below, imperviousness may be calculated for each subbasin within the site by dividing the total impervious area within the subbasin by the total subbasin area.

Table 6.3. Land Use Imperviousness

Land Use	Imperviousness (%, i_p)	Land Use	Imperviousness (%, i_p)
Urban:		Playgrounds	25
Downtown Area	95	Schools	55
Suburban Area	75	Parks, Cemeteries	10
Residential Single-family:		Paved Streets	100
2.5 acres or larger	15	Drive and Walks	90
0.75 - 2.5 acres	20	Roofs	90
0.25 - 0.75 acres	30	Lawns	2
0.25 acres or less	50	Undeveloped Areas:	
Apartments/Duplex/Townhomes	75	Historic Flow Analysis	2
Industrial:		Greenbelts, Agricultural	2
Light Areas	80	Off-site Flow Analysis (land use not defined)	45
Heavy Areas	90		

Table 6.4. Runoff Coefficient Equations

NRCS Soil Group	Storm Return Period			
	2-year	5-year	10-year	25-year
A	$C=0.84i_p^{1.302}$	$C=0.86i_p^{1.276}$	$C=0.87i_p^{1.232}$	$C=0.88i_p^{1.124}$
B	$C=0.84i_p^{1.169}$	$C=0.86i_p^{1.088}$	$C=0.81i_p+0.057$	$C=0.63i_p+0.249$
C/D	$C=0.83i_p^{1.122}$	$C=0.82i_p+0.035$	$C=0.74i_p+0.132$	$C=0.56i_p+0.319$
NRCS Soil Group	Storm Return Period			
	50-year	100-year	500-year	
A	$C=0.85i_p+0.025$	$C=0.78i_p+0.110$	$C=0.65i_p+0.254$	
B	$C=0.56i_p+0.328$	$C=0.47i_p+0.426$	$C=0.37i_p+0.536$	
C/D	$C=0.49i_p+0.393$	$C=0.41i_p+0.484$	$C=0.32i_p+0.588$	

6.4.3.2 Time of Concentration

The storm duration used in Equation 6.1 is the time required for runoff to flow from the most hydraulically distant point within the subwatershed to the design point of interest. This time is known as the time of concentration. Time of concentration is calculated by adding the flow times for each type of flow along most hydraulically distant flow path. Types of flow include sheet flow and shallow

concentrated, or channelized flow. Time of concentration for the Rational Method is calculated using Equations 6.3 through 6.5.

$$t_c = t_i + t_t \quad (6.3)$$

Where:

t_c = time of concentration (min), minimum is 5 min in urban areas, 10 min in rural areas

t_i = initial or overland sheet flow time (min)

t_t = travel time for shallow concentrated flow in a ditch, channel, gutter, pipe, etc. (min)

Initial or overland flow is the sheet flow that occurs at the beginning of the flow path characterized by a flow depth less than 0.1 feet. It can be calculated using Equation 6.4 for flow path lengths up to 500 feet in rural areas and 300 feet in urban areas. However, in highly urbanized areas, the overland flow path is typically shorter than 300 feet because of the presence of drainage systems that collect and convey runoff.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_0^{0.33}} \quad (6.4)$$

Where:

t_i = initial or overland sheet flow time (min)

C_5 = runoff coefficient for 5-year return period (see Table 6.4)

L_i = length of overland flow segment (ft)

S_0 = average slope along the overland flow path (ft/ft)

Travel time for shallow concentrated flow is calculated based on the hydraulic properties of the conveyance element. The channelized travel time, t_t , is estimated by dividing the length of conveyance by the velocity. Equation 6.5 can be used to determine travel time in conjunction with the conveyance factors in Table 6.5.

$$t_t = \frac{L_t}{60K\sqrt{S_0}} = \frac{L_t}{60V_t} \quad (6.5)$$

Where:

t_t = travel time for shallow concentrated flow in a ditch, channel, gutter, pipe, etc. (min)

L_t = shallow concentrated flow path length (ft)

S_0 = average slope of shallow concentrated flow path (ft/ft)

K = NRCS conveyance factor (see Table 6.5)

V_t = travel time velocity (ft/s) = $K\sqrt{S_0}$

For shallow concentrated flow in a pipe or well defined channel, Manning's Equation for open channel flow in Section 6.5 may be used to calculate velocity. The time of concentration, t_c , is then the sum of the initial flow time, t_i , and the travel time for shallow concentrated flow, t_t .

Table 6.5. NRCS Conveyance Factors, K

Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5

Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

Reference: NRCS (1986)

6.4.3.3 *Limitations and Considerations*

The minimum time of concentration in urban areas is 5 minutes. The minimum time of concentration in rural areas is 10 minutes. A common mistake in urban areas is to assume travel velocities that are too slow. Another is to not check the runoff peak resulting from only part of the design catchment. Sometimes a portion of the design catchment closer to the design point or a highly impervious area will produce a larger peak design flow than that computed for the entire catchment. This most often happens when the catchment is long and narrow, or when the upper portion is undeveloped while the lower portion is, or will be, fully developed.

6.4.4 SCS Method

For drainage areas larger than 90 acres, the SCS Method is one method that can be used to develop hydrographs. The procedures used in the SCS Method are described in Technical Release 20 (TR-20) and Technical Release 55 (TR-55) both prepared by the NRCS. Three parameters are needed to use the SCS Method: rainfall, curve number, and time of concentration. This section provides some general information needed to use the SCS Method in a hydrologic model. However, the reader should refer to TR-20 and TR-55 for more detail describing the SCS Method; the applicable hydrologic equations and theory; and all other background information.

6.4.4.1 *SCS Method - Rainfall*

The SCS Method includes four rainfall time distributions that are assigned geographically across the country. The SCS Type II storm distribution is applicable to the entire State of Colorado and therefore should be used when preparing hydrologic analysis for the Town. The rainfall distribution is based on a 24-hour duration.

The 24-hour distribution was developed to include the maximum intensities of all smaller duration storms; the 24-hour storm theoretically includes the 2-hour, 6-hour, etc. distributions within one longer distribution and can be used to estimate peak flows for all storm events. However, it will typically overestimate the volume of a storm event with a duration less than 24 hours. Therefore, the SCS also developed a 6-hour storm distribution, which was derived from the original 24-hour distribution. The 6-hour distribution can be used if the drainage area being modeled has a total time of concentration less than 6 hours. The total rainfall depths should be taken from NOAA Atlas 14 for the project design storm return period.

6.4.4.2 *SCS Method – Curve Number*

The SCS Method curve number (CN) is a variable used to predict infiltration and runoff based on land use and soil types. When using the SCS Method in a hydrologic model, the user will be required to input the percent imperviousness and CN for each watershed or subwatershed modeled. The CN is dependent on land cover and the NRCS Hydrologic Soil Group (A, B, C, or D). The modeled watershed or subwatersheds may be composed of multiple land uses and soil types. In these cases, a composite CN must be calculated as the representative CN for the area. Refer to Tables 6.6 and 6.7 for CN values for specific land uses and hydrologic soil groups.

The initial abstraction is another important parameter used in the CN analysis. It represents all the losses that occur prior to runoff including infiltration, interception, depression storage, and evaporation. The hydrologic model will calculate the default initial abstraction based on the selected CN. However,

in some unique cases it may be desirable to provide a user-defined initial abstraction based on the site conditions.

The table below provides runoff curve numbers for typical land uses based on average imperviousness. If a development's land use does not match a land use in the table below, or if the development's imperviousness does not match the values in the table below, curve numbers for each subbasin within the development may be calculated using TR-20 and TR-55.

Table 6.6. Runoff Curve Numbers

Land Use or Surface Characteristic	Average Imperviousness (percent)	Runoff Curve Number by Soil Type			
		A	B	C	D
Commercial/Mixed Use					
Downtown and Base Areas*	95	95	96	97	97
All Other Commercial Areas	75	83	89	92	94
Residential Single Family					
2.5 acres or larger lot size	12	46	65	77	82
0.75 – 2.5 acres lot size	20	51	68	79	84
0.25 – 0.75 acres lot size	30	74	83	88	91
0.25 acres or smaller lot size	45	66	78	85	88
Multifamily and Resort Residential	75	83	89	92	94
Industrial					
Light	80	86	91	93	94
Heavy	90	92	94	96	96
Public Facilities/Open Spaces					
Parks, cemeteries	10	45	63	75	81
Playgrounds	25	45	63	75	81
Schools	55	69	80	86	89
Lawns and golf courses	2	40	62	74	80
Undeveloped Areas					
Pre-development conditions	2	40	62	74	80
Greenbelts, agriculture	2	40	62	74	80
Off-site analysis, unknown land use	45	66	78	85	88
Outcrops	70	80	87	91	93
Streets/Roads & Surfacing					
Paved	100	98	98	98	98
Road base or recycled asphalt	80	86	91	93	94
Gravel (uniformly graded)	40	63	76	84	87
Drives/Walks	90	92	94	96	96
Roofs	90	92	94	96	96

Reference: Values are from a combination of UDFCD (2016) and USDA NRCS (2004)

Table 6.7. Runoff Curve Numbers for Arid and Semiarid Rangelands

Cover Type	Hydrologic Condition ¹	Runoff Curve Number for Soil Type			
		A ²	B	C	D
Herbaceous – mixture of grass, weeds and low-growing brush, with brush the minor element	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen – mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Coniferous, general; grass understory	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sage-grass – sage with an understory of grass	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55

1. Poor: <30% cover (litter, grass, and brush overstory); Fair: 30 to 70% cover; Good: >70% cover

2. Curve numbers for group A have not been developed for these types of cover

Reference: USDA NRCS (2004)

6.4.4.3 SCS Method – Time of Concentration

The time of concentration (T_c) is defined as the time it takes for water to travel from the most hydraulically distant point in the watershed to the point of interest. The SCS Method for calculating T_c is done by splitting the watershed into three distinct flow types: sheet flow, shallow concentrated flow, and open channel flow.

6.4.4.3.1 Sheet Flow

Sheet flow occurs in the upper part of the basin where there is not yet a defined channel. The assumption is that the depth of flow is very shallow, less than 0.1 feet, and that the total flow length is less than 300 feet. The equation for sheet flow is as follows:

$$T_t = \frac{0.007(nL)^{0.8}}{(s^{0.4})(P_2^{0.5})} \quad (6.6)$$

Where:

T_t = travel time (hr)

n = Manning's n roughness coefficient (refer to TR-55 for example values)

L = flow length (ft)

P_2 = 2-year, 24-hour rainfall (in)

s = slope of hydraulic grade line (land slope, ft/ft)

6.4.4.3.2 Shallow Concentrated Flow

Travel time for shallow concentrated flow is estimated by multiplying the average velocity by the total length of flow. Average velocity is found using the Figure 6.1 below.

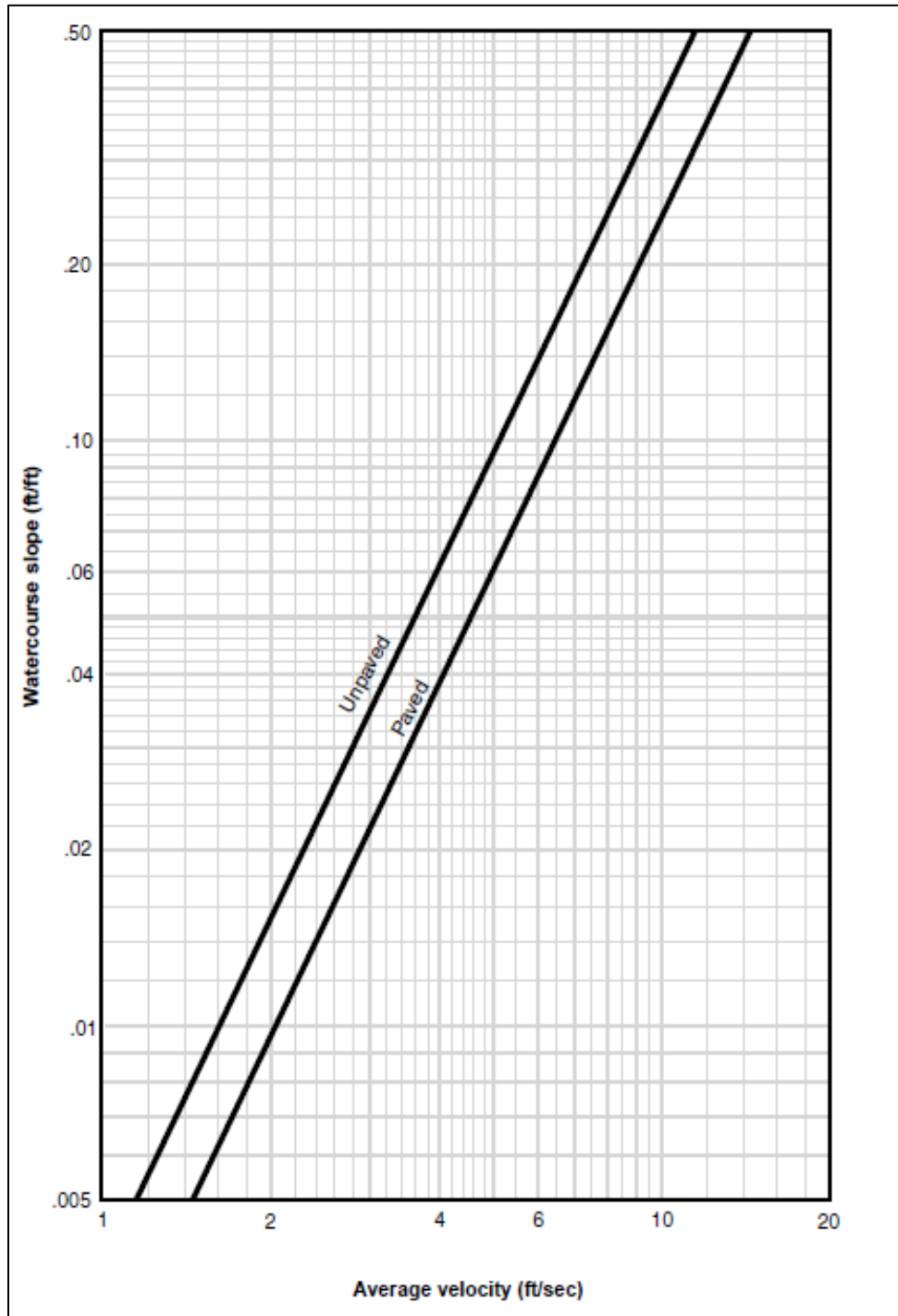


Figure 6.1. Average Velocities for Shallow Concentrated Flow

Reference: TR-55

6.4.4.3.3 Open Channel Flow

Open channel flow begins where there is a visible channel conveying storm water. Average velocity in the channel is estimated assuming the bank full flow. Velocity at bank full flow is calculated using Manning's equation or other available hydraulic modeling for the stream.

The total T_c is calculated as the sum of the three flows: sheet flow, shallow concentrated flow, and open channel flow. Some hydrologic models represent T_c as the lag time for the watershed. Lag time is defined as follows:

$$\text{Lag Time} = 0.6 * T_c \quad (6.7)$$

Where:

T_c = time of concentration (hr)

6.4.5 Hydrograph Development and Routing Models

Runoff hydrographs can be developed using CUHP, SWMM, or HEC-HMS modeling software. CUHP, which stands for Colorado Urban Hydrograph Program, was developed by the Mile High Flood District for use within SWMM. SWMM, which stands for Stormwater Management Model, was developed by the United States Environmental Protection Agency (EPA). SWMM can route hydrographs developed internally or those developed with CUHP. HMS, which stands for Hydrologic Modeling System, was developed by the United States Army Corps of Engineers' Hydrologic Engineering Center (HEC). HEC-HMS can also route the hydrographs it develops.

SWMM and HEC-HMS can evaluate runoff through larger or less homogenous basins or through complex drainage systems by routing flows through these elements. Other routing programs may be used if they are approved by the Town Engineer. The SCS Method should be used within HEC-HMS to generate runoff hydrographs. The EPA developed its own runoff method inherent to the SWMM software program. The SCS Type II storm distribution and NOAA Atlas 14 rainfall depths should be used to develop the hyetograph for input into the model. Other methodology may be used if it is better suited to site characteristics. A narrative describing the selected hydrologic methodology and the reasons for its selection should be included with the Drainage Report.

Basins should be divided into smaller and more homogeneous subwatersheds. The runoff hydrographs from upper subwatersheds are then routed through and combined with hydrographs from the lower subwatersheds, channels, detention basins, or other elements to develop a runoff hydrograph for the entire watershed.

The sizing of the detention storage may be based upon hydrograph storage routing techniques rather than direct calculation of volume and discharge requirements. A HEC or EPA SWMM model shall be used when reservoir routing of hydrographs is conducted, such as for the design of a detention pond. A HEC or SWMM model shall be used when channel routing of hydrographs is required.

6.4.5.1 HEC-HMS

HEC-HMS simulates the complete hydrologic process of a watershed system. The software includes traditional hydrologic analyses including infiltration, unit hydrographs, and hydraulic routing including through detention facilities. HEC-HMS also provides analysis tools for snowmelt. It should be noted that when using the SCS Type II storm distribution, the model is assuming that the storm distribution is for a 24-hour storm. If a 6-hour storm is desired, then the hyetograph must be input as a user-defined table.

6.4.5.2 EPA SWMM

SWMM is a rainfall-runoff model that analyzes a collection of subwatersheds that receive a rainfall hyetograph and generates runoff hydrographs at design points. SWMM can route runoff hydrographs through a system of pipes, channels, basins, and storage elements such as detention ponds; track the quantity of runoff generated at each design point; and track the flow rate and depth of water in each element over a specified simulation time. EPA SWMM is typically used for larger watersheds; for

designing detention basins and water quality facilities; and for modeling large storm sewer systems. Runoff hydrographs can be developed internally or within CUHP.

6.4.5.3 CUHP

CUHP is a rainfall-runoff model that analyzes a collection of subwatersheds that receive a rainfall hyetograph and generates runoff hydrographs and total runoff volumes at design points. The runoff hydrographs are then routed by SWMM through a system of pipes, channels, basins, and storage elements such as detention ponds to determine peak flows and volumes.

6.4.6 FEMA Flows

FEMA has established regulatory 100-year peak flow rates for some of the larger streams within the Town. Where these flow rates have been established, the Town Engineer should be consulted to determine the validity of these flow rates as it is not uncommon for them to be outdated. In some instances, a new hydrologic study may be required to evaluate current peak 100-year flow rates along FEMA-regulated streams. This study would then be submitted to FEMA for review and approval to revise the regulatory flow rates. The 2018 Breckenridge Flood Damage Prevention Ordinance presents the Town's requirements for work near FEMA floodplains and shall be consulted prior to design of any work near a FEMA floodplain.

6.5 OPEN CHANNELS

Open channel flow occurs when water has its surface exposed to the atmosphere. Open channels can be natural waterways, canals, ditches, swales, culverts, flumes, and gravity pipes that are not flowing full. Once water fully fills a closed conduit, flow in that conduit becomes pressure flow. This section discusses types of open channel flow and gives general design guidance for open channels including roadside ditches. Any work in natural channels may be subject to FEMA floodplain regulations. Chapter 2 (Section 2.4) discusses the permits that will be required for work in open channels as well as the applicability of the 2018 Breckenridge Flood Damage Prevention Ordinance to work in open channels.

For a more thorough discussion of open channel design principles, the user is encouraged to review the most recent version of the Urban Storm Drainage Criteria Manual (USDCM) by the Mile High Flood District (MHFD).

6.5.1 Open Channel Hydraulics

The hydraulics of an open channel can be complex, ranging from steady state uniform flow to unsteady, rapidly varied flow. Most drainage design involves uniform, gradually varied, or rapidly varied flow states. Steady uniform flow occurs when the depth of flow remains constant. The calculations for both uniform and gradually varied flow are relatively simple and assume parallel streamlines. In contrast, rapidly varied flow calculations, for hydraulic elements like hydraulic jumps and flow over spillways, have solutions that are generally empirical in nature. This section presents basic equations and computational procedures for uniform, critical, gradually varied, and rapidly varied flow for hydraulic jumps and weirs.

6.5.1.1 Uniform Flow

Open channel flow is considered uniform if the depth of flow is the same at every section of the channel. For a given channel geometry, roughness, discharge, and slope, there is only one possible depth for maintaining uniform flow. This is called the normal depth. For a prismatic channel cross section, the water surface will be parallel to the channel bottom during uniform flow. Uniform flow rarely occurs in nature and is difficult to achieve, even in a laboratory. However, channels are designed by assuming uniform flow as an approximation that is adequate for planning purposes.

Calculations for normal flow depth shall be based on Manning's equation shown as Equation 6.8. A spreadsheet can be developed for this equation as an effective tool for quick analysis.

$$Q = \frac{1.49}{n} A^{5/3} P^{-2/3} \sqrt{S} = \frac{1.49}{n} A R^{2/3} \sqrt{S} \quad (6.8)$$

Where:

- Q = flow rate (ft³/s)
- n = Manning's roughness coefficient (see Table 6.8)
- A = area (ft²)
- R = A/P = hydraulic radius (ft)
- P = wetted perimeter (ft)
- S = Channel or pipe slope (ft/ft)

Open channel flow velocity can be more easily calculated by rearranging Equation 6.8 to yield Equation 6.9. Equation 6.9 may be used to calculate travel time for the Rational Method. It may also be used to design channel revetment.

$$V = \frac{1.49 R^{2/3} S^{1/2}}{n} \quad (6.9)$$

Where:

- V = average velocity (fps)

For prismatic channels with uniform flow, the slope of the energy grade line (EGL), hydraulic grade line (HGL), and bottom of channel are assumed to be equal. Table 6.8 provides recommended Manning roughness coefficients for various channel linings and conditions. As channel roughness increases, a given flow rate will have a greater depth and slower velocity. Decreased roughness results in shallower depth and faster velocity. Selection of roughness coefficients for both the main channel and the overbanks is a critical part of the design and evaluation of an open channel, but it is also based on engineering judgement. Two engineers may look at the same natural channel and assign different Manning's n values.

Manning's n values may be selected to be slightly conservative for the variable being calculated. For example, when calculating a channel velocity, a slightly lower Manning's n value will result in a slightly higher calculated velocity, ensuring that channel revetment is adequately sized. When calculating channel capacity, a slightly higher Manning's n value will result in a slightly larger channel cross section, offering a factor of safety for channel sizing. Another factor to consider might be the anticipated long-term condition of the channel, as Manning's n values are prone to increasing if the channel is not properly maintained. Ultimately the Manning's n value selected by the design engineer must be defensible given the values presented in Table 6.8.

Table 6.8. Manning's Roughness Coefficients for Channels

Type of Channel & Description	Manning's n	Type of Channel & Description	Manning's n
Excavated or Dredged		Lined or Built-Up Channels	
Earth, straight & uniform		Riprap	
Clean, recently completed	.018	Riprap	Eq. 6.12
Clean, after weathering	.022	Concrete	
Gravel, uniform section, clean	.025	Trowel Finish	.013
With short grass, few weeds	.027	Float Finish	.015
Earth, winding & sluggish		Gunite, good section	.019
No vegetation	.025	Gunite, wavy section	.022
Grass, some weeds	.030	Concrete Bottom	
Dense weeds in deep channels	.035	Dressed stone in mortar	.017
Earth bottom & rubble sides	.030	Random stone in mortar	.020
Stony bottom & weedy banks	.035	Dry rubble or riprap	.030
Cobble bottom & clean sides	.40	Asphalt	
Dragline-excavated or dredged		Smooth	.013
No vegetation	.035	Rough	.023
Light brush on banks	.040	Gravel bottom with sides of	
Rock cuts		Formed concrete	.020
Smooth & uniform	.035	Random stone in mortar	.013
Jagged & irregular	.040	Dry rubble or riprap	.016
Channels not maintained, weeds & brush		Grassed	
Dense weeds	.080	Short grass prairie	0.15
Clean bottom, brush on sides	.050	Dense grasses	0.24
Natural Channels		Range (natural)	0.13
Natural channels, good condition	0.025	Wooded	
Natural channels, stones & weeds	0.035	Light underbrush	0.4
Natural channels, poor condition	0.06	Dense underbrush	0.8

References: Chow, V.T., Open Channel Hydraulics (1959), NRCS (1986)

For riprap lined channels, Equation 6.10 shall be used to calculate Manning's n value.

$$n = 0.0395D_{50}^{1/6} \quad (6.10)$$

Where:

 D_{50} = mean riprap stone size (ft)**6.5.1.2 Critical Flow**

Critical flow in an open channel is characterized by the following conditions:

1. The specific energy is at a minimum for a given discharge.
2. The discharge is at a maximum for a given specific energy.
3. The specific force is at a minimum for a given discharge.
4. The velocity head is equal to half the hydraulic depth in a channel with a minimal slope.
5. The Froude Number (Fr) is equal to 1.0.

When critical flow exists for uniform flow, the channel slope is at the critical slope. A slope flatter than critical will cause subcritical flow and result in a Froude number smaller than 1.0. A slope steeper than critical will cause supercritical flow and result in a Froude number larger than 1.0. When flow is at or near critical, it is unstable because minor changes in specific energy, such as from channel debris, will cause a major change in depth. Equation 6.11 should be used to calculate the Froude Number for all open channel designs.

$$Fr = \frac{v}{\sqrt{gD_h}} \quad (6.11)$$

Where:

Fr = Froude number (dimensionless)

v = velocity (ft/s)

g = gravitational acceleration (32.2 ft/s²)

D_h = hydraulic depth, A/T (ft)

A = channel flow area (ft²)

T = top width of flow area (ft)

6.5.1.3 Gradually Varied Flow

Gradually varied flow is most often seen as backwater created by culverts, inlets, and channel constrictions. For these conditions, flow depth will be greater than normal depth in the channel and the water surface profile must be computed using a backwater technique—either the direct step or the standard step method. The direct step method is best suited to the analysis of simple prismatic channels, whereas the standard step method is best suited for irregular or nonuniform cross-sections.

Hydrologic Engineering Center's River Analysis System (HEC-RAS), developed by the U.S. Army Corps of Engineers, is recommended for calculating water surface profiles in the Town of Breckenridge. If a designer would like to compute water surface profiles by hand, the methodology for using both the direct-step and standard-step methods can be found in the HEC-RAS Hydraulic Reference Manual (Brunner, 2016), as well as in Open Channel Hydraulics (Chow, 1959).

6.5.1.4 Rapidly Varied Flow

Rapidly varied flow has a very pronounced curvature of the streamlines. The change in curvature may be so abrupt that the flow profile is virtually broken, resulting in high turbulence. Common instances of rapidly varied flow include weir flow, orifice flow, and hydraulic jumps. Only hydraulic jumps will be discussed in this section. In the Town, weir and orifice flow are used almost exclusively for detention pond outlets and will be discussed in Section 6.9.

Hydraulic jumps may occur at grade control structures, inside storm drains or culverts, and at the outlet of a spillway and can be very erosive and affect hydraulic capacity. For grassed channels, the forces from a hydraulic jump must be controlled to prevent serious damage. Drops or other grade control structures can be used to direct the jump to an area specifically designed to resist the forces that come with it.

Jump locations within storm drain systems can be approximated by intersecting the energy grade line of the supercritical and subcritical flow reaches. There is little threat of damage to storm drains, but pipe capacity may be impacted. The effect on pipe capacity can be determined by evaluating the energy grade line and accounting for the energy lost by the jump. In general, for Froude Numbers less than 2.0, energy loss is less than 10%. For long concrete boxes, the concerns of the jump are the same as for storm drains. However, the jump can be adequately defined for box conduits and for spillways using the jump characteristics of rectangular sections. These Standards do not include a

detailed evaluation of hydraulic jumps, but the USDCM has procedures that can be used. Calculations must be included with the required submittals in accordance with Chapter 2.

6.5.2 Open Channel Design

The design standards for all open channels in the Town, except for roadside ditches addressed in Section 6.5.3, are those in the most recent edition of the USDCM. The design standards in the USDCM include channel centerline alignment and cross section layout, hydraulic analysis, and using rocks and boulders for protection from erosion. The design process for an open channel can be somewhat circular because of a wide range of options available for materials, typical cross section, channel slope, and the frequency and height of drop structures.

6.5.2.1 Channel Selection Factors

Each type of channel must be evaluated for hydraulic, structural, environmental, sociological, maintenance, economic, and regulatory factors. Table 6.9 summarizes the multi-disciplinary factors that should be used when selecting the channel that is most suitable for a specific site.

Table 6.9. Factors to Consider for Channel Design

Hydraulic	Structural	Environmental	Sociological	Maintenance	Regulatory
Topography	Cost	Habitat	Pedestrian	Lifespan	Federal
Capacity	Shear Stress	Water Quality	Recreation	Accessibility	State
Slope	Momentum	Traffic Patterns	Demographics	Repair	Local
Offsite Drainage	Seepage & Uplift	Aesthetics	Social Patterns	Reconstruction	Right-of-Way
Basin Sediment Yield	Material Availability	Wetland Mitigation		Maintenance Activities	
	Haul Off Site	Green Area Need			

6.5.2.2 General Design Guidelines

Except for roadside ditches and the additional criteria in these Standards, all open channel improvements shall be designed in accordance with the latest versions of the Open Channels, Hydraulic Structures, and Stream Access and Recreational Channels chapters of the USDCM.

All open channels within the Town shall be designed to convey both the minor and major design storms in a subcritical flow condition with a Froude number of less than 0.80. The major storm shall not result in a flow depth greater than 4.0 feet at any point along the channel reach. All open channels shall also be designed with public safety in mind and adequate maintenance access shall be provided.

Natural channels and grass-lined channels are preferred, and concrete-lined and riprap-lined channels are discouraged. Channel improvements that drastically change the look, shape, lining, alignment, or flow characteristics of the existing channel should be avoided. Improvements to natural channels should strive to maintain the capacity and alignment of the existing channel. In the event an entirely new channel is required, such as through a new development, it should closely mimic natural channels in the surrounding area with the same capacity.

The design components that have the greatest potential effect on the performance and cost of the improvements should be evaluated early on to guide the design process. High cost items include riprap channel linings and boulder drop structures, and the engineer should strive to design open channels to minimize the need for and use of these elements. Consideration should also be given to long term maintenance and repair costs.

6.5.2.3 High Gradient Channels

In mountainous areas, natural channels can have steep grades with cobble or rock along their bottoms. While uniform flow calculations with standard channel roughness values generally predict supercritical flow, field observations show that these channels are often protected by natural armoring. Field investigations have resulted in procedures for estimating hydraulic roughness for these streams that result in lower calculated velocities than those obtained with the Manning's equation using a uniform roughness coefficient. The designer is encouraged to review Determination of Roughness Coefficients for Streams in Colorado by Robert D. Jarrett in cooperation with the Colorado Water Conservation Board.

Equation 6.12 may be used as an aid in predicting the roughness coefficient of a high-gradient channel provided the following conditions are met.

1. The channel must be a natural channel that has a relatively stable bank material and a cobble or boulder bed material.
2. The channel friction slope must be between 0.01 and 0.04 feet per foot and the hydraulic radius must be between 0.5 and 7 feet.
3. The channel must not be affected by backwater.

$$n = 0.39S_f^{0.38}R^{-0.16} \quad (6.12)$$

Where:

n = Manning's roughness coefficient

S_f = channel friction slopes (ft/ft)

R = hydraulic radius, A/P (ft)

Additionally, while mountainous channels may have high average grades, they have often achieved this by cutting very steep drops interspersed along what are otherwise flatter reaches. The analysis of a natural mountain stream requires a careful topographical investigation. The hydraulic model must recognize that friction slope, hydraulic radius, and n value may change frequently along the length of the channel and take this into account by dividing the channel into reach lengths of reasonably uniform discharge, depth, slope, and channel and floodplain geometry. Determination of Roughness Coefficients for Streams in Colorado gives an in-depth discussion of suggested reach lengths and subdivision of cross sections to be used in the hydraulic model.

Natural channels have typically reached a reasonable state of equilibrium based on the amount of peak runoff they are accustomed to receiving. Although a new development may not encroach on the floodplain of a natural channel, it is also critically important that it does not increase the peak runoff the channel receives. This could easily cause erosion of the channel and require costly remediation.

If site conditions suggest use of Equation 6.12 might be appropriate, the designer shall consult with the Town to confirm its applicability and discuss any additional specific site concerns regarding the stability of the natural channel. Development shall be planned around natural channels so they remain in place in their natural alignment. If a Developer believes there is a benefit to realigning a natural channel, the proposed modifications shall be submitted to the Town Engineer for review. If the average slope of an existing natural channel through a development is greater than 1.0%, the existing natural channel should not be reconfigured either in horizontal or vertical alignment to suit development unless a geotechnical investigation identifies that the channel is unstable in its current condition. Rather, development should be planned to accommodate the location of the natural channel and its existing floodplain.

6.5.2.4 Ecological Channel Design Guidelines

The USDCM puts a considerable amount of emphasis on preserving and restoring natural stream corridors. The Town of Breckenridge strongly supports using ecological concepts to preserve and restore local channels. Ecological channel design includes bioengineering practices that utilize vegetation in a combination with natural structural measures to stabilize and protect stream banks while providing habitat.

Ecological channel design can have numerous public and environmental benefits when applied in an appropriate location, but care should be taken in selecting the location and completing design calculations to ensure an ecological channel design will hold up under the stream forces it is intended to withstand. Numerous types of bioengineering components can be used. Table 6.10 lists some of the potential advantages and disadvantages of an ecological channel design, as opposed to more traditional riprap and concrete design concepts. The potential for every channel restoration project to include ecological components shall be examined and discussed with the Town.

Table 6.10. Ecological Channel Design Advantages and Disadvantages

Advantages	Disadvantages
Environmental clearances (may facilitate permits)	Potentially more expensive
Aesthetically pleasing	Specialized vegetation
Fish passage	Additional maintenance required
Habitat for fish, birds, and macroinvertebrates	Susceptible to failure during larger storms
Open space creation and preservation	May require a larger footprint
Water temperature moderation	Specific hydrologic conditions required
Water quality enhancement	

Ecological channel design may be applied when the overall channel design is firmly rooted in engineering principles and when the following conditions are met:

1. Hydrologic conditions are favorable for establishment and successful growth of vegetation.
2. Designs are conservative in nature, and bioengineered features are used to provide redundancy.
3. Maintenance responsibilities are clearly defined.
4. Adequate structural elements are provided for stable conveyance of the major storm runoff.
5. Species are selected based on individual site characteristics.

It is important to note that bioengineered elements are commonly designed to withstand flows from more frequently occurring storms. Design events are typically between the 1.5-year to 10-year storm, with the 100-year storm occasionally being a consideration. While designing for a larger event is prudent, stability during such events may often be achieved by traditional engineering techniques because bioengineered elements may not remain stable above a certain threshold. If stability is critical at a given location, such as at bridge piers, bioengineering measures may not be enough without the addition of traditional engineering techniques. Bioengineering techniques can be incorporated into almost all traditional engineering projects, often to great ecological benefit. The design approach must balance ecological function with the need for channel stability when selecting a design discharge. Both the Town and the design engineer should discuss and agree upon the various ecological and hydraulic criteria the design will meet.

The key elements to consider in an ecological channel design include hydrology, hydraulics, geomorphology, physiochemistry, and biology. Each of the following elements should be addressed when designing the channel:

1. Future hydrologic changes associated with urbanization
2. Channel stability
3. Hydrology to support vegetation
4. Supplemental structural measures

The USDCM should be reviewed as part of the design process because it offers valuable guidance on typical minimum standards. The Natural Channel Design Review Checklist published by the US Fish and Wildlife Service should also be reviewed to ensure that all appropriate parameters have been considered.

No specific criteria or design guidance is included in these Standards because each site is unique and will require a solution based on the characteristics of and goals for each site. However, there are publications that offer guidance on ecological channel design, and these should be consulted to ensure the design will stand up to the chosen design hydraulic event. The Technical Supplements contained in *Stream Restoration Design* (National Engineering Handbook 654) (NRCS, 2007) offer extensive and detailed guidance on the physical design of ecological channels. Specifically, Technical Supplement 14, letters I through O, offer design guidance and equations for soil bioengineering, using large woody material for habitat and bank protection, vegetated rock walls, fish passage, and fish lunkers, among many other components.

Monitoring and maintenance should be performed throughout the life of the ecological channel design. The following list consists of four periods when a bioengineered structure is most at risk:

1. Immediately after construction
2. During the driest time of the year
3. During high magnitude discharge events
4. When a shift in plant community occurs away from plants chosen for biostabilization.

6.5.2.5 Revegetation

To achieve the highest likelihood of establishment of the specified vegetation, a 3-year maintenance plan from a certified landscaping company that understands native vegetation is required. The Town shall be consulted to provide a site-specific seed mix for each project. Plantings need to be completed in the fall or late winter to provide the best odds of establishment. Depending on the site, irrigation may also be required. Other techniques to improve the odds of successful vegetation establishment are in Chapter 7.

6.5.3 Roadside Ditch Design

Much like the design of any open channel, design of roadside ditches is a balance of several design components, including velocity, capacity, available right-of-way, slope, and cross-sectional geometry. Chapter 5 discusses several constraints and factors to consider when laying out a roadside ditch. The capacity requirements of a roadside ditch are based on the roadway encroachment criteria discussed in Section 6.6.

This section discusses permissible velocities and Froude numbers for a roadside ditch. Roadside ditch hydraulic calculations will be completed using Manning's equation. The Manning's roughness coefficients for calculating velocity, Froude number, shear stress, and capacity included in Table 6.8 will be used for all roadside ditch calculations. The designer should note that if a ditch is expected to be vegetated there is a much higher potential for erosion until revegetation is complete. The use of erosion control measures such as turf reinforcing mat prior to revegetation will minimize this potential.

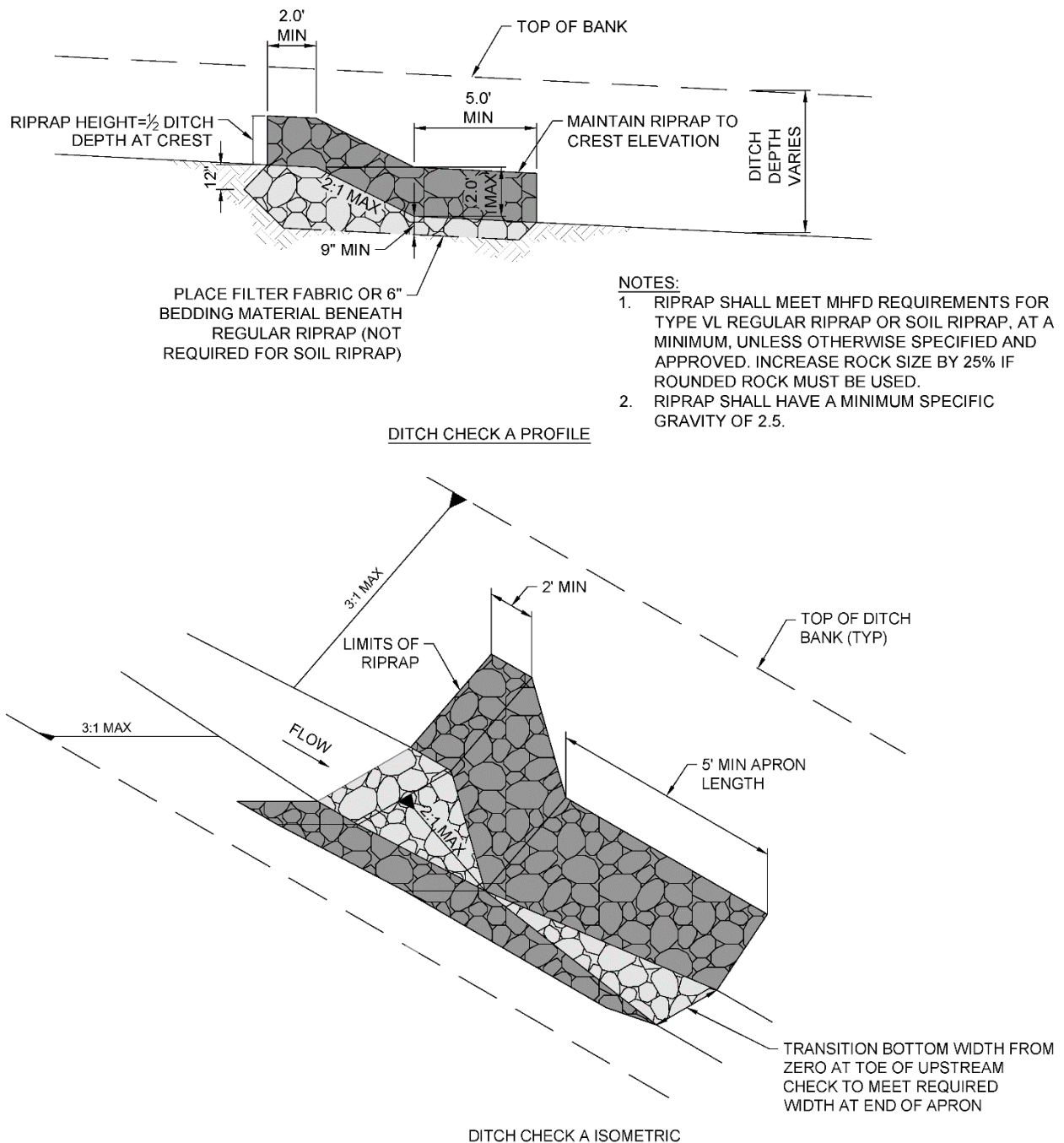
Roadside ditch flow with design depths less than or equal to 1.0 feet have no Froude number or velocity limitations. For ditch flow depths greater than 1.0 feet, velocity shall not exceed 7.0 feet per second, and the Froude number shall not exceed 0.8. These criteria are shown in Table 6.11.

Table 6.11. Allowable Velocity and Froude Number for Roadside Ditches

Design Component	Maximum Allowable Values	
	Flow Depth $\leq$ 1.0 feet	Flow Depth $>$ 1.0 feet
Velocity	No maximum	7 ft/s
Froude Number	No maximum	0.8

It is preferable that roadside ditches have side slopes no steeper than 3H:1V. If right-of-way is constrained, the ditch slope may be steepened to 2H:1V. Slopes steeper than 3H:1V shall be stabilized with erosion netting or stabilized with a method approved by the Town Engineer. Where right-of-way allows, roadside ditches will have a flat bottom at least two feet wide, but ditches may be V-shaped if right-of-way is constrained, with approval of the Town Engineer. Roadside ditches should ideally be designed as grass-lined channels without the need for riprap revetment. If riprap revetment is required, buried soil riprap shall be used in accordance with the design guidance in the USDCM and the ditch shall be revegetated.

Where roadway slopes are too steep to accommodate a ditch design that will meet velocity or Froude number criteria, a flattened ditch slope may be used with ditch checks placed at intervals to make up for grade discrepancies. An example of a ditch check is shown in Figure 6.2. In no case shall a roadside ditch have a slope steeper than 4%, regardless of whether allowable velocity and Froude number values are met.

Figure 6.2. Ditch Check Schematic

6.6 STREETS AND ROADSIDE CONVEYANCE

The primary function of public streets is the movement of traffic. The use of streets as part of the drainage system must be limited to prevent interference with traffic. Streets also typically convey runoff collected on the street surface as well as from some limited portion of the surrounding area. Streets must be capable of conveying that runoff to either a storm drain or open channel system. The drainage system in many parts of the Town is an open channel system with roadside ditches, which are discussed in Section 6.5. In dense and newly developed areas, an enclosed storm drain system is more appropriate, as discussed in Section 6.7.

This section presents the limitations on stormwater in public streets regardless of the type of roadside conveyance used. Limitations are established with roadway function and public safety in mind and are presented in terms of ponding depths at the curb face, the depth of flow permitted at the roadway crown, and the width of roadway that must remain clear during a storm event. Criteria vary based on the design storm and the roadway classification. When runoff in the street exceeds the allowable limits, a storm drain system, an open channel, or a combination of both is required to convey the excess flow. In all cases, the most stringent criteria will apply.

6.6.1 Allowable Flow Depth and Spread

Each street or roadway in the Town of Breckenridge is classified based on its role in connecting and providing access within and between various land uses. These classifications are available from the Town. The extent to which runoff from the minor or major design storm may encroach onto a roadway is based on that roadway's classification. Limiting the encroachment of stormwater onto a roadway section is the primary criteria by which public safety is maintained during a storm event.

Although many roads will utilize a roadside ditch to convey stormwater along the road, some will have a curb and gutter section. Using a curb and gutter or roadside ditch to convey flow along a street does not affect encroachment criteria because safety concerns remain the same for all types of roadways. The allowable encroachment onto the roadway for each roadway classification is presented in Table 6.12. These criteria may include the width of the roadway that must remain free of water or the allowable depth of flow at certain points along the roadway cross section. Curb overtopping criteria applies only to streets with a curb and gutter section.

In no case shall any roadway improvement, reconstruction, or expansion cause more flow encroachment on a parcel or structure outside the public right-of-way than currently exists. These criteria apply to roads with roadside ditches, curb and gutter sections, and culvert crossings. They do not apply to bridge crossings. Criteria for bridges are included separately in Section 6.8. Street inundation during both the minor and major storms must be analyzed for compliance with the criteria in this section.

Table 6.12. Maximum Allowable Flow Depth and Encroachment

Roadway Classification	Minor Storm Encroachment	Major Storm Encroachment
Arterial	10 feet clear each way; No curb overtopping; No encroachment on adjacent property	15 feet clear in center; Ponding below finished floor of all occupied structures
Major Collector	10 feet clear in center; No curb overtopping; No encroachment on adjacent property	Allowable depth at crown = 3 inches; Ponding below finished floor of all occupied structures
Minor Collector	10 feet clear in center; No curb overtopping; No encroachment on adjacent property	Allowable depth at crown = 6 inches; Ponding below finished floor of all occupied structures
Local	Flow may spread to crown; No curb overtopping; No encroachment on adjacent property	Allowable depth at crown = 9 inches; Ponding below finished floor of all occupied structures

Where roadside ditches are used to convey flow, they shall have sufficient capacity to meet the maximum encroachment and flow depth criteria in Table 6.12. Ditch geometry requirements are in Section 6.5 Open Channels.

6.6.2 Minimum and Maximum Grades

The minimum concrete or paved gutter grade shall be 0.5%. The minimum open channel grade shall be 1.0%. Maximum grades in roadside ditches shall meet criteria in Section 6.5 Open Channels.

6.6.3 Cross Street Flow

For all roadway classifications, flow in cross pans shall not exceed the limits set forth in Table 6.12.

6.6.4 Calculations

For roadway drainage, the minor and major storm must be evaluated separately for each side of the street using a Manning's n value of 0.016 for the gutter and street flow areas and a Manning's n value of 0.025 for sidewalk and grass areas, if needed. When a roadside ditch is used, a Manning's n value must be assigned based on the ditch lining.

6.6.4.1 Streets with Curb and Gutter

Design calculations can be performed manually, but this section assumes UD-Inlet will be used to calculate street capacity for those streets with curb and gutter. The USDCM provides additional details on the equations and methodologies that have been incorporated into the UD-Inlet spreadsheet, and guidance in the most recent version of the USDCM can be used for manual design. Note that as the MHFD updates their design spreadsheets they may change the prefix from UD to MHFD. The most recent version of UD-Inlet or MHFD-Inlet should be used.

A reduction factor from Figure 6.3 must also be applied to streets with curb and gutter, which will reduce effective street capacity. The reduction factor accounts for the increased effect on capacity that items like debris and parked cars can have at steeper roadway slopes. UD-Inlet includes these reduction factors automatically.

Street capacity calculations for the minor and major event shall be based on the following procedure:

1. Calculate the theoretical street capacity based on the allowable spread in Table 6.12.
2. Calculate the theoretical street capacity based on the allowable depth in Table 6.12.
3. Apply the appropriate reduction factor from Figure 6.3 to the theoretical flow rate based on allowable depth.
4. The lesser value from steps 1 and 3 is the allowable street capacity.
5. An inlet should be added whenever the runoff reaching the street exceeds the allowable street capacity for the major or minor event.

6.6.4.2 Streets with Roadside Ditches

Design calculations for streets with roadside ditches can be completed with a spreadsheet using Manning's equation in accordance with the design procedures in Section 6.5 Open Channels. The flow areas for the roadway and ditch must be separated so the appropriate Manning's n values can be used for each.

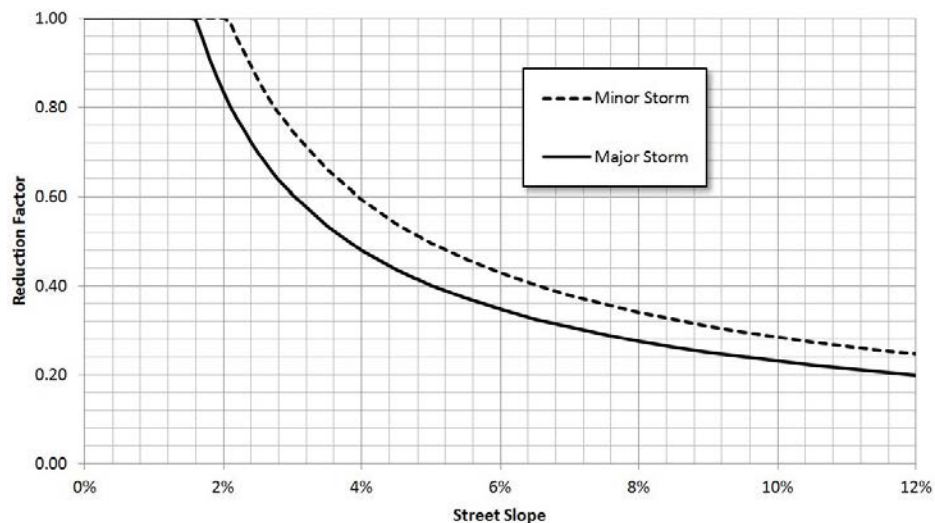


Figure 6.3. Reduction Factor for Gutter Flow
(UDFCD, 2018)

6.7 STORM DRAIN SYSTEMS

The criteria presented in this section shall be used to design and evaluate storm drain systems in the Town. A storm drain system refers to the system of inlets, pipes, manholes or junctions, outlets, and other appurtenant structures that are designed to collect and convey the initial or minor storm runoff. The storm drain system is a part of the local drainage system, which may also include curb and gutter, streets, roadside ditches, swales, and channels. This section presents both technical criteria and the general procedures for design and evaluation of pipes and inlets. Allowable roadway encroachment is in Section 6.6.

6.7.1 Storm Drain Design Criteria

A storm drain system is required when the allowable street capacity is exceeded during the minor storm event, or as required to eliminate the need for cross pans, or to prevent ponding/icing issues on roads. All criteria and guidelines below apply to the minor storm event unless site conditions offer no viable overflow option for the major storm event. Storm drain systems shall also be required where sump conditions exist and on major collectors and arterials to eliminate cross pans and ponding and icing near intersections.

6.7.1.1 Construction Materials

Pipe materials suitable for storm drains include reinforced concrete and high density polyethylene (HDPE). If the Town Engineer has reason to believe that pipe corrosion may be a problem, the Town Engineer may require a soils report to evaluate the corrosive potential of the soils and groundwater to be determined in the Geotechnical Report.

All pipe joint fillers, sealing compounds, gaskets, and the installation thereof, shall be in accordance with CDOT specifications. Rubber gaskets shall be used at pipe joints where the HGL is five feet higher or more than the pipe crown.

6.7.1.2 Pipe Size

The minimum allowable pipe diameter for storm drains shall be 18 inches for trunk lines and 15 inches for laterals. The minimum inside diameter of all pipes shall be no less than 14 inches for elliptical and arch pipe. In areas where debris, sediment deposition, adjacent wildfire burn area, or freezing are potential problems, the Town Engineer may require larger pipes. There is no maximum pipe size;

however, using multiple smaller barrels in lieu of very large pipes may be physically or economically advisable under some circumstances. For pipes below 5' diameter, a single barrel pipe is preferred over multiple smaller barrel pipes.

6.7.1.3 *Horizontal and Vertical Alignment*

Storm drains shall be designed and installed with sufficient cover to support an HS-20-44 loading in accordance with the pipe manufacturer's recommendations. Minimum and maximum cover are determined by the size, material, and class of pipe, as well as by the characteristics of the cover material and the expected surface loading. The designer should consult appropriate data sources to determine these values, but the minimum cover in all instances shall be greater than 24 inches of cover.

To prevent freezing issues, the following cover requirements shall be met as well, where feasible. In areas that are regularly plowed, storm sewers shall have a minimum cover of 5 feet. In areas not typically plowed, storm sewers shall have a minimum cover of 4 feet. Less cover may be allowed if winter flows are diverted and an alternate means of flow disposal is provided, such as a dry-well. If utility conflicts or grade restrictions do not allow the minimum values above, additional measures may be required to prevent freezing, including insulation around pipes, slotted pipes, deep inlets that are perforated or bottomless, and other measures as determined by the Town Engineer.

The following resources should be consulted to assist the designer in determining cover requirements:

1. Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, Section 700 (Materials Details)
2. Concrete Pipe Design Manual (ACPA)
3. Handbook of Steel Drainage and Highway Construction Products (AISI)
4. Pipe Manufacturer Specifications
5. Other applicable references

Trench installations, including bedding, shall be in accordance with the most recent edition of the CDOT M&S Standard Plans. In manholes and junction boxes, the lowest inlet pipe invert elevation must be at least 0.2 feet higher than the outlet pipe invert elevation. In cases where inlet pipes are smaller than outlet pipes, the top of the inlet pipes shall be at least 0.2 feet higher than the top of the outlet pipes.

6.7.1.4 *Utility Crossings*

The Town's required minimum clearance between storm drains and other utilities is 12 inches, regardless of whether the crossing utility is above or below the storm drain. If either the storm drain or crossing utility is encased, the minimum clearance may be reduced to 6 inches. In all cases, backfill material, compaction, and additional protection shall be designed and provided to prohibit settling or failure of either the storm drain or crossing utility.

When storm drains cross above or within 18 inches below water mains, the storm crossing shall be constructed of a 20-foot section of pipe centered on the water main alignment, and the bounding joints shall be encased. Storm drain joints shall also be encased at all locations less than 10 feet horizontally from a water main. Encasement shall be a reinforced concrete collar, 6 inches thick, extended to 12 inches on either side of the joint. The minimum reinforcement shall be a minimum of four continuous #4 bars, equally spaced around the pipe, and tied with #3 bars around the pipe at 8 inches on center.

All work shall be in accordance with these Standards, the Town's Standard Drawings, CDOT M&S Standard Plans, or other approved details, and the design must be approved by both the Town and

the utility owner. Utility owners may have more stringent requirements and local utilities shall be consulted to ensure these requirements are met.

6.7.1.5 Inlets and Manholes

The standard inlets permitted in the Town are a CDOT Type 13 combination inlet, a CDOT Type 13 valley inlet, and a CDOT Type C grated inlet. Type 13 combination inlets may also be called a Type 16 inlet. Type 13 combination inlets shall be used with a 6-inch vertical curb and gutter section and installed with a localized depression at least 2 inches below the gutter flowline elevation. Type 13 combination inlets shall be located, at a minimum, just upstream of curb ramps, and never in the ramp itself. Type C inlets shall be used in roadside ditches and installed in accordance with the CDOT standard plans, including creating a sump condition where one does not naturally exist. Type C inlets are not traffic rated and shall not be placed in roadways. Type C inlets may not be placed in sidewalks or other pedestrian routes. Other types of inlets, including those made of PVC, HDPE, or other materials are only allowed in landscaped areas outside of roadway and sidewalk clear zones.

Table 6.13 provides the maximum allowable manhole or junction box spacing for storm drains. Manholes are also required where there is a change in pipe size, vertical or horizontal alignment, elevation, or slope, and where there is a junction of two or more pipes or laterals. All manholes and junction boxes must provide access to the storm drain system for maintenance and inspection. All manhole and junction box inverts shall be formed with a minimum of a half bench to provide more hydraulically efficient flow through the manhole.

Table 6.13. Maximum Allowable Manhole Spacing

Vertical Pipe Dimension	Maximum Manhole or Junction Spacing
15 to $\leq$ 36 inches	400 feet
> 36 to $\leq$ 60 inches	500 feet
> 60 inches	750 feet

The required diameter of the manhole barrel is dependent upon the size of the largest pipe connecting to it. Minimum manhole sizes are in Table 6.14 and assume the storm drain alignment passes straight through the manhole with no incoming lateral lines. If a storm drain system changes alignment or must accommodate incoming lateral lines at a manhole, the manhole may need to be larger.

Table 6.14. Manhole Sizing

Maximum Pipe Dimension	Minimum Manhole Size
$\leq$ 24 inches	4-foot diameter
> 24 to $\leq$ 42 inches	5-foot diameter
> 42 inches	6-foot diameter or box base

6.7.1.6 Capacity and Velocity

Minimum velocities are required in storm drains to reduce sedimentation and promote positive drainage through the pipe at all flow depths. Public and private storm drains shall have a minimum flow velocity of 3 feet per second when normal flow in the pipe is at 0.25D and never be constructed at less than 0.40% slope. Public and private storm drains shall have a maximum flow velocity of 16 feet per second for all storm events, although care should be taken with velocities this high as there is a higher risk for hydraulic jumps and extreme head loss through junctions.

The storm drain system shall be designed to convey the minor storm without resulting in pressure flow, and the energy grade line (EGL) for the minor storm shall be at or below finished grade at all manholes, inlets, or other junctions. Pressure flow during the major storm is discouraged, but if it does occur, it must not create a surcharged condition at any inlet. Where the 100-year hydraulic grade line (HGL) is above any manhole rim, or if any manhole or inlet is in a floodplain, all manhole and inlet covers must be bolted down.

The EGL and HGL for both the minor and major storm events shall be calculated and plotted for all storm drain systems. Hydraulic losses will include friction, expansion, contraction, and junction losses at a minimum. The methods for estimating these losses are presented in the following sections. Manning's *n* values for capacity and velocity calculations for storm drains shall be the values in Table 6.15. The design of storm drain outlets into open channels, including revetment shall meet the requirements of Section 6.8 for culvert outlets.

Table 6.15. Manning's Roughness Coefficients for Storm Drain Conduits

Pipe Interior	Manning's <i>n</i>
RCP (newer)	0.013
RCP (older)	0.015
RCP (preliminary design)	0.015
Smooth Plastic (HDPE)	0.011

When a planned storm drain system connects directly into the Town's existing storm drain system, an analysis must be provided showing the additional flow from the proposed project does not result in the capacity of the existing storm drain system being exceeded. The requirement for detention in Section 6.9 is intended to facilitate meeting this requirement.

6.7.2 Storm Drain Hydraulics

This section presents the general aspects of hydraulic design and evaluation of storm drains. Hydraulic design calculations can be performed manually with a spreadsheet or by using a computer model. Both methods are briefly discussed below. The user is assumed to possess a basic working knowledge of storm drain hydraulics and is encouraged to review technical literature available on the subject as needed.

6.7.2.1 Manual Calculations

Manual storm drain hydraulic calculations shall be performed in accordance with the HEC-22 (Brown et al., 2013) or the latest version of the USDCM. HEC-22 includes a discussion of both open channel and pressure flow and includes a design example.

Two of the critical design elements of a storm drain system are the HGL and the EGL. The HGL is a line that represents the water surface elevation along an open channel, including open channel flow within a pipe. In pressure flow, the HGL is the level to which water would rise in a vertical tube at any point along the pipe. The EGL is an imaginary line that represents the total energy at any point in the system. Total energy includes elevation head, velocity head, and pressure head and is the HGL plus the velocity head ($V^2/2g$). The total energy at any location equals the energy at any downstream location plus the losses that occur between the two locations.

Losses are typically classified as either friction or form losses. Friction losses occur as water flows along the length of a pipe. Form losses occur at the exit from the system and at junction structures within the system. Because the Town does not allow transitions or bends outside of manholes, form

losses will be restricted to exit losses when flow leaves the system, and structure losses, such as through inlets or manholes. These are referred to by HEC-22 as inlet and access hole losses.

6.7.2.2 Computer Model Calculations

Computer models are often used to calculate the HGL and EGL of storm drain systems. The benefits of using a computer model include consistency, speed, and the ability to check the validity of the model with relative ease. One disadvantage of computer modeling is that errors can occur and be hidden when the model user is inexperienced. Three common programs used throughout Colorado include those listed below. Additional software may be used as approved by the Town provided it utilizes industry standard calculation methods:

1. UD-Sewer 2009, a simple and free program developed by the MHFD that is easy to learn. Note that while UD-Sewer is still provided on the MHFD website and may still be used for new projects, the MHFD no longer supports this program.
2. Storm and Sanitary Analysis, a more complex design tool which runs within the AutoCAD Civil 3D design software package by Autodesk.
3. StormCAD, a more complex design tool which runs within the MicroStation design software package by Bentley Systems or within AutoCAD.

This section provides specific guidance for UD-Sewer 2009. The program uses Manning's equation to analyze and size storm sewer systems. The program can also use the Rational Method to calculate runoff, perform HGL and EGL calculations, and provide plots of the storm drain, ground line, HGL, and EGL. The user's manual is embedded in the software, which can be obtained from the MHFD website (<https://mhfd.org/resources/software>) or via an internet search for "MHFD UD-Sewer."

6.7.2.2.1 Rational Method

UD-Sewer 2009 uses the Rational Method to calculate runoff based on input parameters provided by the user. The user can override Rational Method calculations by manually entering known flows that have been calculated separately; however, values must be entered for Rational Method parameters or the program will give an error.

6.7.2.2.2 Bend and Lateral Loss Coefficients

UD-Sewer 2009 requires bend and lateral loss coefficients for each storm drain segment within a model. Bend and lateral losses both occur at a manhole or inlet junction. Bend losses are the result of the angle between the incoming storm drain and the exiting trunk line at a junction. Lateral losses are the result of turbulence or eddies that occur from lateral flows joining a trunk line. These coefficients are calculated by the program based on user inputs that define the geometry of the system.

To calculate the bend loss coefficient, the user must select the shape of the manhole invert and enter the angle between the incoming and downstream pipe segments. To calculate the lateral loss coefficient, the user must enter the angle between the incoming lateral and downstream trunk line. When entering the angle, the user must select main line or lateral line. Lateral loss is only applied to the main lines of a storm sewer system in UD-Sewer 2009. For all lateral lines, the user should select lateral line and the program will default to zero. If more than one lateral enters a manhole, the user must exercise judgment to determine the appropriate loss coefficient. .

6.7.3 Inlet Hydraulics

This section presents the general procedures for sizing and spacing inlets for a storm drain system. Design calculations can be done manually, but this section focuses on the use of UD-Inlet to calculate street and inlet capacity. The USDCM provides additional details on the equations and methodologies that have been incorporated into the UD-Inlet spreadsheet, and guidance in the most recent version

of the USDCM shall be used for manual design. Note that as the MHFD updates their design spreadsheets they may change the prefix from UD to MHFD. The most recent version of UD-Inlet or MHFD-Inlet should be used.

6.7.3.1 Introduction

Inlets on a continuous grade result in uncaptured flow bypassing the inlet and continuing to the next inlet in the system. Sump inlets are located at low points in the roadway vertical alignment which are known as sags or sumps; there is no way for excess water to bypass a sump curb inlet. A sump condition can occur at a change in street grade from positive to negative or at an intersection due to the crown of the cross street.

6.7.3.2 Inlet Capacity

Inlet capacity may be calculated using the UD-Inlet spreadsheet developed by the MHFD. UD-Inlet is an Excel-based program that calculates both street and inlet capacities based on several parameters entered by the user. In general, the procedure consists of defining the amount and depth of flow in the gutter and determining the theoretical flow interception by the inlet. The calculations within the spreadsheet program are based on physical research completed at Colorado State University. The most recent version of UD-Inlet can be obtained via an internet search for "UD-Inlet MHFD" or from the MHFD website (<https://mhfd.org/resources/software>).

Information required by the UD-Inlet spreadsheet includes design flow; height of curb; distance from curb face to street crown; gutter width; street cross and longitudinal slopes; gutter cross slope; Manning's n for the street; maximum allowable spread from gutter flow line; maximum allowable depth at gutter flow line; and allowable flow depth at the street crown. Additionally, if flow is allowed behind the curb, the allowable spread width, side slope, and Manning's n behind the curb must be entered. The spreadsheet can use the Rational Method to calculate a design flow at the inlet or will accept a flow entered by the user. If the inlet receives bypass from an upstream inlet, the bypass flow can be entered or referenced from another UD-Inlet worksheet. Default clogging factors included in the UD-Inlet spreadsheet shall be used to account for potential debris clogging, pavement overlaying, and varying design assumptions.

6.7.3.3 Continuous Grade Condition

The capacity of an inlet on grade is dependent on street slope, depth of flow in the gutter, height and length of curb opening, street cross slope, and the amount of local inlet depression. Cost effective inlet design allows for some bypass. The amount of bypass or carryover flow must be included in the drainage facility evaluation as well as in the design of the inlet.

6.7.3.4 Sump Condition

Due to frequent freezing conditions and the associated hazards, sump conditions will only be allowed where no practical alternatives for grading and drainage exist. Where a sump condition is unavoidable, sump inlets shall be sized to have twice the capacity as otherwise required by these Standards to decrease the likelihood of ice buildup preventing the inlet from functioning.

6.7.3.5 Inlet Spacing

The optimum spacing of storm inlets is dependent upon several factors, including traffic requirements, contributing land use, street slope, allowable street capacity, and distance to the nearest outfall system. The suggested sizing and spacing of the inlets is based on an ideal interception rate of 70% to 80%. This spacing has been found to be more efficient than a spacing that will accomplish a 100% interception rate; although, the downstream-most inlet will still need to be designed to intercept 100% of the flow.

Inlet spacing is typically an iterative process, and the designer may have to move inlet locations multiple times before determining the appropriate spacing to meet design criteria and maintain efficiency. After initial inlet locations are determined, the designer should recalculate the peak flow to each inlet and check that the allowable street capacity has not been exceeded at any location. If the actual flow is less than the allowable street capacity, inlets may be spaced further apart to prevent overdesign of a system. Locating inlets is a balance between meeting criteria and efficient design. It is not usually possible to have optimum inlet spacing throughout an entire storm drain system. The inlets must be spaced so that no portion of a roadway exceeds the spread criteria of this chapter.

6.7.3.6 *Inlet Grates*

All grates used on storm inlets in the Town will be bicycle-safe grates in accordance with the most recent version of the AASHTO Guide for the Development of Bicycle Facilities. Grates shall be Type L vane grates or approved equal style meeting AASHTO bicycle and ADA requirements. Grates shall be cast iron and rated to withstand HS-20-44 loading.

6.7.4 **Design of a Storm Drain System**

This section presents the general procedure used to design a storm drain system from preliminary through final design. A typical local drainage system consists of flow in the storm drain and allowable flow in the gutter and street. These flows are ultimately discharged to a larger drainage system or an open channel with capacity for a much larger event.

6.7.4.1 *Preliminary Design*

The preliminary design of the storm drain system begins after a preliminary development plan has been prepared that delineates the general development areas, major drainage paths, and drainage outfall locations. Allocation of space for drainage facilities and considerations shall be incorporated into the preliminary development plan. The drainage engineer must have input into the development plan to ensure proper drainage planning.

1. The first step in any drainage project is the collection of basic data. Information typically required includes:
 - a. Topographic maps of the development and drainage basins that show existing and proposed roadways, existing and proposed land uses, major drainage features such as creeks and streams, development area, and property boundaries
 - b. Typical street cross sections
 - c. Preliminary grading information, such as contours, profiles, and control elevations
 - d. Soils information
 - e. Existing and proposed utilities
 - f. Existing irrigation and raw water facilities and requirements for maintaining facilities
 - g. Rainfall information
2. Perform the hydrologic evaluation of the basin(s) for both the minor and major storms, typically using the Rational Method. Divide each basin into smaller subbasins and calculate the peak design flow for each hydrologic point of interest or potential inlet location. The degree of basin subdivision will depend on the detail of information available and the experience of the licensed professional drainage engineer.
3. Complete preliminary sizing for the minor storm. Beginning at the upper end of the basin, calculate the flow in the street until the allowable capacity of the street as calculated in Section 6.6 matches the design runoff. The storm drain system will typically start at this point. Removal of all street flow by inlets is not required, except at sump locations, and is typically not

economical. The sum of the flow in the storm drain and the street must be less than or equal to allowable capacity.

4. Assign a diameter, pipe material, and slope for preliminary sizing. Manning's *n* values should be those in Table 6.15. A profile may be required to check for utility conflicts or to confirm compatibility with the receiving drainage system. The preliminary vertical alignment should not be steeper than the proposed street grade. The designer should also be aware of existing utility locations, especially when crossing water and sanitary main and service lines.
5. After sizing the system for the minor storm, route the major storm through the system and evaluate the results. The combined total of the allowable street capacity and the storm drain capacity during the major storm should equal or exceed the 100-year runoff. A plan and profile of the pipes and minor and major storm EGL and HGL is required. If the combined allowable capacity is less than the design flow, some or all the following actions may be taken:
 - a. Increase storm drain sizes and/or the number and size of inlets
 - b. Increase street grade within acceptable limits or revise street cross-sectional geometry to allow additional capacity
 - c. Provide additional onsite detention within the development to decrease peak flow.
6. Evaluate the preliminary design for costs and benefits. The impact of the system on downstream properties must be evaluated and mitigated as needed.

6.7.4.2 Final Design

Final design consists of final revisions to the storm drain system model and preparation of plans, profiles, and specifications for the storm drain system in enough detail for construction. Basic data, hydrologic analysis, and inlet sizing performed during preliminary design should be reviewed and verified. Drainage subbasin boundaries should be confirmed or revised as necessary, and design peak flows should be recalculated. The pipe and inlet sizes and locations are finalized while accounting for final street and storm drain grades, locations of existing and proposed utilities, and the design of the major drainage system. The EGL and HGL should be revised with updated energy losses at manholes and any other structures.

6.8 CULVERTS AND BRIDGES

Culverts and bridges convey surface water through or beneath an embankment such as a roadway, railroad, or canal. The size, alignment, and support structures of a culvert or bridge directly affect the capacity of the drainage system. An undersized culvert or bridge will force water out of the channel and cause flooding and damage. Culverts and bridges may significantly influence upstream and downstream flood risks, floodplain management, and public safety.

The criteria presented in this section shall be used to evaluate and design culverts and bridges in the Town, regardless of whether they are located within public right-of-way. The review of all submittals will be based on the criteria in this section. Stormwater crossings of CDOT roadways may have additional requirements.

6.8.1 Culvert Design Standards

Culverts shall be designed and constructed to the following standards. All proposed culverts, regardless of whether they are in public right-of-way, are subject to review and approval by the Town Engineer.

6.8.1.1 Materials and Structural Design

Allowable materials for culverts include HDPE and reinforced concrete. The culvert materials and joints shall meet the most recent versions of the standards listed in Table 6.16 for each type of culvert.

Each culvert installation shall be designed to maintain its full shape and function under an HS-20-44 loading in accordance with the design procedures in the latest edition of the AASHTO Standard Specifications for Highway Bridges, or appropriate ASTM standard, and with the pipe manufacturer's recommendations. For roadway crossing culverts, the minimum cover shall be 24 inches measured from the top of the pavement. For culverts crossing private driveways, the minimum cover shall be 8 inches. In all cases, minimum cover over roadway crossing culverts shall also include at least 6 inches of aggregate base course under the pavement. Total minimum cover may need to be increased for thicker pavement sections. In all cases, the minimum and maximum cover shall be in accordance with the manufacturer's recommendations. Trench installations shall be in accordance with the most recent edition of the CDOT M&S Standard Plans.

Table 6.16. Applicable Culvert Standards

Culvert Type	Standard
Reinforced Concrete Pipe—Round	ASTM C76 or AASHTO M 170
Reinforced Concrete Pipe—Elliptical	ASTM C507 or AASHTO M 207
Reinforced Concrete Pipe—Joints	ASTM C443 or AASHTO M 198
Reinforced Concrete Box Culvert—Joints	ASTM C1677
Reinforced Concrete Pipe—Arch	ASTM C506 or AASHTO M 206
Precast Concrete Box Culverts	ASTM C1433/C1577 or AASHTO M 259/M 273
Concrete for Cast-in-place culverts	CDOT 601
High Density Polyethylene Pipe (HDPE)	ASTM F2306
Gaskets for Joining Plastic Pipe (HDPE)	ASTM F477

6.8.1.2 Minimum Size

The minimum pipe diameter for culverts in the public right-of-way that are not driveway culverts shall be 18 inches. The minimum vertical pipe dimension shall be 18 inches where elliptical or arch pipe is used. Equivalent sizes for a 24-inch round pipe are a 29-inch by 18-inch arch and a 30-inch by 19-inch elliptical section.

Roadside ditch culverts crossing private driveways shall have a minimum diameter of 18 inches. Roadside ditches shall be re-graded if necessary to provide positive drainage below the culvert and prevent ponding or a sump condition near the culvert. The developer is responsible for re-grading and reconditioning existing swales to prevent ponding or a sump condition. If existing conditions prohibit the installation of an 18" culvert, the Town Engineer may grant a variance to allow a smaller culvert.

6.8.1.3 Allowable Headwater

Ponding above culvert entrances can cause property or roadway damage, culvert clogging, saturation of fills, detrimental upstream deposits of debris, an increase in floodplain elevation, or inundation of existing or future facilities. The maximum headwater for the 100-year design flow shall be 2.0 times the culvert diameter or culvert rise dimension for shapes other than round ($H_w/D \leq 2.0$) for culverts with a rise dimension less than or equal to 36 inches. For culverts with larger rise dimensions, the headwater to depth ratio for the 100-year design flow shall be less than 1.5. There is no maximum headwater value for the minor storm. Table 6.17 lists these criteria. The criteria in Table 6.17 are in

addition to roadway encroachment and overtopping criteria, and do not apply to detention, water quality, or sedimentation facility outlets.

Table 6.17. Allowable Headwater

Culvert Diameter or Rise	100-Year Maximum Headwater/Diameter (H_w/D)
≤ 36 inches	2.0
> 36 inches	1.5

6.8.1.4 Roadway Overtopping

No overtopping of any public roadway at a roadway culvert crossing is permitted during the minor storm. Roadway overtopping of up to 6 inches may occur at culvert crossings of local roads during the major storm. Overtopping at arterial, major collector, and minor collector roadways may not occur during the major storm. Overtopping of driveways at culverts in roadside ditches may not result in roadway encroachment that exceeds that specified in Section 6.6. These criteria should be considered as headwater limitations in addition to those in Table 6.17 above.

Additionally, culverts under arterial and major collector roadways, or those conveying flows from drainage areas larger than 0.50 square miles shall pass the 100-year storm assuming 20% of the inlet is plugged.

The depth of roadway overtopping is assumed to be the difference between the headwater elevation and the roadway crown elevation along the centerline of the culvert. Where overtopping is not permitted, but some amount of encroachment is permitted, the culvert headwater elevation can be set at the elevation corresponding to the limits of encroachment.

During roadway overtopping, the roadway crown is assumed to act as a broad-crested weir. A weir coefficient of 2.8 shall be assumed along with a weir length not to exceed 100 feet, regardless of roadway geometry. The designer should first calculate weir flow using the allowable overtopping depth for the major storm. The designer should then calculate flow through the culvert in accordance with these Standards, with culvert headwater set at the allowable overtopping elevation. If the calculated weir flow plus the flow through the culvert exceeds the design flow, the allowable overtopping condition has been met.

6.8.1.5 Velocity and Outlet Protection

A minimum flow velocity within the culvert of 3 feet per second is required to prevent sediment from accumulating in the culvert. The minimum flow velocity should be calculated using Manning's equation with a flow depth equal to 0.25 times the vertical dimension of the culvert. Manning's n values are presented in Table 6.15 above. Regardless of calculated flow velocity, the minimum slope of any culvert shall be 0.40%.

Culvert design must include revetment to protect the outlet from erosion if exit velocity exceeds 6 feet per second during the 100-year event as calculated in accordance with these Standards. The most common type of outlet protection is riprap, either as a riprap apron or as a low tailwater basin. Procedures for designing a riprap apron or low tailwater basin downstream of a culvert outlet, including for multiple conduit installations, can be found in the USDCM. Culverts should not be designed with 100-year outlet velocities greater than 16 feet per second.

An economical culvert design that meets allowable headwater requirements should not result in a Froude number larger than 2.5 when design velocities are kept below 16 feet per second. Culvert

slopes should be as flat as practicable to limit the amount of revetment required at the outlet. A riprap apron is typically used when the culvert discharges to a well-defined channel that can be expected to have a tailwater elevation equal to at least one-third of the height of the culvert. A low tailwater basin is typically used when the receiving channel may have little or no tailwater or where the receiving channel is not well defined.

6.8.1.6 Headwalls, Wingwalls, and End Sections

Except for private driveway culverts, all culverts in the public right-of-way shall be designed with headwalls and wingwalls or flared end sections at the inlet and outlet to minimize head loss. Stone headwalls and wingwalls are not allowed in roadside ditches. Private driveway culverts less than 36 inches in equivalent diameter may have projecting ends. Headwalls, wingwalls, and end sections shall be in accordance with the most recent edition of the CDOT M&S Standard Plans. Headwalls or end sections shall be located to provide a grade no steeper than 3H:1V between the back of the structure and the edge of the roadway shoulder or back of walk. Ditch and channel sections and profiles shall be transitioned at culvert inlets and outlets to allow for adequate cover over the culvert and to provide inlet and outlet conditions that will not cause erosion or sediment deposition.

6.8.1.7 Grates

Where a clear and present danger exists such as a siphon, a drop in elevation adjacent to a sidewalk or road, a long pipe with one or more manholes, or at pipes which are near playgrounds, parks and residential areas, a grate at the inlet and outlet of the culvert may be required. For most pipes through embankments and under streets, grates will not be required.

6.8.1.8 Location and Alignment

Culverts shall be located to completely drain all rainfall and snowmelt runoff where drainageways intersect a roadway or sidewalk. All areas that water could be impounded, or flow restricted, by the new embankment must be identified and considered for culvert locations. Culverts shall be aligned to give drainageways a linear entrance and exit. Abrupt changes in alignment at either end of a culvert may retard flow and make a larger structure necessary. If possible, a culvert shall have the same alignment as the channel it conveys. If this is not practical, and the water must be turned into a culvert, headwalls, wingwalls, and aprons shall be used as protection against scour and to provide a more hydraulically efficient inlet.

Where the natural channel alignment would result in a culvert alignment skewed more than 30 degrees from perpendicular to a roadway, modification may be necessary. Such modifications will change the natural stability of the channel, and an investigation into other options is recommended. Although economic factors are important, hydraulic effectiveness of the culvert must be given primary consideration.

Roadway alignment also affects culvert design. The vertical alignment of roadways may define the maximum culvert diameter that can be used. Low vertical clearance may require the use of elliptical or arched culverts or the use of multiple barrels.

6.8.2 Bridge Design Standards

Based on hydraulic capacity requirements, bridges may be required to cross major open channels. Sizing bridge openings is of great importance. Improperly designed bridges may cause excessive scour or deposition or may not be able to pass the design flow. Backwater caused by bridges can cause flooding of upstream property, overtopping of roadways, or costly maintenance. Bridge openings should have as little effect on the flow characteristics as is reasonable, consistent with good design and economics. The criteria in this section apply to bridges on public and private roads in the Town. The Town will review bridge designs based on the guidance in this section.

It is possible that a bridge designed to meet the criteria of these Standards may be on a roadway that becomes flooded during the storm event the bridge is designed to pass. New bridges shall be designed to these Standards regardless of adjacent roadway flooding because roadways that experience frequent flooding may be reconstructed at a higher elevation in the future to achieve an overall greater level of protection.

6.8.2.1 Bridge Sizing

The low chord of all bridges must provide a minimum freeboard. All bridges on arterial and major collector roadways, or above the Blue River or its major tributaries, shall have a low chord elevation set at least 3 feet above the HGL. All other bridges shall have a low chord elevation at least 1 foot above the HGL. Arch culverts, large diameter culverts, or other structures may be classified as a bridge and subject to freeboard requirements. Freeboard requirements apply to both vehicular bridges, pedestrian bridges, and any other structures spanning a floodway.

6.8.2.2 Hydraulic Analysis

Hydraulic analysis and design calculations for all bridges must be prepared and certified by a licensed Colorado Professional Engineer. The procedures for design as outlined in the Federal Highway Administration (FHWA) publication *Hydraulic Design of Safe Bridges* shall be used for the hydraulic analysis of the proposed design. HEC-RAS may be used to complete the hydraulic analysis of bridge openings provided the guidance in the publication is followed. All bridges are assumed to remain in place during all storm events and shall not be assumed to break away or otherwise be removed from any modeling scenario. Design flow rates shall be those specified by FEMA or as calculated in accordance with these Standards.

6.8.2.3 Inlet and Outlet Configuration

Where bridge abutments and foundations are located below the 100-year water surface elevation, concrete wingwalls shall be tied to the existing side slopes to prevent erosion behind the abutments and to provide slope stabilization from the top of the embankment to the toe of slope. Riprap protection on the inlet and outlet transition slopes shall be provided to prevent erosion caused by eddy currents.

6.8.2.4 Scour Analysis and Countermeasures

Velocity limitations through the bridge opening are intended to limit potential scour. Regardless of the results of the scour analysis, a maximum 100-year average channel velocity of 16 feet per second shall be allowed through a bridge opening. Whenever a new or replacement bridge is designed, it is critical that scour depths at piers and abutments be estimated. The scour estimate must consider subsurface data and a hydraulic analysis of the proposed design.

The FHWA has published a set of Hydraulic Engineering Circulars (HEC) to provide guidance for bridge scour and stream stability analysis. The set includes HEC-18, Evaluating Scour at Bridges, HEC-20, Stream Stability at Highway Structures, and HEC-23, Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance. Latest editions of each shall be used in concert with each other to evaluate stream stability, potential scour, and appropriate scour countermeasures. HEC-RAS may be used to provide the raw data required for the HEC-18 equations. HEC-RAS may also be used to evaluate scour, but the user must be experienced in the nuances HEC-RAS presents in evaluating scour and the potential errors that can occur. Using HEC-RAS default values will cause inaccurate results.

The potential for local scour (pier and abutment) and general scour (contraction, stream degradation, and pressure) should be evaluated using HEC-18 to determine the extent of the various types of scour as applicable to each site. HEC-20 should be consulted to determine the general stability of the stream and whether lateral channel movement should be anticipated. If there is potential for scour during the scour design storm shown in Table 6.18, countermeasures shall be designed in accordance with HEC-

23. In all cases, the length of bridge piles shall be such that the design structural load may be safely supported entirely below the probable scour depth.

Table 6.18. Bridge Scour Design Standards

Roadway Classification	Design Storm for Abutment, Pier Cap, and Retaining Wall Design	Design Storm for Foundation Design
Arterial	500-year	500-year
Major Collector	100-year	500-year
Minor Collector	100-year	500-year
Local	50-year	500-year

6.8.2.5 Structural Design

The type of bridge foundation and foundation elevations should be determined by the bridge structural design engineer. During the design of the bridge foundations, the design engineer shall consider the design loading, the findings of the geotechnical investigation, scour depth as calculated using the procedures in HEC-18, anticipated frost depth, pressure flow during the 100-year event, and any other factors the engineer considers appropriate in his or her professional judgement. If scour is anticipated, the engineer can either design scour countermeasures using the procedures in HEC-23 for the applicable design storm or locate the bridge foundations below the anticipated depth of scour by a distance that provides a sufficient factor of safety in his or her professional judgement. Scour countermeasures will be required if anticipated scour depth is more than 5 feet.

Structural, scour, and foundation design calculations must be accompanied by a certification statement that is signed and sealed by a professional engineer licensed in the State of Colorado and submitted to the Town for review. The certification statement shall read as follows.

I hereby affirm that the design calculations and plans for the bridge at [insert address] were prepared by me, or under my direct supervision, for the owners thereof, in accordance with the requirements of the International Building Code, the Breckenridge Town Code, the Breckenridge Town Standards, any approved variances and exceptions thereto, and my professional engineering judgment. I understand that the Town of Breckenridge does not and will not assume liability for facilities, structures, or improvements designed by others.

Registered Professional Engineer [Affix Seal]

State of Colorado No. _____

All assumptions made by the bridge design engineer shall be provided in the calculations. Furthermore, the design of bridges may be subject to review by a third party at the Town's discretion. When located within a FEMA floodplain, all bridges are subject to requirements of the National Flood Insurance Program (NFIP) and local floodplain management regulations.

The Town recognizes that in certain limited instances, it may be exceptionally difficult to conform to these Standards. In these instances, the applicant may submit a variance request in accordance with the requirements in Chapter 1. The request must be signed and sealed by a professional engineer licensed in the State of Colorado.

6.8.3 Culvert Hydraulics

Presented in this section are the general procedures that shall be used for hydraulic design and analysis of culverts. The user is assumed to possess a basic working knowledge of culvert hydraulics

and is encouraged to review the technical literature on the subject that is included in Hydraulic Design Series 5 (HDS-5), *Hydraulic Design of Highway Culverts*, published by the FHWA). The two primary types of culvert flow are inlet control and outlet control. Under inlet control, the cross-sectional area of the barrel, inlet geometry, and headwater are the factors that affect capacity. Outlet control involves the additional consideration of tailwater and the slope, roughness, and length of the culvert barrel. The Culvert Design Form, included as an attachment to this chapter, is a template for culvert hydraulic analysis that can be used with the information and equations below. All culvert designs shall include an analysis to determine whether inlet or outlet control conditions govern for both minor and major storm runoff.

6.8.3.1 Inlet Control Calculation

Under inlet control conditions, the slope of the culvert is steep enough that the culvert does not flow full. The control section of a culvert operating under inlet control is located just inside the entrance. Inlets may be either unsubmerged or submerged. In an unsubmerged condition, the headwater is high enough to submerge the top of the culvert and the culvert slope is supercritical. In a submerged condition, the headwater submerges the top of the culvert, but the pipe does not flow full. In this situation, the culvert inlet acts like an orifice.

In the submerged inlet condition, the equation governing the culvert capacity is the orifice flow equation. However, because of the uncertainty in estimating the orifice coefficient for a submerged culvert inlet, it is recommended that the inlet control nomographs published in HDS-5 be used to determine headwater for submerged inlets operating under inlet control. Nomographs may be found online in the second edition of HDS-5, publication number FHWA-NHI-01-020. Later editions do not have as many nomographs. Table 6.19 provides the appropriate inlet control nomograph to use for various types of culverts and end treatments. The FHWA has not published inlet control nomographs for plastic pipe. In their absence, the nomographs for concrete may be used for round HDPE with a smooth interior wall.

Table 6.19. Inlet Control Nomograph Selection

Material	Cross Section	End Treatment	Chart
Concrete/HDPE	Circular	None (Projecting), Headwall	1B
Concrete/HDPE	Circular	Flared end section	55B
Concrete	Horizontal Elliptical	Headwall or Projecting (use scale 1 for end section)	29B
Concrete	Rectangular	Wingwalls, angle and headwall bevel varies	8B-13B

6.8.3.2 Outlet Control Calculation

Outlet control occurs when the culvert barrel is not capable of conveying as much flow as the inlet opening will accept. Either subcritical or pressure flow exists in the culvert barrel under these conditions. Outlet control will govern if the headwater is deep enough, the culvert slope is sufficiently flat, or the culvert is sufficiently long.

Outlet control generally exists under two conditions. The first, and less common, occurs when headwater is not high enough to submerge the top of the culvert and the culvert slope is subcritical. The more common outlet control condition exists when the culvert is flowing full. A culvert with a submerged inlet and an unsubmerged outlet may also operate under outlet control, especially if it has a long barrel length or a flat enough slope. Culverts under outlet control may flow full or partly full, depending on various combinations of hydraulic factors.

Culvert capacity under outlet control is calculated using Bernoulli's equation. An energy balance is determined between the headwater at the culvert inlet and at the culvert outlet and includes inlet losses, friction losses, and velocity head. The general equation is expressed as:

$$H = h_e + h_f + h_v \quad (6.13)$$

Where:

H = total energy head (headwater elevation minus tailwater elevation) (ft)

h_e = entrance head loss (ft), $K_e V^2 / 2g$

h_f = friction losses (ft)

h_v = velocity head (ft), $V^2 / 2g$

K_e = entrance loss coefficient per Table 6.20

Friction loss is the energy required to overcome the culvert barrel roughness and is calculated by the following equation.

$$h_f = (29n^2 L / R^{1.33}) (V^2 / 2g) \quad (6.14)$$

Where:

n = Manning's coefficient per Table 6.15

V = velocity of flow (ft/s)

L = length of culvert (ft)

g = gravitational acceleration, 32.2 ft/s²

R = hydraulic radius (ft)

Table 6.20. Culvert Entrance Loss Coefficients, K_e , for Outlet Control Calculations

Structure and Entrance Type	K_e	Structure and Entrance Type	K_e
<u>RCP</u>		<u>RCB</u>	
Headwall, socket end of pipe	0.2	<u>Wingwalls at 30° to 75° to barrel</u>	
Headwall, square edge	0.5	Square edge at crown	0.4
Projecting from fill, socket end	0.2	Rounded or beveled top edge	0.2
Projecting from fill, square cut end	0.5	<u>Wingwalls at 10° to 25° to barrel</u>	
Mitered to conform to fill slope	0.7	Square edge at crown	0.5
Side- or slope-tapered inlet	0.2	<u>Wingwalls parallel (side extensions)</u>	
Beveled edges, 33.7° or 45° bevels	0.2	Square edge at crown	0.7
Rounded (radius = D/12)	0.2	Side- or slope-tapered inlet	0.2
End section that conforms to fill slope ⁽¹⁾	0.5	<u>No wingwalls</u>	
<u>HDPE</u> ⁽²⁾		Square edge on 3 sides	0.5
Projecting from fill	0.9	Rounded or beveled on 3 sides	0.2

⁽¹⁾ End sections that conform to fill slope are the sections commonly available from manufacturers. From limited hydraulic tests, they are equivalent in operation to a headwall in both inlet and outlet control. Some end sections, which incorporate a closed taper in their design, have a superior hydraulic performance. These latter sections can be designed by using the information given for the beveled inlet.

⁽²⁾ Conditions not listed specifically for HDPE with a smooth interior wall have the same coefficient as RCP. The "projecting from fill" value given for HDPE is an approximation based on published values for CMP.

Combining the equations yields the following equation, which can be used to calculate culvert capacity directly only when the tailwater is at or above the crown of the culvert outlet.

$$H = (K_e + 1 + 29n^2L/R^{1.33})(V^2/2g) \quad (6.15)$$

When the tailwater is below the culvert outlet crown, the tailwater depth used for calculations shall be the larger of the tailwater anticipated in the downstream channel at the culvert outlet and the average of the critical depth in the culvert and the culvert diameter, $(D+d_c)/2$. The FHWA has determined the average of the critical depth and the culvert diameter to be an adequate approximation for tailwater depth for culverts that flow partially full. Critical depth calculation is a direct process for a box culvert but an iterative one for a circular pipe that is easily accomplished with a spreadsheet. Critical depth occurs when the Froude number is equal to 1.0. The flow area and top width will be those that occur at critical depth in the pipe. Many online tutorials are available.

$$Fr = \frac{v}{\sqrt{gD_h}} \quad (6.16)$$

Where:

Fr = Froude number (dimensionless)

v = velocity (ft/s)

D_h = hydraulic depth (ft), A/T

A = flow area (ft²)

T = top width of flow area (ft)

g = gravitational acceleration, 32.2 ft/s²

In addition to equation 6.15, outlet control nomographs published by the FHWA in HDS-5 can also be used to calculate the required headwater under outlet control conditions where the outlet is submerged. Outlet control nomographs can be found online in the second edition of HDS-5, publication number FHWA-NHI-01-020. Later editions do not have as many nomographs. Table 6.21 provides the appropriate outlet control nomograph to use for various types of culverts. The FHWA has not published outlet control nomographs for plastic pipe. In their absence, the nomographs for concrete may be used for round HDPE with a smooth interior wall. End treatments do not affect outlet control.

Table 6.21. Outlet Control Nomograph Selection

Material	Cross Section	Chart
Concrete/HDPE	Circular	5B
Concrete	Rectangular	15B
Concrete	Horizontal Elliptical	33B

Culvert capacity shall be computed using the Culvert Design Form, included as an attachment to this chapter. Two example calculations for culvert sizing are at the end of this section. The first is for a roadway crossing culvert and the second is for a driveway culvert in a roadside ditch. HDS-5 offers extensive guidance on the design of culverts that are under roadways and that may be used in conjunction with the requirements of these Standards.

6.8.3.3 Evaluation of Results

If the culvert selected will not fit the site, return to the design process, and select another culvert. Repeat the design process until an acceptable culvert configuration is determined. Compare the headwater elevations calculated for inlet and outlet control. The higher of the two is the controlling

headwater elevation. The culvert can be expected to operate with that higher headwater for at least part of the time.

If outlet control governs and the headwater depth is less than $1.2D$, it is possible that the barrel flows partly full through its entire length. In this case, caution should be used in applying the approximate method of setting the downstream elevation based on the greater of tailwater or $(d_c + D)/2$. If an accurate headwater is necessary, backwater calculations should be used to check the result from the approximate method. If the headwater depth falls below $0.75D$, backwater calculations are required.

6.8.3.4 Outlet Velocity Calculation

The outlet velocity may be calculated as follows:

1. If the controlling headwater is based on inlet control, determine the normal depth and velocity in the culvert barrel. The velocity at normal depth is assumed to be the outlet velocity.
2. If the controlling headwater is based on outlet control, determine the area of flow at the outlet based on the barrel geometry and the following:
 - a. Critical depth if the tailwater is below critical depth.
 - b. Tailwater depth if the tailwater is between critical depth and the top of the barrel.
 - c. Height of the barrel if the tailwater is above the top of the barrel.

6.8.3.5 Computer Applications

While it is possible to use the procedures and nomographs for analyzing culvert hydraulics, it is more common to design culverts using computer applications. Among the applications approved for use by the Town is the FHWA's HY-8 Culvert Analysis Program and the Mile High Flood District's MHFD-Culvert spreadsheet, both of which may be used to calculate roadway overtopping, inlet and exit velocity, and hydraulic grade line.

6.8.4 Design Examples

Two design examples are included in this section. The first example is the analysis of an existing roadway cross culvert using the Culvert Design Form. Calculations from this design example are shown in the Culvert Design Form Example, included as an attachment to this chapter. The second example is the design of a private driveway culvert in a roadside ditch.

6.8.4.1 Crossing Culvert Analysis Example

The procedure to evaluate culverts is based on the procedures presented in HDS-5. The methodology consists of evaluating the culvert headwater requirements for both inlet and outlet control. The type of flow control that results in a larger required headwater is the governing flow condition.

An example calculation for rating an existing culvert is presented in the Culvert Design Form Example, included as an attachment to this chapter. The culvert is a 48-inch RCP. The length is 150 feet. The upstream invert elevation is 8540.0, and the downstream invert elevation is 8535.5. The slope is 0.030. The low point of the embankment over the culvert has an elevation of 8551.90. The n value is 0.015, in accordance with Table 6.15 for older concrete pipes. The culvert has flared end sections on each end. All depths are in feet unless noted otherwise.

The tailwater rating values are provided for this example and shown in Column 5. If the tailwater condition is unknown, it must be computed using the normal depth (subcritical or critical only) of a trapezoidal channel approximating the existing drainageway. A HEC-RAS model of the site could also be used to determine the tailwater rating curve.

The entrance loss coefficient, K_e , is determined from Table 6.20 as 0.5 for an end section that conforms to fill slope, which is the category used to represent a common flared end section. The full flow and the velocity are calculated from these values for comparison. The rating then proceeds in the following sequence:

1. The culvert design process begins with selecting a range of discharges or headwater depths and then using an inlet control nomograph to determine the corresponding flow values. This example begins with a range of headwater depths that are entered in Column 3. Headwater to pipe diameter ratios (H_w/D) are calculated and entered in Column 2. If the culvert is not circular, the culvert height is used for the calculation. Note that for design of new culverts, the Town has restrictions on the headwater-to-depth ratio in Table 6.17.
2. For each H_w/D ratio, inlet capacity is read from the appropriate inlet control nomograph (Chart 55B for this example because of the flared end sections) and entered in Column 1. Scale (1) for concrete should be used on Chart 55B to determine discharges, which then completes the inlet control rating.
3. For outlet control, the Q values that have been entered in Column 1 are used to determine the head values (H) in Column 4 from the appropriate outlet control nomograph, Chart 5B in this case. Note that flared end sections do not affect outlet control calculations. The first line drawn in Chart 5B is between the pipe diameter and the pipe length. The second line connects the Q value and passes through the turning line where the first line crossed it to determine H .
4. The known tailwater depths (T_w) for normal flow in the downstream channel are then entered into Column 5 for each Q value in Column 1. The depths have been provided in this example but must be calculated if they are not available using the normal depth of a trapezoidal channel approximating the existing drainageway downstream of the culvert. If the tailwater depth is less than the diameter of the culvert, Columns 6 and 7 must be calculated per Step 5, and the larger of the tailwater depth and the value of Column 7 shall be used as h_o . If the tailwater depth is greater than the diameter of the culvert, the tailwater values in Column 5 are entered into Column 8 as the values for h_o , and Step 6 should begin (Step 5 being skipped).
5. Approximate tailwater depths are calculated when tailwater depths in the downstream channel are less than the diameter of the culvert. The critical depth, d_c , for each Q value in Column 1 is calculated and entered in Column 6. For a circular pipe, the Froude number calculation is completed iteratively using a spreadsheet until the Froude number is 1. Alternately, Chart 4B from HDS-5 can be used to determine d_c for the pipe size and Q value. The average of the critical depth and the culvert diameter is calculated and entered in Column 7 as the approximate h_o value.
6. The headwater values (H_w) in Column 9 are calculated according to Equation 6.17:

$$H_w = H + h_o - LS_o \quad (6.17)$$

where H is from Column 4 and h_o is either the value from Column 8 where $T_w \geq D$ or the larger value of Column 5 and Column 7 where $T_w < D$. L is the length of the culvert barrel and S_o is its slope.

7. The final step is to compare the inlet and outlet control headwater requirements (Columns 3 and 9) and record the higher of the two values in Column 10. The type of flow control is recorded in Column 11. The upstream water surface elevation is then calculated by adding the controlling headwater (Column 10) to the upstream invert elevation. Add this value to Column 12. The culvert rating curve can then be plotted from the values in Columns 12 and 1.

Outlet velocity for designing downstream protection can be computed using $V = Q/A$. For full flow conditions, the culvert area is the full cross sectional area of the culvert. For partially full conditions, the culvert area is the area calculated at a depth of h_o . Channel protection shall be in accordance with

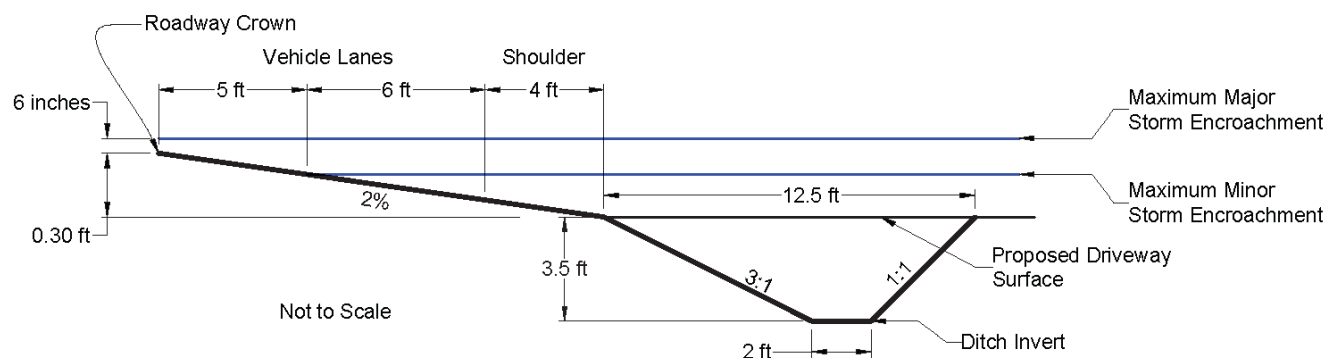
guidance in the USDCM. Velocity values are not shown in the Culvert Design Form but should be calculated for the 100-year event.

To size a culvert crossing, the same form can be used, with some variation in the basic data. First, a design Q is selected, and the maximum allowable headwater is determined. An inlet type is selected, and the invert elevations and culvert slope are estimated based on site constraints. A culvert type and size is then selected and rated for both inlet and outlet control. If the controlling headwater exceeds the maximum allowable headwater, the design data must be modified, and the procedure repeated, until the desired results are achieved.

6.8.4.2 Private Driveway Culvert Design Example

A driveway is planned to provide access to a new residence from a minor collector roadway with an existing roadside ditch. The minor collector has a transverse slope of 2%. The roadside ditch is trapezoidal with a 3:1 side slope down from the road, a 1:1 backslope, a 2-foot bottom width, and a 3.5-foot depth as shown in Figure 6.4.

Figure 6.4. Private Driveway Culvert Example Ditch Geometry



The driveway is assumed to have no slope over the ditch for calculation purposes. The calculated peak flow is 28 cfs for the major storm and 12 cfs for the minor storm. Floodwater encroachment onto the road must not exceed the limitations set forth in Table 6.12 of these Standards. Inlet control is assumed for this example; however, actual projects should use the Culvert Design Form to determine if culverts are under inlet or outlet control.

1. During the major storm, water on a minor collector may be 6 inches deep at the crown of the road. The depth of the water from the allowable water surface to the ditch invert is 4.3 feet. This value is assumed as the headwater depth.
2. For the major storm, calculate the discharge through an 18-inch HDPE ($D = 1.5$ feet) with projecting ends and a headwater depth of 4.3 feet using Chart 1B:

$$H_w/D = 4.3 \text{ ft}/1.5 \text{ ft} = 2.9$$

A H_w/D ratio of 2.9 on Scale 3 of Chart 1B for projecting culvert ends gives a discharge of 18.0 cfs for an 18-inch HDPE.

3. Calculate weir flow over the road and driveway during the major storm. Flow over the road and over the driveway are calculated independently. Because the road grade is sloped across the cross section, the average depth of flow over the road is used. Flow outside the top of the ditch side slope is assumed to be negligible for this example, but it may be considered if the designer feels it is appropriate. Assume a weir coefficient of 2.8.

$$Q_{\text{weir}} = Q_{\text{road}} + Q_{\text{drive}}$$

$$Q_{\text{weir}} = CLH^{3/2} + CLH^{3/2}$$

$$Q_{\text{weir}} = (2.8)(15)((0.85 + 0.50)/2)^{3/2} + (2.8)(12.5)(0.85)^{3/2}$$

$$Q_{\text{weir}} = 23.3 \text{ cfs} + 27.4 \text{ cfs} = 50.7 \text{ cfs}$$

Total flow over the road and driveway is 50.7 cfs.

4. The combined flow through the 18-inch HDPE and over the road/driveway is 68.7 cfs, which is significantly more than the major storm design flow of 28 cfs. Encroachment onto the minor collector will not exceed allowable and the chosen culvert is acceptable for the major storm. If the combined flow would have been less than the major storm flow, a larger culvert would be required, and Steps 2–3 would be repeated using a 24-inch HDPE. In this case, a shallower ditch or a smaller pipe may be considered.

Verify that the design meets the minor storm criteria. During the minor storm, flow may spread to within 5 feet of the crown of a minor collector to allow a single 10-foot lane to remain clear during the minor storm. Assuming encroachment extends only to within 5 feet of the roadway crown yields a headwater depth of 3.7 feet and a H_w/D ratio of 2.5.

5. Scale 3 of Chart 1B indicates a discharge of 16.0 cfs for an 18-inch HDPE with a H_w/D ratio of 2.5, which is greater than the 12 cfs peak flow during the minor storm. The design will meet the minor storm criteria.
6. Verify that the culvert has a minimum 8 inches of cover. The driveway surface is 3.5 feet or 42 inches above the ditch invert. The 18-inch HDPE has more than the minimum 8 inches of cover and meets all criteria for this location.

6.9 DETENTION

The imperviousness of any site typically increases when it is developed. Roof areas, sidewalks, and parking all contribute to site imperviousness. Rain falling on this added impervious area cannot infiltrate into the ground after development. The rainfall discharges from the site instead, impacting adjacent properties, storm drain capacity, and even the capacity of larger drainageways when development is considered in the aggregate. The purpose of detention facilities is to store the additional runoff volume associated with development and discharge it from the developed site at the rate experienced during pre-development conditions. Detention helps to minimize peak flows in urbanized areas. Detention can include individual site options such as small landscaped basins and larger regional options that serve multiple sites. Detention facilities can also be dual purpose when they are designed to meet water quality requirements as well as hydraulic detention requirements. This section presents the Town's criteria and guidance for designing detention ponds.

6.9.1 Applicability

Detention is required for all new development and redevelopment. Subdivided developments may use a single detention facility provided it captures runoff from the entire development. All detention facilities in the Town are subject to oversight by the Town. A maximum of 5% of the total development site may discharge directly from the site, without hydraulic detention, provided the peak site discharge does not exceed the peak historic discharge from the site.

Exemptions from the detention requirement may be granted if the project has either of the following characteristics, provided the additional undetained runoff will cause no adverse impacts to any downstream properties.

1. Impervious area is increased by no more than 0.10 acres or 4360 square feet.

2. Other situations as may be determined by the Town to be in the best interest of the Town.

Exemptions may also be provided for single family homes in subdivisions without regional detention provided low-impact development principles are included in the design to minimize the increase in runoff and not aggravate flooding or erosion problems. Low impact development principles include using pervious pavers or pavement for driveways and walkways, minimizing directly connected impervious areas, and routing drainage from impervious areas such as roofs and driveways through infiltrating swales or across vegetated pervious areas prior to discharging it from the site. Detailed guidance on low impact development can be found in Volume 3 of the USDCM.

Supporting analysis and certification by a professional engineer that exclusion from the detention requirement will not cause any adverse downstream impacts must be submitted to the Town Engineer for consideration if an exemption is requested. An exemption to provide detention issued by the Town does not eliminate potential liability to others.

Although development increasing impervious area by less than 0.10 acres is exempted from detention requirements, any new development or redevelopment is required to analyze and correct any inadequate drainage, including insufficient drainage away from buildings, runoff adversely affecting downstream properties, inadequately sized drywells, drainage exceeding existing storm drains, pipes, or other conveyance, or other drainage concerns identified by the Town Engineer.

6.9.2 Detention Facility Design

All detention facilities shall be designed as full-spectrum detention facilities. The Mile High Flood District has developed detailed design guidance for detention basins. The USDCM provides discussion on the applicability of detention; an explanation for why full-spectrum detention is the preferred approach; and calculations for sizing a detention facility and designing the outlet structure.

The most recent versions of the USDCM and the design tool MHFD-Detention.xlsm (formerly UD-Detention.xlsm) may be used for sizing and designing all detention facilities in the Town. Detention facilities in the Town may be extended detention basins, sand filters, and rain gardens. Constructed wetlands may also be used provided water rights are accommodated. The USDCM also includes weir and orifice equations for the design of detention basin outlets that may also be used for other applications within these Standards as needed. Guidance on the use of MHFD-Detention within the Town is included in this section.

6.9.2.1 Historic Flow Rates

The policy of the Town is to require detention storage of stormwater runoff to limit peak discharges from new development and redevelopment sites to historic rates. Detention facilities shall be designed to release stored runoff volumes at or below the calculated historic peak rate for the 2-, 5-, 10-, 25-, 50-, and 100-year storms.

For new development, historic peak runoff rates per acre shall be calculated in accordance with the procedures in these Standards using a site imperviousness of 2% to represent historic conditions in accordance with Table 6.3. For redeveloped areas, historic rates shall be those calculated for the condition immediately prior to redevelopment in accordance with these Standards unless other criteria are specified by the Town Engineer in writing. Calculated historic rates will vary based on the methodology chosen to calculate peak flow, whether it is the Rational Method, the SCS Method, or a computer model. Calculated historic rates for each storm event shall be presented as part of the drainage analysis in the Drainage Report.

Post-development peak runoff from a site may not be greater than pre-development runoff from a site for any storm event. Total site runoff is typically a combination of detention basin release and direct runoff from areas not draining to a detention facility, both of which must be considered. A maximum of

5% of the total site area may contribute direct runoff. Note that the allowable peak discharge from a detention facility will be less than the allowable peak runoff from the whole site unless the entire site drains to the detention facility.

For redevelopment sites, any existing detention facilities shall be factored into the runoff calculations and accounted for with the revised runoff characteristics to preserve the pre-development runoff rates as identified in any previous drainage studies. If a HEC model of the watershed exists, it can be used to generate historic runoff rates by changing the imperviousness of the watershed to historic conditions.

6.9.2.2 MHFD-Detention

The last three tabs in the MHFD-Detention spreadsheet contain helpful information on how to use the MHFD-Detention spreadsheet as a design tool. Users are highly encouraged to thoroughly review the information in these tabs, including the video provided before beginning design. For designing detention facilities within the Town, the following inputs shall be used in lieu of default values.

1. While most detention basins in the Town will include water quality treatment, the first drop down menu on the Basin worksheet below Watershed Information should be set to Flood Control Only if no water quality treatment is to be provided. If water quality treatment is to be provided within the detention facility, the user should select the type of facility being designed.
2. Location for 1-hr Rainfall Depths on the Basin worksheet shall be set to User input and the P_1 values from Table 6.1 of these Standards shall be entered into the appropriate, blue-shaded cells on the Basin worksheet.
3. In the three cells used to Define Zones and Basin Geometry in the Basin worksheet, the Zone 1 Volume shall be the WQCV if water quality treatment will be provided. If water quality will not be provided, the Zone 1 Volume shall be the 2-year event. In all cases, the Zone 2 Volume shall be set to EURV – Zone 1, and the Zone 3 Volume shall be set to 100-year minus Zones 1 & 2.
4. The remainder of the user inputs on the basin worksheet tab shall follow the recommended guidelines indicated as notes in each cell. Assuming the design of the facility was completed in accordance with guidelines in the USDCM, the design values for these inputs will be within the recommended ranges of values for each variable. Note that the Total Available Detention Depth should be set at the maximum allowable 100-year water surface, not at the downstream embankment crest, to allow for design freeboard.
5. On the Outlet Structure worksheet, an Outlet Type must be selected from the drop down menu at the top of the worksheet for each Zone. When water quality treatment is provided, the lowest outlet is typically an orifice plate, which is a plate with multiple smaller orifices cut into it. When water quality treatment is not provided, the lowest outlet may be a vertical orifice, which is also a plate, but with a single, larger hole cut into it. The options available in the drop down menu for Outlet Type will automatically only be those applicable to the design completed up to that point. The user should only enter additional design values into the User Input rows in the remainder of this worksheet that correspond to the Outlet Types selected at the top of the worksheet. For example, if there is no orifice plate, there is no need for the user to enter data describing an orifice plate. But each Outlet Type selected must have its design data entered for the worksheet to yield correct results.
6. Several rows of hydraulic results are presented at the bottom of the Outlet Structure worksheet. While several of the values are of interest, there are only a handful that are critical for detention facilities in the Town. If these criteria are not met, the design must be adjusted until they are.
 - a. Peak Outflow for each design storm may not exceed the historic rates calculated for the site.

- b. Time to Drain 97% of Inflow Volume must not exceed 72 hours after the end of a 5-year storm.
- c. Time to Drain 99% of Inflow Volume must not exceed 120 hours after the end of storms greater than the 5-year storm.
- d. Maximum Ponding Depth must be at or below the emergency spillway and at least 12 inches below the surrounding embankment.

6.9.4 Snow Storage in Detention Ponds

If it is intended that a detention pond will serve as a snow storage area, the calculation of the pond's required volume must be increased by 50% of the full design snow storage volume and the pond must provide permanent water quality treatment in the form of the water quality outlet.

6.9.5 Maintenance

The performance of detention facilities is extremely sensitive to a lack of maintenance, and all detention facilities must be designed to facilitate maintenance. Section 6.10 of these Standards includes design guidance related to maintenance. It is the responsibility of all private detention facility owners to regularly maintain their detention facilities, except as modified by a recorded agreement. Outlets, especially, must be regularly maintained to ensure the basins do not detain water longer than allowed by Colorado water law.

The Town may require an enforceable Ownership and Maintenance (O&M) Agreement to be in place for detention and water quality facilities before issuing any applicable local permits. The O&M Agreement must include the party responsible for maintaining the facility, inspection frequency, and proposed maintenance activities in an Operations and Maintenance Plan (O&M Plan). Should the responsible party fail to adequately maintain the detention facility, the Town shall have the right to enter the property for the purpose of maintenance. All such maintenance costs and associated legal fees will be assessed to the property owner. Guidance on maintenance frequency for various types of facilities is included in Section 6.10. Guidance on the development of the O&M Plan is included in Chapter 2.

6.9.6 Detention and Water Rights

Senate Bill 15-212 became effective on August 5, 2015, as Colorado Revised Statute (CRS) §37-92-602 (8), *Concerning a Determination that Water Detention Facilities Designed to Mitigate the Adverse Effects of Storm Water Runoff Do Not Materially Injure Water Rights*. This statute provides legal protection for any stormwater detention and infiltration facility in Colorado, provided the facility does not materially injure water rights and meets the following criteria.

1. It is owned or operated by a governmental entity or is subject to oversight by a governmental entity.
2. It continuously releases or infiltrates at least 97% of all the runoff from a rainfall event that is less than or equal to a 5-year storm within 72 hours after the end of the event.
3. It continuously releases or infiltrates as quickly as practicable, but in all cases releases or infiltrates at least 99% of the runoff within 120 hours after the end of events greater than a 5-year storm.
4. It operates passively and does not subject the stormwater runoff to any active treatment process such as coagulation, flocculation, and disinfection.

There are reporting requirements for any owner or operator of any detention facility constructed after August 5, 2015 that seeks protection under the new statute. A data sheet and online map-based compliance portal website has been developed that will allow owners and operators in the Town to

upload the required notification information. The notification requirement applies only to facilities constructed after August 5, 2015. Facilities in existence before August 5, 2015, are defined in the statute as materially noninjurious to water rights and do not require notification.

The compliance portal can be found online (<https://maperture.digitaldataservices.com/qvh/?viewer=cswdif>). A document containing frequently asked questions, links to a video tutorial, and the link to the compliance portal can be found online (<http://www.crgov.com/DocumentCenter/View/12225>) or via an internet search for “Colorado water rights compliance portal.” The owner or operator must report new detention via the portal, and the county must approve the portal entry once it is complete. The owner or operator shall inform the county once the portal documentation is ready for approval.

6.9.7 Jurisdictional Dams

Detention facilities with a downstream embankment height in excess of 10 feet, 100-year water surface area in excess of 20 acres, or 100-year volume in excess of 100 acre feet are considered jurisdictional dams and require approval by the State Engineer’s office.

6.10 PERMANENT WATER QUALITY

The naming convention for facilities that treat stormwater quality after construction has varied over time. These facilities have been called both best management practices (BMPs) and control measures by various entities. The Town’s term for these facilities is permanent stormwater treatment facilities. The term treatment facilities may also be used. This term distinguishes these facilities from those used during construction.

The goal of the requirements in this section is to keep the Town’s streams and drainageways healthy. This section presents runoff reduction and site planning principles, the applicability of the requirements for permanent water quality treatment, design requirements for permanent stormwater treatment facilities, and design requirements associated with maintenance.

6.10.1 Planning Principles

Increases in impervious area that typically come with development can negatively impact flow volumes, temperature, and stormwater quality. To minimize these impacts, site planning should consider how the site will be used as well as how stormwater runoff will be conveyed and treated. While no specific design criteria is associated with many of these guidelines, general site planning goals for every development include:

1. Considering stormwater quality needs early in the development process to better integrate stormwater treatment facilities into the site.
2. Minimizing impacts to the natural environment including water quality, air quality, wildlife habitat, vegetation, and natural landforms and protecting areas with high ecological value such as those with mature trees, stream corridors, wetlands, and soils with high infiltration rates.
3. Developing creative site layouts to reduce the extent of paved and other impervious areas.
4. Reducing runoff from the site and maximizing infiltration by minimizing directly connected or continuous impervious areas and slowing runoff through pervious and/or vegetated areas. Developing the layout of a site to reduce runoff will also reduce the required size of WQCV treatment facilities.
5. Centralizing water quality treatment for larger developments and integrating them with site operations to minimize land use, achieve greater economy of scale, and reduce the number of treatment facilities requiring maintenance.

6. Developing operational procedures to minimize the risk of spills and designing the site layout to prevent any spills from leaving sites with operations that include washing, fueling, manufacturing, materials storage, and vehicle maintenance, among others.
7. Using pervious drainage conveyances where appropriate, routing downspouts across pervious areas, and incorporating vegetated areas into locations that generate and convey runoff like parking lots and driveways. Grass buffers, grass swales, and bioretention can all be used.
8. Discharging site runoff across a vegetated area prior to discharge from the site. No impervious area should discharge directly into wetlands, the Blue River, or one of its tributaries.
9. Maintaining natural drainage patterns and implement sheet flow.
10. Selecting permanent stormwater treatment facilities based on expected pollutant type.
11. Providing areas for snow storage so that snow melt will not be a nuisance and will drain to a permanent water quality facility.

Chapter 1 of Volume 3 of the USDCM includes a section on ways to minimize the adverse impacts of development on water quality, including ideas to minimize site runoff. This document should be reviewed to gain a better understanding of planning principles as they relate to water quality. A discussion on how design of the site minimizes site runoff and the impacts to water quality shall be included in the permanent water quality portion of the Drainage Report.

6.10.2 Applicability

Permanent stormwater treatment facilities are required to be designed and installed for all new development and redevelopment sites that meet one of the following criteria:

1. Disturb at least one acre of land.
2. Disturb less than one acre but are part of a larger common development plan. In these cases, the individual development need not provide a permanent stormwater treatment facility, provided the larger common development provides a centralized facility that will provide treatment for all the sites within it.
3. Increase impervious area by more than 0.10 acres or 4360 square feet.
4. Include any of the following land uses: auto service station, auto repair, auto body work/paint, auto wash/polish, equipment repair, lumberyard, nursery, asphalt plant, concrete batch plant, industry, manufacturing, crushing gravel/rock, milling, mining, sawmill, silviculture, junkyard, sludge, sanitary landfill, truck terminals, impound yard, motor vehicles parking/storage, or storage of pesticides, herbicides, fertilizer, or other potentially hazardous materials.

New development is classified as any land disturbing activity or construction of any building or structure. Redevelopment is any creation, addition, or removal and replacement of any impervious area, or any building construction or land disturbing activity, on a site that is already substantially developed.

For sites that require permanent stormwater quality treatment, treatment must be provided for at least 80% of the added impervious area on the site. At least 80% of the disturbed site pervious area must also be treated unless justification is provided showing that runoff from these areas will not negatively impact water quality within the Town. An area larger than the minimum required may necessarily drain to the treatment facility, and this runoff must be accounted for in the design of the facility. Calculations documenting this has been achieved shall be included in the permanent water quality portion of the Drainage Report.

Although certain development that is exempted from permanent water quality requirements, any new development or redevelopment is may still be required by the Town to analyze and correct any

inadequate drainage, including insufficient drainage away from buildings, runoff adversely affecting downstream properties, inadequately sized drywells, drainage exceeding existing storm drains, pipes, or other conveyance, or other drainage concerns identified by the Town Engineer.

6.10.3 Treatment Facility Types

There are three basic methods by which stormwater quality can be treated in the Town.

1. Collecting and storing the water quality capture volume (WQCV) and releasing it slowly, thereby settling out pollutants in the stormwater instead of discharging them downstream,
2. Infiltrating the WQCV into the ground within a given time, and
3. Using a proprietary vault or structure that has been developed to treat stormwater quality.

Volume 3 of the USDCM provides graphics that offer some general guidance as to the treatment facilities that are typically used for sites having specific characteristics. Details for the design of each type of treatment facility, as well as design constraints, are in the next section.

6.10.4 Design Criteria

The Town's general criteria for permanent water quality treatment is 80% removal of the 60 micron particle from the WQCV of the area being treated or from the peak runoff rate from the 2-year return period storm over the area being treated, depending on the type of treatment facility being designed. For sites that require permanent stormwater quality treatment, treatment must be provided by one of the methods in Section 6.10.3. Meeting the criteria in this section for each type of treatment mechanism is assumed to result in this criteria being met. Supporting calculations must be included in the Drainage Report.

6.10.4.1 Tributary Offsite Area

When offsite area is tributary to a permanent stormwater treatment facility there are two options. The first option is to intercept the offsite flow and route it around or through the site in a separate conveyance system. The second option, if offsite flow cannot be separated, is to size the treatment facility for the entire tributary area. This could mean a much larger design volume or a larger peak runoff rate.

6.10.4.2 Right-of-Way Restrictions

Privately owned and maintained treatment facilities must be located outside the public right-of-way and offline from public stormwater conveyance systems. Easements are required for the area occupied by all facilities located outside the public right-of-way including for access.

6.10.4.3 WQCV Storage and Release

The WQCV is a volume of water designated for treatment that has been determined to provide the most water quality benefit for the cost to construct the improvements required to treat it. Volume 3 of the USDCM provides detailed discussion on the development of the WQCV. Capturing, storing, and slowly releasing the WQCV of a site will meet the Town's requirements for permanent water quality treatment by storing it long enough that pollutants settle out. WQCV treatment facilities acceptable for use in the Town include extended detention basins, sand filter basins, rain gardens, and infiltration galleries and trenches. Other types of facilities may be considered on a case-by-case basis.

The first step in designing a WQCV facility is calculating the WQCV. Two variables are required to calculate the WQCV. The first is the total imperviousness of the area draining to the treatment facility.

Recommended imperviousness values are in Section 7.5. The total imperviousness of a site can be determined by taking an area-weighted average of the different imperviousness values for the site. Total imperviousness can also be adjusted to an effective imperviousness if certain practices are implemented as part of the site design. Effective imperviousness applicability and calculations are discussed below the calculation for the WQCV.

The second variable is the design drain time of the treatment facility. Recommendations for design drain time for different types of WQCV treatment facilities can be found in Volume 3 of the USDCM. The most common WQCV facility is an extended detention basin, for which the recommended drain time is 40 hours. WQCV drain time coefficients are in Table 6.22 below. The general equation to calculate the WQCV in Breckenridge is expressed as:

$$WQCV = 0.84Aa(0.91I^3 - 1.19I^2 + 0.78I)/12 \quad (6.18)$$

Where:

WQCV = water quality capture volume (acre-feet)

a = WQCV drain time coefficient

I = imperviousness as a decimal percentage

A = area draining to the treatment facility in acres

Table 6.22. Drain Time Coefficients for WQCV Calculations

Drain Time	Coefficient, a
12 hours	0.8
24 hours	0.9
40 hours	1.0

The WQCV equation was initially developed based on rainfall data from the Denver metro area. However, the precipitation depth of the average runoff producing storm in Breckenridge is 0.36 while in Denver it is 0.43. The WQCV equation above includes a coefficient of 0.84 to adjust the equation for use in Breckenridge. A map showing the variance in the average runoff producing storm across Colorado is shown as Figure 6.5.

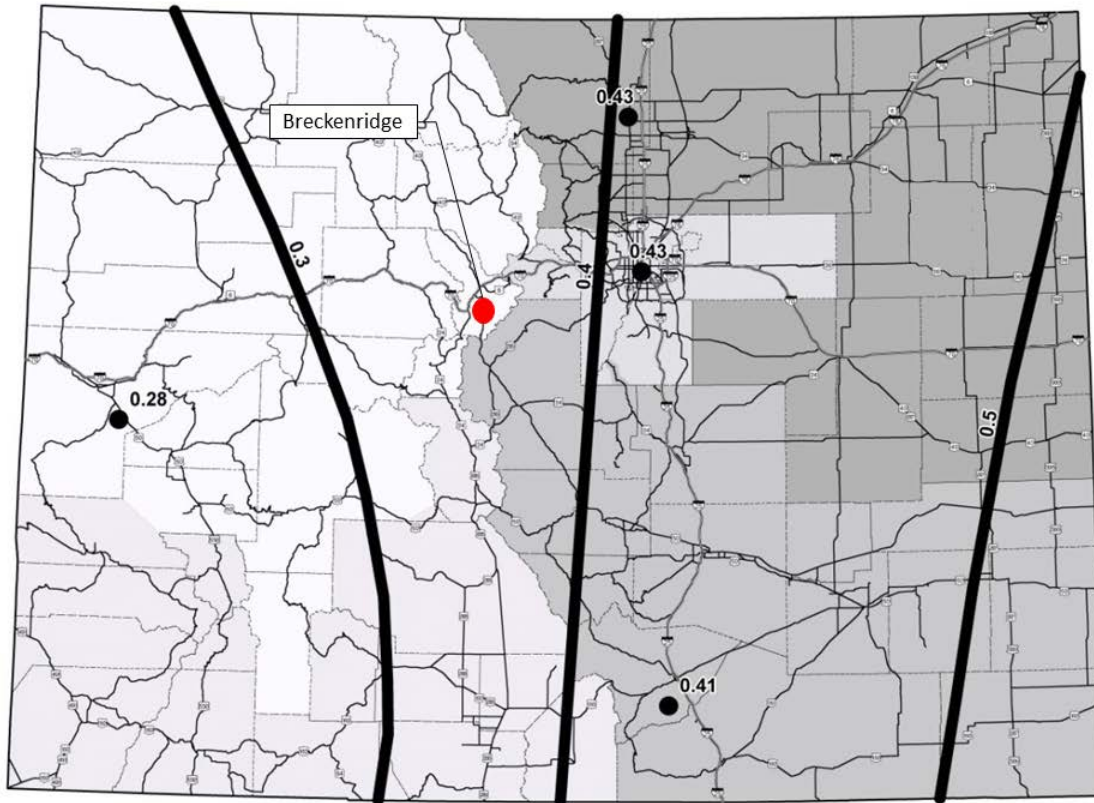


Figure 6.5. Map of the Average Runoff Producing Storm's Depth
(Modified from UDFCD, 2016)

Guidance on how to design extended detention basins, sand filter basins, and rain gardens to meet the WQCV standard are included in the Fact Sheets in Volume 3 of the USDCM. Sand filter basins are referred to as simply sand filters and rain gardens are referred to as bioretention.

6.10.4.3.1 Effective Imperviousness

The imperviousness value used in the WQCV calculation for sites that implement low impact development (LID) principles such as green infrastructure and MDCIA may be reduced to reflect the site's effective imperviousness. The effective imperviousness is dependent on the level of MDCIA implemented for high-level planning applications. Level 1 includes designing impervious surfaces to drain over a grass buffer or other pervious surface prior to reaching any stormwater conveyance system. Level 2 is an enhancement to Level 1 and includes eliminating curb and gutter or using slotted curbs; low-velocity pervious grass- or rock-lined swales instead of storm sewers, and pervious street shoulders. Guidance on calculating effective imperviousness for Level 1 and Level 2 MDCIA can be found in Volume 3 of the USDCM.

Where a detailed site plan has been developed and the square footage of directly connected impervious area, unconnected impervious area, receiving pervious area, and separate pervious area have all been defined, a more detailed effective imperviousness can be determined using the methods in Volume 3 of the USDCM.

6.10.4.3.2 Design Volume and Bypass Capacity

If it is intended that a WQCV treatment facility will serve as a snow storage area, the calculation of the required volume must be increased by 50% of the full design snow storage volume.

WQCV treatment facilities will likely receive more runoff than they were designed to treat during larger storm events. The design of any treatment facility designed to store and release the WQCV must include bypass capacity for the 100-year peak inflow rate into the facility. This is often provided in the form of an overflow weir set at the elevation of the design WQCV. Design guidance is provided in the Fact Sheets in Volume 3 of the USDCM.

6.10.4.3.3 Detention

When a site requires detention in addition to permanent water quality treatment, a single facility may be designed to serve both needs. Detention facilities that are also water quality treatment facilities have outlets to provide for both the stormwater quality treatment and detention release rates. For these facilities, the guidance in the USDCM for Excess Urban Runoff Volume (EURV) facilities shall be followed. Section 7.12 discusses detention further.

6.10.4.4 Infiltration

It is common within the Town of Breckenridge for the subgrade soils to have a high infiltration rate. Infiltration testing is required when infiltration facilities are planned. Infiltration rates must be established by a double ring infiltrometer test performed by a geotechnical engineer at each proposed infiltration site at the proposed elevation of the bottom of the filter material prior to beginning detailed design. Treatment facilities acceptable for use in the Town that can be designed to infiltrate the WQCV include sand filter basins, rain gardens, drywells, infiltration trenches, and infiltration galleries. Other types of facilities may be considered on a case-by-case basis. ~~Note that~~ However, if the same area is intended being used as that an infiltration treatment facility will ~~to~~ serve as a snow storage area, the calculation of the required volume must be increased by an additional 50% of the full design snow storage volume.

Infiltration facilities must have a high enough subsoil permeability to infiltrate the entire WQCV of the area draining to them within 6 hours without the use of underdrains. Infiltration facilities shall be designed to drain 150% of the WQCV (see attached fact sheet for more information) within 72 hours. Infiltration facilities are not allowed within 300 feet of any active waterway without appropriate pretreatment prior to infiltration (examples include sand filters, water quality vaults, detention basins, and rain gardens). Infiltration facilities located between 300 and 1000 feet from an active waterway must not drain the WQCV in less than 4 hours unless appropriate pretreatment is designed. If subgrade soils at these facilities result in infiltration of the WQCV in less than 4 hours, a sand layer must be designed to slow the infiltration of the WQCV to a minimum of 4 hours. There are no ~~additional~~ restrictions on infiltration facilities located more than 1000 feet from an active waterway.

Guidance on how to design sand filter basins and rain gardens to infiltrate the WQCV standard are included in the Fact Sheets in Volume 3 of the USDCM. Sand filter basins are referred to as simply sand filters, rain gardens are referred to as bioretention. Guidance on how to design drywells, ~~and~~ infiltration trenches and galleries ~~is-are~~ included in the Fact Sheets ~~included as~~ attachments to this chapter.

Permeable pavements may be considered with a legally binding maintenance agreement in place as alternative to conventional pavement in pedestrian areas and lower-speed vehicle areas. They will not be allowed for treatment of tributary areas with high sediment yields that could easily clog the system and they are not allowed in the public right-of-way. Permeable pavements will not be allowed on steep slopes or in areas receiving runoff from bare or nearly bare earth. Permeable pavements will be considered impervious materials for detention and water quality calculations and must be designed in accordance with manufacturer's recommendation.

See the subsurface infiltration facility fact sheet in Appendix D of these Standards for additional information and requirements for designing infiltration facilities.

6.10.4.5 Proprietary Structures

Proprietary structures are designed to treat a design flow rate instead of a design volume, and typically function by gravitational separation, vortex separation, filtration, or by screening and retaining pollutants within the structure. The use of proprietary facilities is acceptable but generally discouraged as more frequent maintenance is typically required to maintain adequate performance, proprietary structures often have high long-term costs, and they are often very large while treating only a small flow rate. Proprietary facilities that require removable or replacement cartridges and those that require confined space entry procedures or remote camera operation for routine inspections may be considered on a case-by-case basis.

The two most recognized national programs that test the TSS removal of proprietary structures are in Washington state and New Jersey. Proprietary structures acceptable for use in the Town are those that have been tested by one of these programs and have received one of the following:

1. General or Conditional Use Level Designation for the Pretreatment or Basic test protocols of the Washington State Department of Ecology (WSDOE) Test Assessment Protocol – Ecology (TAPE) for emerging stormwater treatment technologies
2. Certification by the New Jersey Department of Environmental Protection (NJDEP) with verification by the New Jersey Corporation for Advanced Technology (NJCAT) that the manufactured treatment device (MTD) is adequate for TSS removal.

The Town may consider allowing a proprietary structure that is not approved by WSDOE or NJCAT provided that, as part of the drainage report, a qualified professional engineer submits adequate documentation, as determined by the Town, of the manufacturer's test data showing similar performance to that required by either the WSDOE or the NJCAT. The level of scrutiny during review for approval of such devices may be significant.

Proprietary structures must be designed to provide water quality treatment for the 2-year peak design flow rate from the area they are treating. Bypass capacity must be included for the 100-year peak flow rate from this same area. If bypass capacity is not included within the structure, it must be provided before the structure in the form of a diversion for higher flows provided the first flush flows pass to the treatment facility.

6.10.4.6 Treatment in Series

Treatment in series is a very effective way to provide water quality treatment and is highly encouraged. Treatment in series, also referred to as a treatment train, involves passing stormwater from one treatment facility to the next, with each facility providing additional treatment. The facilities used in a treatment train are positioned so facilities that can handle a larger, coarser pollutant load are first, while those facilities that are more suited to a smaller, finer pollutant load are last. This allows for longer periods between required maintenance, especially for the facilities that provide more refined removal.

One option for calculating TSS removal rates is presented in the *Methodology for Analysis of Detention Basins for Control of Urban Runoff Quality* (EPA,1986). The development of this manual was supported by the EPA Nationwide Urban Runoff Program (NURP). While the entire document is worth reviewing, Chapter 4.2.1 of this document presents an analytical method under which TSS removal can be evaluated under the dynamic conditions expected in permanent stormwater treatment facilities. Removal due to sedimentation in a dynamic system is expressed by the equation below.

$$R = 1 - \left[1 + \frac{1}{n} * \frac{V_s}{Q/A} \right]^{-n} \quad (6.19)$$

Where:

R = fraction of solids removed

V_s = settling velocity of particles

Q/A = rate of applied flow divided by surface area

n = turbulence parameter

The turbulence factor offers a way to factor in poor performance caused by turbulence and short circuiting, with $n=1$ representing very poor performance and $n=5$ or more indicating very good performance. With n equal to infinity, removal efficiency is linked to detention time. This equation is useful in areas without enough relief to drain a pond that could hold the entire WQCV, or to design basins in series or those receiving inflow that may have already been partially treated by a different type of upstream treatment facility.

Particle settling velocity is calculated as the submerged weight of a particle minus the drag. This calculation requires the minimum particle size of interest be specified. It also requires the viscosity of water, which varies with temperature. To meet Town requirements, a spherical particle with a diameter of 60 microns may be used. A water temperature of 40 degrees Fahrenheit may be assumed, having a viscosity of 1.664×10^{-5} ft²/s.

Given the Town requirement for 80% removal of the 60 micron particle, an appropriate treatment train composed of any types of permanent treatment facilities discussed herein may be designed using the equation above. Grass buffers and grass swales are especially helpful at the upstream end of a treatment train. Each of the facilities in the treatment train must include physical components in accordance with these Standards and with the manufacturer's recommendations for permeable pavement, if applicable. A Treatment Train Example Calculation is included as an attachment to this chapter.

6.10.5 Designing for Inspection and Maintenance Requirements

Long-term maintenance requirements are a critical component of treatment facility selection and design because facilities that are not properly maintained do not function properly and/or do not treat stormwater runoff to the extent required by the Town. All new facilities shall be designed to facilitate maintenance operations.

Maintenance considerations that must be evaluated during the selection and design process include accessibility, required equipment, frequency of maintenance, special required training, the freeze/thaw nature of the Town's climate, and the need for replacement materials.

Property owners shall be responsible for the maintenance of stormwater detention and water quality facilities to ensure proper functioning. See Section 6.10.5.7 for additional maintenance requirements.

6.10.5.1 Access

An easement shall be provided to allow Town staff to access the facility if the responsible agency is negligent. Access roads shall be provided to all structures including forebays, outfalls, inlets, micropools, outlet structures, and proprietary facilities. Access roads must support an 80,000-pound vehicle load, be at least 10 feet wide, and have an inside turning radius of at least 25 feet. Access roads must pass close enough to each treatment facility component needing maintenance (forebays, micropools, subgrade vaults, etc.) that the equipment to be used will be able to reach the structure. For example, a backhoe with a reach of 25 feet must be able to pass within 25 feet of the structure without leaving the access road. The Town's vacuum truck has a reach of only 5 feet. If a vacuum truck is required for maintenance, the access road must pass within 5 feet of the facility being maintained. If the access road cannot pass close enough to the structure for the equipment to reach, a concrete access ramp or similar supportable material, such as a 6-inch layer of angular 4-inch-minus

riprap, shall be provided at a slope no steeper than 10:1. Concrete ramps shall be scored for wet weather traction.

6.10.5.2 Forebays

Accessible forebays shall be provided at all concentrated inflow points of extended detention basins and sand filter basins for removal of accumulated sediment and floatables. The forebay must be designed in accordance with the Fact Sheets in Volume 3 of the USDCM.

6.10.5.3 Stockpile Areas

Facilities should be designed with stockpile areas for temporary storage and drying of mucked out material. A stockpile area should be directly adjacent to each structure to be cleaned out. Stockpile areas shall be located outside the low flow area and should be as flat as possible. Total stockpile area shall be twice the square footage of all forebays and the micropool.

6.10.5.4 Extended Detention Basins

Extended detention basins shall include a micropool with a hard bottom against which to excavate that is accessible to a vacuum truck or backhoe. Extended detention basins shall include a trickle channel at least 48 inches wide with no cross slope. Trickle channels shall have a concrete bottom and sides at least 6 inches high to allow access for lightweight maintenance equipment if the trickle channel longitudinal slope is less than 5%. If there is a desire for a more aesthetically natural trickle channel, the Town Engineer shall be consulted to discuss and determine maintenance requirements and protocols.

6.10.5.5 Infiltration Facilities

Sand filter basins, rain gardens, drywells, and infiltration trenches have a short lifespan before needing replacement filter material. These facilities shall include pretreatment to remove trash and larger sediment. If located next to a roadway, infiltration facilities shall also include a barrier to prevent degradation of the roadway subgrade. Infiltration testing is required prior to facility design if an infiltration facility is planned. Infiltration testing shall also be conducted after construction and prior to acceptance to ensure the facility functions as intended.

During construction and maintenance operations, special care shall be taken to avoid compaction of subsurface soils that will reduce infiltration rates. If a full infiltration basin is not used, an underdrain system including a loading evaluation will be required and cleanouts must be provided every 300 feet.

Guidance on how to design drywells and infiltration trenches and galleries is included in the Fact Sheets included as attachments to this chapter.

6.10.5.6 Proprietary Structures

Proprietary structures must not require confined space entry procedures for maintenance. Careful design of access to vaults and use of a vacuum truck may eliminate confined space entry requirements.

6.10.5.7 Ownership and Maintenance Plan and Agreement

Treatment and detention facilities require regular inspection and maintenance, to be completed by the property owner. Table 6.23 lists the minimum required inspection and maintenance schedule and typical maintenance activities and operational protocols for various types of treatment and detention facilities. Based on site conditions, the design engineer may require additional maintenance measures, a more frequent schedule, or unique protocols for a site. Volume 3 of the USDCM should be consulted when determining the maintenance schedule, activities, and protocols to be included on the O&M Plan.

An Ownership and Maintenance (O&M) Plan must be developed, submitted, and approved as part of the Drainage Report and then also included as part of the Ownership and Maintenance (O&M) Agreement. An executed O&M Agreement may be required prior to facility approval and project close out. The Town will have the right to access the property to maintain the treatment or detention facility and invoice the owner for the cost of such work if the owner fails to maintain the facility. An example O&M Plan, including a template for the O&M Plan text, and an O&M Plan checklist are included as attachments to Chapter 2. Town staff is available for consultation during the treatment and/or detention facility selection and design process to ensure the design meets the requirements of these Standards. Minimum required components for maintenance are presented in Table 6.23 below.

Town staff will routinely inspect facilities or respond to complaints relating to facilities that may not be performing properly. Facility owners should expect notification of inspections and subsequent findings to be communicated by inspection personnel.

Table 6.23. Recommended Inspection and Maintenance Schedule

Extended Detention Basin	
Activity	Required Frequency
Inspection for debris at outlet, sediment in the forebay, and damage to structures or embankments; maintain or repair as necessary.	Twice annually
Remove sediment from forebay, trickle channel(s), and micropool; aeration of vegetated areas	Annually
Mowing	As needed to maintain 6" height and control weeds
Irrigation and application of fertilizer, herbicide, and pesticide	As needed to maintain vegetative health

Notes: Maintenance frequency is highly dependent on construction activity within the tributary area, associated erosion control measures, and the design of the facility. More frequent removal of accumulated sediment may be required, but detention basins are generally low maintenance facilities.

Sand Filter Basin, Rain Gardens, Dry Wells, and Infiltration Trenches and Galleries	
Activity	Required Frequency
Inspection to confirm infiltration rate after rainfall; maintain as necessary. Debris and litter removal.	Twice annually
Mowing, plant care, irrigation, and application of fertilizer, herbicide, and pesticide (for bioretention only)	As needed to maintain vegetative health
Mulch replacement (for rain gardens only)	As needed to maintain 3" depth
Inspection of underdrain	When ponding lasts longer than 24 hours
Sediment removal and replacement of media	When ponding lasts longer than 24 hours and underdrain is not clogged

Proprietary Structure	
Activity	Required Frequency
Inspection for debris that may cause bypass of design treatment flow rate; maintain as necessary.	Quarterly for first 2 years, as indicated based on first 2 years after that

Filter cartridge inspection; replace as necessary.	Twice annually
Debris removal, filter cartridge replacement, and vacuuming	As recommended by the manufacturer

6.11 CONSTRUCTION STORMWATER MANAGEMENT

Management of stormwater runoff from construction sites in the Town of Breckenridge contributes to our community goal of protecting and maintaining water quality within our local watercourses. A significant amount of sediment can be discharged with stormwater runoff from a construction site. This sediment has the potential to end up in receiving streams, lakes, and rivers, negatively impacting the riparian and aquatic habitat. Establishing a program to minimize untreated runoff from construction sites is essential to keeping streams and drainageways healthy and to minimizing impacts from pollutants and litter.

This section presents the Town's requirements regarding the control of stormwater runoff quality from construction sites, the applicability of the requirements, design guidance for selected BMPs, and references that provide additional information and details. The goal of the requirements in this section is to keep the Town's streams and drainageways healthy. Volume 3 of the USDCM includes a substantial amount of guidance on construction stormwater management and is referenced throughout this section.

The naming convention for facilities or practices that treat stormwater quality during construction has varied over time and between documents. These facilities and practices have been called best management practices (BMPs) in the past. While some more recent documents refer to them as control measures or temporary control measures, these Standards will continue to refer to them as BMPs.

6.11.1 Applicable Codes and Permits

The Town requires applicable construction activity to obtain at least one permit from the Town prior to beginning construction activity. See Chapter 2 for permit requirements. A Stormwater Management Plan (SWMP) or Construction Site Management Plan (CSMP) is required as part of these permits. CSMP requirements are in the Town Code.

Applicable construction projects must apply for a permit from the CDPHE to be covered by the CDPS General Permit for Stormwater Discharges Associated with Construction Activity (Permit No. COR400000). For activity involving dewatering operations, a Construction Dewatering Permit from the CDPHE is required. Information on these permits, and others that may be required during construction, can be found at the CDPHE's webpage for water quality construction permits.

CDOT Erosion Control and Stormwater Quality Field Guide will be used to ensure compliance designing, installing and maintaining BMPs through construction.

6.11.2 Applicability within the Town

The Town's requirements depend on the area disturbed by the project. Applicable projects must develop a Stormwater Management Plan (SWMP). Non-applicable projects, those disturbing less than one acre including any commercial, multi-family, or applicable single family/duplex development, must develop a Construction Site Management Plan (CSMP). CSMP requirements are in the Town Code

A SWMP consists of construction plans and details, specifications for BMPs, and a narrative report that collectively indicate how a construction site will implement structural, non-structural, and planning measures to reduce erosion at the source and prevent pollutants such as sediment and litter from leaving the site. Detailed SWMP requirements are included later in this section.

The Town also requires a Construction Site Management Plan (CSMP) for certain projects. For sites disturbing one acre or more, the CSMP applies only to traffic and site access control. For sites disturbing less than one acre, the CSMP applies to traffic, site access, and erosion and sediment control. Criteria in this section for the design of BMPs and for site inspections apply to sites that require a SWMP and those that require a CSMP.

6.11.3 Stormwater Management Plan Requirements

The intent of a Stormwater Management Plan (SWMP) for construction activities is to prevent pollution, contamination, or degradation of waters of the State and to prevent discharge of pollutants from a project site. Appropriate BMPs must be implemented prior to the start of construction activity, must control potential pollutants during each phase of construction, and must be maintained in operational condition through final stabilization. BMPs must be selected, designed, installed, implemented, and maintained to provide control of all potential pollutants including sediment, construction site waste, trash, discarded building materials, concrete truck washout water and materials, chemicals, sanitary waste, and contaminated soils in discharges from the site. The SWMP will include the following at a minimum:

6.11.3.1 SWMP Report

The SWMP Report is a narrative description and summary of the project site and proposed improvements, how construction activities will be conducted, and the erosion and sediment control practices, procedures, and physical BMPs that will be installed or implemented on site. Items to be included in the SWMP Report are:

1. Administrative Information: Include the project name, location, owner, operator, qualified stormwater manager that will conduct inspections, and the CDPHE certification number.
2. Existing Site Information: Include a description of the existing site, the existing site vegetation and percent density, and the name of the receiving water.
3. Proposed Improvements: Include a description of the proposed project, a description of construction activities, the total area of planned disturbance including access, staging, and storage areas, a sequence of major activities, an approximate construction schedule, and a description of how the project site will be phased.
4. Structural Control Measures: Include a description of the structural BMPs for each stage of construction. Each site must provide structural BMPs that:
 - a. Trap sediment before it leaves the site or enters the municipal storm sewer system or watercourse. These shall be installed prior to initiating earth disturbances. Examples include check dams, inlet protection, sediment basins, sediment control logs, and silt fence. Sediment basins are required for sites that have more than 3 acres of tributary area or are directly adjacent to a wetland or major tributary.
 - b. Capture and retain runoff from vehicle and equipment washing operations, such as cleaning of concrete trucks, chutes, and associated equipment. An example is the concrete washout. Equipment wash water may not be discharged to State waters or storm sewer systems.
 - c. Stop erosion at the source and minimize off-site vehicle tracking of sediment. These include BMPs that stabilize earth disturbances with vegetation or soil stabilization techniques after grading is substantially complete on any portion of the site or for any portion of the site that is inactive for a certain duration of time. Examples include surface roughening, mulching, vehicle tracking control, and installation of blankets, straw wattles, tackifiers, netting, and matting.
 - d. Provide bulk storage and prevent spills of petroleum products and other chemicals or fertilizers and contain storm runoff from construction wastes to a designated area, if

- applicable. These BMPs shall be able to contain all spills and prevent any spilled material from entering State waters. Secondary storage must be provided, and all bulk storage shall be located as far away from State waters as possible.
- e. Provide final stabilization of a site. These may include sod, seed, mulch, landscape plantings, decorative rock, or hard surfacing such as pavers, concrete, or asphalt. Seed mixes must be provided. An anticipated schedule must be provided. If a site is to be winterized, discuss temporary stabilization measures to be utilized. The Town may require a revegetation and stabilization bond for some projects.
5. Non-Structural Control Measures: Include a description of the non-structural BMPs that will be used throughout construction. This section of the report must include:
 - a. Discussion about how the following operations will be conducted: trash management; dust and particulate management; materials loading and unloading; vehicle and equipment maintenance and fueling; building materials, chemical, fertilizer, and stockpile storage; routine maintenance involving fertilizers, pesticides, detergents, petroleum products, and solvents; and concrete and batch plants.
 - b. A plan to remove from the site and dispose of all waste composed of building materials in licensed disposal facilities. No building material waste or unused building materials shall be buried, dumped, or discharged at the site.
 - c. A program and schedule for regular inspection and maintenance of BMPs.
 6. Include a description of how construction will be sequenced to reduce the duration any disturbed areas are exposed. Temporary disturbed areas and disturbed areas that will be permanently stabilized shall be exposed no longer than 30 days.
 7. Addition Potential Pollutants: Identify and address pollutant sources associated with any other areas or operations not included above where spills can occur. Identify other non-stormwater discharges not included above including construction dewatering not covered under the Construction Dewatering Discharges general permit and wash water that may contribute pollutants to Town waters.

6.11.3.2 SWMP Plans

The SWMP Plans are construction plans that locate and identify the number, extent, and installation details of the structural and nonstructural BMPs included and discussed in the SWMP Report. The SWMP plans must also include property boundaries, construction site boundaries, existing and proposed utilities, limits of cut and fill, stockpile areas, porta-let locations, arrows to depict the direction runoff will flow, and the locations of all receiving waters and drainages.

6.11.3.3 SWMP Specifications

BMP materials specifications and installation requirements may be provided with the BMPs installation details included with the SWMP Plans or as separate technical specifications in the project manual. Installation and implementation specifications must be provided for all structural BMPs in one of these two documents.

6.11.4 SWMP Submittal, Inspection, & Maintenance

For applicable sites, a SWMP must be submitted to the Town for review and approval prior to construction. Once the SWMP is approved and construction begins, regular inspection and maintenance of the BMPs will proceed throughout the duration of construction. The subsections below provide more detail on these requirements and processes.

6.11.4.1 SWMP Submittal Requirements

SWMP plans are construction plans that depict the type and location of structural and procedural BMPs that will be implemented on site during various stages of construction. SWMP plans must be submitted to the Town for review and approval. A SWMP shall be developed by a qualified stormwater professional.

Each SWMP must have separate sheets for the initial/interim and final phases of construction as well as detail sheets with a design and installation detail for each BMP specified in the SWMP. A legend shall be provided that includes all abbreviations used (e.g. CWA is used for concrete washout area) as well as all symbols, blocks, and line types that represent various BMPs. Each kind of symbol, block, or line type shall be labeled at least once on each sheet on which it is used. Text on all SWMP plan sheets, including the detail sheets, shall be legible when the SWMP plan set is printed on 11 x 17 paper, using at least a 9-point font. In the case of overlapping or adjacent project sites that are separately managed, the SWMP shall include at least one plan sheet that clearly shows the site area managed as part of the submitted permit. If more than one sheet is required for each phase of the SWMP plan set, the first sheet of the initial phase shall match the first sheet of the interim phase, and so forth. For project sites that are adjacent to or within construction activity that is not being performed by the same owner or operator, the SWMP shall delineate the exact project site boundaries that each owner or operator is responsible for.

6.11.4.1.1 Initial SWMP Plan

Initial SWMP plans include all BMPs that will be installed before construction begins. These shall include vehicle tracking at all exits from the site and enough stabilized staging area to accommodate the site's operations. Initial SWMP plans will also include any construction fence, inlet protection, curb socks, perimeter controls, or concrete washout areas that are required on site. Initial BMPs shall be identified on the initial SWMP plan by their two- or three-letter abbreviation and a quantity such as linear feet (LF) or square feet (SF), where applicable. The initial plan may be combined with the interim plan for small sites that do not have complex phasing. Sites disturbing 40 acres or more must have separate initial and interim SWMP plan sheets that detail the planned phasing of the site, and it is likely that more than one of each will be required to cover the larger area at a reasonable scale.

6.11.4.1.2 Interim SWMP Plan

Interim SWMP plans include all BMPs that will be installed as construction progresses. These include all BMPs such as temporary stream diversions, check dams, sediment basins, stockpile areas, sediment control logs on exposed slopes, and culvert outlet protection, among others. The interim SWMP plan should include all the BMPs shown on the initial SWMP plan, but they should have their dimensions removed for clarity. Like the initial SWMP plan, interim BMPs shall be identified on the interim SWMP plan by their two- or three-letter abbreviation and a quantity such as linear feet (LF) or square feet (SF), where applicable. Operators are encouraged to phase construction sites to minimize erosion. A complicated site may require more than one interim SWMP plan. The interim plan may be combined with the initial plan for small sites that do not have complex phasing. Sites disturbing 40 acres or more must have separate initial and interim SWMP plan sheets that detail the planned phasing of the site, and it is likely that more than one of each will be required to cover the larger area at a reasonable scale.

6.11.4.1.3 Final SWMP Plan

Final SWMP plans include final stabilization BMPs such as seeding, mulching, and erosion control blanket. For some sites, the landscape plan, if it is comprehensive and included in the construction plan set, may be used as the final SWMP plan, provided the required information is included. In other cases, a separate final SWMP plan will be required. The final SWMP plan should generally not include initial and interim BMPs and abbreviation labels. If an initial or interim BMP is to remain, it shall be

included on the final SWMP plan and noted to remain. Otherwise all initial and interim BMPs shall be assumed to be removed.

6.11.4.1.4 SWMP Details

Details for all BMPs specified shall be provided on SWMP plan detail sheets. Details shall be in accordance with CDOT or MHFD standard details.

6.11.4.2 SWMP and CSMP Inspection

Each SWMP permittee shall designate a qualified stormwater manager to inspect the BMPs on the construction site. Inspections should occur either weekly or every 14 days and after each runoff-producing storm event to confirm they are installed and functioning as intended, beginning with an inspection of the initial BMPs prior to any excavation and ending with final approval of the site by the Town. The stormwater manager shall be an individual knowledgeable in the principles and practices of erosion and sediment control and pollution prevention, and with the skills to assess: 1) conditions at construction sites that could impact stormwater quality and 2) the effectiveness of stormwater controls implemented to meet the requirements of this permit.

The stormwater manager should keep a record of all inspections including the date and time of the inspection, recent precipitation, required maintenance activities to be completed, and a summary of maintenance completed since the previous inspection. The stormwater manager shall update the SWMP (or CSMP) plans to reflect current conditions by showing changes made to the location and/or type of BMPs based on their performance and/or inspection reports throughout the duration of construction. An updated set of SWMP plans, including installation details, shall be on site during construction activities.

The Town will periodically inspect construction sites for conformance to the SWMP, to confirm installation, maintenance, and function of the BMPs are adequate, and to assure compliance with the Town's permit(s) and Town Code. Work that is not in compliance with the Town's Standards, the SWMP, the CSMP, or the Town Code is subject to enforcement action.

6.11.4.3 SWMP Maintenance

Maintenance of BMPs is typically ongoing for the duration of construction. The SWMP permittee shall schedule any required maintenance noted during regular inspections to be completed prior to the next inspection or reinspection. The SWMP must be updated as needed to reflect current site conditions and be maintained on site. Possible modifications may include replacing and adding BMPs and identifying additional pollution sources. Hand-written notations, initialed and dated, are adequate for most plan updates.

6.11.4.4 SWMP Adequacy

If BMPs installed on the site are inadequate to properly control pollutants during construction as evidenced by their performance during or after storm events or as identified during inspections, the SWMP permittee shall immediately complete any modifications required to properly control pollutants or those noted during inspection. Modifications completed shall be physically noted in the SWMP plans. BMPs, or lack thereof, identified as inadequate based on a Town inspection shall be rehabilitated immediately.

6.11.5 Temporary BMPs

Temporary BMPs are structural or site planning BMPs that are utilized to minimize sediment or other pollutants during construction activities. These BMPs shall be removed from the site upon completion of site stabilization unless they are designated to remain by the SWMP or by the Town because, for example, they do not impede use or maintenance of the site or will biodegrade. This section presents

some specific structural and site planning BMPs that are to be used during construction. It also offers several reference documents that provide design and construction details for BMPs that are not specifically discussed in this section.

6.11.5.1 Vehicle Tracking

Vehicle tracking pads are an essential part of preventing sediment from leaving a construction site. Vehicle tracking pads shall be implemented at every exit point to the site, regardless of the type of equipment that will be exiting at each location. The stone used should be hard, durable, angular stone, resistant to weathering with a long dimension not less than 3 inches. Larger stone is preferable, and stone should have a minimum specific gravity of 2.6. Other means of keeping sediment on site may be acceptable with proper documentation and provided performance is maintained. Any damage to sidewalk, curb, or gutter shall be replaced by the permittee. The minimum dimension for each vehicle tracking pad is 20 feet wide by 50 feet long by 6 inches thick, although more length may be required if the minimum size does not provide adequate performance.

6.11.5.2 Sediment Basins

Sediment basins to capture construction site runoff shall be installed on construction sites that disturb more than 3 acres. Runoff is detained in sediment basins and slowly drained so that sediment may settle out before the runoff leaves the site.

For sites with less than 40 acres of disturbance, at least 66% of disturbed area shall drain to a sediment basin. Multiple basins may be more efficient to achieve this requirement than a single basin, depending on the site configuration. Each basin must have a way to drain detained runoff as well as an emergency overflow with a revetted overflow path for runoff exceeding the sediment basin design volume. Sediment basins should drain passively through an outlet structure designed to drain the full basin volume within 12 hours. Designs for outlet structures should be per the criteria references provided in 6.11.5.7. Sediment basin storage volume may also be actively drained by pumping through a sediment bag with the basin being pumped empty when the basin volume reaches 50% of capacity or when rain is forecasted within 24 hours. When pumping is proposed in lieu of a passive outlet structure but is not performed per this criteria, the owner and operator are subject to enforcement action for improperly maintaining the selected BMP.

Each sediment basin shall provide 1600 cubic feet of storage per acre of tributary area provided it is not utilized as a BMP during the months of March, April, or May. If a sediment basin is utilized as a BMP during March, April, or May, it shall provide 3200 cubic feet of storage per acre of tributary area.

For sites with 40 acres or more of disturbance, every acre of disturbance exceeding 40 acres shall drain to a sediment basin. For example, a site with 39.9 acres of disturbance would be required to drain 26.3 of those disturbed acres to a sediment basin. A site with 45 acres of disturbance would be required to drain 31.7 of those disturbed acres to a sediment basin. This criteria encourages owners and operators to minimize the area of site disturbance at any one time to less than 40 acres.

Sediment basin design elements that must be in accordance with the Volume 3 of the USDCM include a spillway crest length based on tributary drainage area, a 12-inch minimum distance between the overflow crest and the surrounding embankment, outlet protection for the spillway, outlet works, and embankment slopes.

6.11.5.3 Check Dams

Check dams may be used to slow runoff in drainageways to limit erosion and sediment transport. Different agencies have specified different cross sections for check dams in their BMP details, however, all agencies specify that the elevation of the crest of the downstream check dam should be equal to the downstream toe of the next upstream check dam. This may become unreasonable in

because of the steep grades of some drainageways. For check dams in Breckenridge, the following criteria apply.

1. For preliminary sizing and spacing, check dam height above existing grade shall be a minimum of 18 inches and a maximum of 3 feet. Check dams shall be spaced along the drainageway such that the crest of the downstream check dam is at the same elevation as the downstream toe of the next upstream check dam.
2. If preliminary sizing results in a check dam spacing of less than 200 feet (i.e. the drainageway is steeper than 1.5%), Check dam height may be increased to 4 feet or may spacing may be less than 200 feet for slopes up to 2%. If drainageway slope exceeds 2%, the SWMP preparer shall propose a check dam height and spacing that he or she believes will meet the intent of the intended purpose of the check dam. The proposal shall be discussed during a SWMP review meeting with the Town.
3. Check dam embedment in the underlying ground shall be at least 12 inches and stones used in the check dam shall have a D50 of at least 12 inches.
4. A plan view and sections of a typical check dam used on the site will be provided with the SWMP plan as an initial BMP.
5. All check dams must be removed as part of final stabilization unless designated or approved to remain by the Town.

6.11.5.4 Materials Storage and Stockpiles

Construction materials that are not earth or aggregate shall be stored on a stabilized staging area. Earth and aggregate may be stockpiled outside of a stabilized staging area, but earth materials must be bounded by silt fence or some other BMP that will prevent sediment from escaping the stockpile during a runoff event.

The stabilized staging areas shall be large enough to store all required materials, provide parking for vehicles and equipment on site, and accommodate loading and unloading activities. The stabilized staging area must be installed as an initial BMP, prior to any other construction activities. The size of the stabilized staging area will vary with each site but may be required to be enlarged if inspections show it is not sized sufficiently to contain all required items and activities. Each stabilized staging area shall consist of granular material at least 3 inches thick unless it is demonstrated that native materials provide adequate stabilization. If rutting occurs, or if the underlying subgrade becomes exposed, additional granular material will be required. Once construction is complete, the granular material shall be removed, and the site shall be stabilized in accordance with the final SWMP plan or landscape plan.

6.11.5.5 Temporary Stabilization and Winterization

All areas disturbed by construction or stockpiles shall be stabilized as soon as possible to reduce the duration bare soil is exposed to runoff. All disturbed areas which are either final graded or will remain inactive for a period of more than 30 days shall be stabilized after the completion of the grading activities. Acceptable temporary stabilization BMPs include surface roughening, seeding and mulching, erosion control blankets or turf reinforcement matting, and tarping for stockpiles. Temporary stabilization by revegetating should take place progressively as the project moves forward and as soon as feasible.

To prevent damage during spring runoff, all disturbed areas shall be temporarily stabilized with one of the acceptable methods listed above prior to winter. While the Town requires winterization activities by completed by December 1, it is recommended that winterization be completed by November 1.

6.11.5.6 Erosion Blanket

Any embankment, cut, or fill slope that is in its final graded state and steeper than 3H:1V shall be seeded and covered with erosion blanket within 30 days of final grading being completed. Erosion blanket installation shall be in accordance with the manufacturer's details and specifications which shall be included on the SWMP plan detail sheet.

6.11.5.7 Control Measure Specifications and Details

Unless the Town has included its own temporary BMP details or design guidance in this section, construction details and design procedures shall be as presented in the most recent version of one or more of the following references. Note that these documents are updated regularly and can be found via an internet search.

1. Colorado Department of Transportation Erosion Control and Stormwater Quality Guide and Standard Plan M-208-1.
2. Urban Drainage & Flood Control District Urban Storm Drainage Criteria Manual, Volume 3 Stormwater Quality.
3. Southeast Metro Stormwater Authority Grading, Erosion, and Sediment Control Manual.

The BMPs presented in the documents referenced above shall be designated in the SWMP where appropriate, and details for each BMP specified shall be included in the SWMP. Use of alternate BMPs not specified above is subject to approval by the Town.

6.11.6 Construction Site Inactivity

Temporary stabilization must be implemented for earth disturbing activities on any portion of the site where ground disturbing construction activity has permanently ceased, or temporarily ceased for more than 30 calendar days. Temporary stabilization methods may include, but are not limited to, hydromulching, tarps, soil tackifier, hydroseed, and erosion control blankets. The permittee may exceed the 30-day schedule when either the function of the specific area of the site requires it to remain disturbed, or physical characteristics of the terrain and climate prevent stabilization. The SWMP must document the constraints necessitating the alternative schedule, provide the alternate stabilization schedule, and identify all locations where the alternative schedule is applicable on the site map.

6.11.7 Final Stabilization

Final stabilization is reached when all surface disturbing activities at the site are complete and a uniform vegetative cover has been established with a plant density of at least 70% of pre-disturbance levels, or an equivalent amount of permanently stable surface has been constructed. Permanently stable surfaces include landscape rock, wood mulch, and landscape pavers. Only the vegetation specified in the SWMP planting plan or seed mix shall count toward plant density.

CHAPTER 7 GRADING & EXCAVATION

TABLE OF CONTENTS

7.1 PURPOSE	i
7.2 OTHER STANDARDS	i
7.3 PERMITS	i
7.4 GRADING	i
7.4.1 Geotechnical Engineer	i
7.4.2 Maximum Slope	ii
7.4.3 Earthen Berms	ii
7.4.4 Detention and Water Quality Features	ii
7.4.5 Retaining Walls	ii
7.4.6 Site Stabilization	iii
7.4.7 Revegetation	iii
7.5 DRAINAGE	iv
7.5.1 Positive Drainage	iv
7.5.2 Offsite Drainage	iv
7.5.3 Spa and Pool Drainage	v
7.6 ENVIRONMENTALLY SENSITIVE AREAS (ESA)	v
7.6.1 Setbacks	v
7.6.2 Wetland Delineation Surveys	vii
7.1 PURPOSE	i
7.2 OTHER STANDARDS	i
7.3 PERMITS	i
7.4 GRADING	i
7.4.1 Geotechnical Engineer	i
7.4.2 Maximum Slope	ii
7.4.3 Earthen Berms	ii
7.4.4 Detention and Water Quality Features	ii
7.4.5 Retaining Walls	ii
7.4.6 Site Stabilization	iii
7.4.7 Revegetation	iii
7.5 DRAINAGE	iv
7.5.1 Positive Drainage	iv
7.5.2 Offsite Drainage	iv

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

7.6 ENVIRONMENTALLY SENSITIVE AREAS (ESA).....v

7.6.1 Setbacks.....v

7.6.2 Wetland Delineation Surveys.....vi

LIST OF ATTACHMENTS – APPENDIX E

APPROVED SEED MIXES

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

7.1 PURPOSE

Development sites within the Town of Breckenridge's mountain environment frequently contain steep slopes, wetland areas, and perennial streams and may be located close to the Blue River. This chapter establishes standards and regulations for development to protect the environment and public health and safety. The standards in this section provide the minimum regulations for grading, excavation, and drainage. Special site conditions or constraints may justify additional requirements from the Town Engineer.

7.2 OTHER STANDARDS

This section provides standards and regulations for general grading, excavation, and drainage for all construction and property development, including work in the right-of-way, single family home development, large residential developments, and commercial property development. Additional grading and excavation standards are provided in the following standards:

1. Chapter 2 of these Standards provides submittal requirements for various types of grading and excavation projects.
2. Chapter 5 of these Standards provides grading requirements within or near streets and driveways.
3. Chapter 6 of these Standards provides information on grading of open channels, detention facilities, and stormwater features.
4. The Subsurface Infiltration Facilities Fact Sheet, included as an attachment to Chapter 6, provides additional requirements for subsurface infiltration facilities.
5. Chapter 8 of these Standards provides requirements and procedures for inspection and acceptance of grading and excavation work.
6. Chapter 9 of these Standards provides construction specifications pertaining to grading and excavation.
7. OSHA provides requirements for temporary trenching, grading, shoring, and other construction requirements.

7.3 PERMITS

Any grading or excavation work of any kind requires a permit prior to commencing work. An infrastructure permit, right-of-way permit, or building permit is required before beginning any grading or excavation activities. Additional Town, County, State, or Federal permits may be required as well. See Chapter 2 (Section 2.4) of these Standards for additional guidance on permits.

7.4 GRADING

The sections below set minimum grading requirements, including geotechnical engineering requirements, slope stability, maximum slopes, earthen berm requirements, detention ponds, retaining walls, and revegetation requirements.

7.4.1 Geotechnical Engineer

Sites with existing grades exceeding a 3H:1V slope will require a geotechnical report analyzing slope stability that is stamped by a geotechnical engineer licensed in the State of Colorado. The geotechnical engineer shall analyze the slope stability for the existing site, proposed structures, and driveways, and examine any impacts to adjacent structures or properties.

Sites with unique conditions, high groundwater, poor or expansive soils, previously mined areas, or any other geotechnical concerns shall require a geotechnical report stamped by a geotechnical engineer licensed in the State of Colorado.

7.4.2 Maximum Slope

A maximum slope of 3H:1V is recommended and preferred for all development in the Town. If existing topography makes it infeasible to provide 3H:1V slopes, slopes of 2H:1V may be allowed. Slopes exceeding 3H:1V require erosion netting or other erosion control systems as approved by the Town Engineer. Slopes should be designed at a maximum of 2.5H:1V, as 2H:1V design slopes often result in localized areas with slopes steeper than 2H:1V, which will not meet code nor pass inspection.

7.4.3 Earthen Berms

Earthen berms constructed for landscaping, screening, or sound mitigation shall be constructed at a maximum slope of 3H:1V. Berms shall be designed to appear natural and match surrounding topography; this should be accomplished through the following design standards:

1. Berms shall be designed with vertical and horizontal undulation. Vertical undulations shall be 50% of the maximum berm height and horizontal undulations shall be 25% of the maximum berm width. A variance may be granted for berms shorter than 100 feet.
2. Maximum height of berm shall be 10 feet.
3. Berms shall be connected to the existing grades at the bottom gradually with a vertical curve to make the berm more natural appearing.
4. Berms shall flatten near the top to appear more natural.

7.4.4 Detention and Water Quality Features

Detention and water quality feature grading shall be designed to balance aesthetics and maintenance. Grading shall be designed to add horizontal undulations so the features appear more natural and match the natural landscape, provided that the undulations do not negatively impact maintenance of the facility.

7.4.5 Retaining Walls

The maximum slope of unretained finished grades shall be 2H:1V. Slopes with proposed grading that will result in grades steeper than 2H:1V will require retaining walls. All retaining walls taller than 4 feet (measured from finished grade at bottom of wall to top of wall) shall be engineered. Engineered walls require the following to be submitted to the Engineering Division from a professional engineer licensed in the State of Colorado:

1. Detailed plan by Colorado professional engineer showing retaining wall details and stamped
2. Inspections during construction certifying all aspects of retaining wall construction meet plan requirements and good engineering practices
3. Final certification of the retaining wall construction by Colorado professional engineer

Multiple retaining walls constructed close to each other will be treated as a single wall for height calculation purposes unless the horizontal distance between the walls exceeds the height of the taller wall. For example, two 4-foot walls separated by only 3 horizontal feet will be treated as a single 8-foot wall and must meet the requirements for an engineered wall.

Walls designed to be less than 4 feet tall and not engineered, but ultimately constructed over 4 feet tall due to site grading, shall be documented, inspected, and certified by a registered professional engineer during construction. A single inspection post-construction will not meet the certification requirements for retaining walls over 4 feet tall.

All retaining walls, including walls less than 4 feet tall, shall be designed with free-draining, granular material for wall backfill, ~~and foundation drains shall be installed behind the wall.~~

Retaining walls connected to buildings or building egresses shall have railings installed and meet requirements of Title 8 of the Town Code (Building Regulations).

See Chapter 5 of these Standards for additional information on retaining walls. See Town Code for planning requirements related to retaining walls.

7.4.6 Site Stabilization

All disturbed areas shall be stabilized prior to final acceptance by Town and should be stabilized as soon as possible after completion of earth disturbance activities and no longer than 14 days after completion of earth work. For larger projects, grading shall be completed in phases and stabilized immediately after completion of a phase. Final stabilization must be a permanent feature designed and installed to prevent erosion and sediment runoff. Final stabilization methods shall be installed and maintained following good engineering, hydrologic, and pollution control practices. The following is a list of acceptable site stabilization methods in Breckenridge. Additional methods not listed below may be submitted to and approved by the Town Engineer.

1. Revegetation with native grass achieving an individual plant density of at least 70% of pre-disturbance levels. Pre-disturbance levels refer to pre-disturbance vegetation that would represent the naturally supported vegetation density in the area. See Section 6.12.1.7 below for additional information on revegetation.
2. Permanent Pavement and Buildings, including roofed buildings, concrete, and hot mix asphalt are considered final stabilized surfaces. Aggregate base course, fine gravel, and asphalt millings are generally not considered permanent pavement and shall not be used for final stabilization.
3. Hardscape surfaces, such as flagstone pavers.
4. Rip-rap, cobble, and large rock. A scour analysis shall be included in the drainage report when required for rock installed on steep slopes.
5. Other landscaping materials, including trees, shrubs, perennials, wood mulch, rock mulch, and turf grass. It is recommended that a landscape architect be used to design landscaping plans.

7.4.7 Revegetation

It is recommended that a revegetation plan be developed by a licensed professional landscape architect to develop a site specific revegetation and landscaping plan. The Town shall be consulted for approval of site specific topsoil and native seed requirements. A list of pre-approved seed mixes are included in Appendix G.

To achieve the highest likelihood of establishment of the specified vegetation, a 2-year maintenance plan from a certified landscaping company that understands native vegetation is required. Plantings shall be completed in the fall or late winter to provide the best odds of establishment. Irrigation is generally required for trees, shrubs, and perennials. Temporary irrigation systems are recommended to establish native grasses. The Town shall be consulted for approval of site specific topsoil and native

seed requirements. General requirements to improve successful vegetation establishment include the following:

1. Seeding all disturbed areas with an approved weed free native seed mix. Approved seed mixes for most sites in the Town of Breckenridge include the Middle Park Conservation District "Forest Mix" and the NRCS "Forest Mix." Alternative seed mixes may be required near environmentally sensitive areas, such as wetlands and the Cucumber Gulch Wildlife Preserve. Diverse early-serial seed mixes with the potential to fully occupy the site's botanical niches shall be selected. Alternate seed mixes shall be approved by Town Engineer.
2. Adequate seeding rates and seeding techniques coupled with soil amendments and fertilizer as determined by proper soil testing and Town construction specifications.
3. Preparing disturbed areas with a minimum depth of 3 inches of topsoil. Topsoil shall be free of rocks, weeds, and other invasive plant species.
4. Pretreating disturbed areas to remove invasive or noxious species.
5. Minimizing or eliminating the use of nitrogen as exotic weeds are often preferentially stimulated over native species.
6. Monitoring for non-target species and noxious weed seeds that are often present in a seed mix.
7. Developing an iterative weed management plan based on regularly scheduled monitoring.

See Chapter 9 for additional information on revegetation specifications.

7.5 DRAINAGE

The sections below set minimum grading and excavation requirements pertaining to drainage and stormwater flow patterns. These sections provide general guidance for site drainage and do not provide standards for water quality or detention requirements. See Chapter 6 of these Standards for water quality, detention, and other drainage requirements.

7.5.1 Positive Drainage

All residential and commercial buildings shall be graded with positive drainage away from building foundations. Positive drainage is defined as a minimum 2% grade perpendicular away from the building foundation for a minimum of 10 feet. Where pavement is adjacent to a building, the minimum slope may be reduced to 1%. Drainage swales, drywells, infiltration facilities, foundation drain pipe daylight, detention and water quality facilities, and all other drainage structures shall be a minimum of 10 feet from the edge of any building foundation [or structural element](#). Foundation drains shall not daylight in roadside ditches, on adjacent parcels, or areas that will drain directly onto adjacent parcels.

7.5.2 Offsite Drainage

Drainage from new development shall be designed to discharge to an infiltration facility, drainage swale, storm sewer, regional detention facility, stream, or other drainage conveyance. Grading shall be designed to prevent any developed drainage or altered drainage flows from crossing onto a neighboring property parcel unless a drainage easement exists on that parcel. Subdivisions shall be platted to add drainage easements for all areas where runoff drainage flows onto another parcel. In no case shall development worsen drainage issues for any downstream properties. Grading shall be designed to prevent erosion and any damage to adjacent structures, streets, or storm sewer infrastructure. Infiltration may be utilized in areas where applicable. Stormwater may drain into an approved location in the Town right-of-way, but it shall not drain directly onto streets, sidewalks, pedestrian paths, trails, or other areas where it could create public safety hazards. Infiltration facilities

shall be used in areas where drainage would otherwise cross a street, sidewalk, or other facility. See the subsurface infiltration facility fact sheet attached to Chapter 6 for additional information.

Drainage from existing developments shall be designed with preliminary stormwater treatment prior to discharging directly to a stream, wetland, or other body of water.

Snow storage areas for all development, including single family homes, shall be designed ~~not~~ to drain ~~toward away from~~ foundations, ~~nor directly onto~~ roadways, sidewalks, pedestrian paths, trails, or other areas where it could create public safety hazards. Snow storage shall be designed to drain into a permanent water quality facility or onto a vegetated area prior to discharging to a stormwater conveyance facility.

New development and redevelopment are both required to analyze and correct any existing inadequate drainage, including insufficient drainage away from buildings, runoff adversely affecting downstream properties, inadequately sized drywells, drainage exceeding storm sewer inlets, pipes, or other conveyance, or other drainage concerns identified by the Town Engineer.

7.5.3 Spa and Pool Drainage

Spas, swimming pools, and other water features installed through new development (existing homes replacing existing spas are exempted) shall meet the following drainage requirements:

1. Pools and spas shall be connected to a drywell meeting all requirements of these Standards. Pools and spas shall not drain into storm sewers, roads, or surface flow off property. Pools, spas, and their drainage shall not be located near environmentally sensitive areas. Within the Cucumber Gulch Protected Management Area (PMA), the Upper Blue Sanitation District may allow spas to be connected to the sanitary sewer. If the sanitary sewer connection is allowed, a drywell is not required.
2. Drains shall be designed to maintain a maximum flow rate of 10 gallons per minute. Drywell infiltration rate shall be designed to exceed the drainage flow rate.
3. Prior to draining a pool or spa, no chlorine, salts, or other chemicals shall be added to the water for a period of at least five days.

Formatted: List Paragraph, Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.25" + Indent at: 0.5"

7.6 ENVIRONMENTALLY SENSITIVE AREAS (ESA)

Environmentally sensitive areas (ESA) are defined as wetlands, streams, lakes, ponds, Cucumber Gulch Wildlife Preserve, and other special wildlife habitat areas. These areas require special requirements to protect their sensitive nature during development. The Town and the developer shall work in conjunction with the Environmental Protection Agency (EPA), Army Corps of Engineers (USACE), State Engineer's Office Water Commissioner, and the Natural Resource Conservation Service (NRCS). For floodplain development regulations, see Title 10 of the Town Code.

7.6.1 Setbacks

No structures or soil disruption shall be located within 25 feet of the top of the banks or delineated boundary of all ESAs. The setback requirements also apply to all channels draining 20 acres or more. Exceptions to the setback requirements may be allowed if one of the following conditions is met and approved by the Town Engineer:

1. Development sites with the most recent plat being recorded prior to January 1, 1986 and platted in a manner which does not allow a feasible development option meeting the 25-foot disturbance setback. This exception only applies if the disturbance setback prohibits any feasible development and the developer demonstrates there are no feasible alternatives to

eliminate disturbance within the setback. Additionally, sites that were platted prior to January 1, 1986, but that were re-platted after January 1, 1986, do not qualify for this exemption.

2. The ESA has previously been mined or extensively disturbed in the area adjacent to the proposed development, resulting in dredge tailings in the area. In this case, the setback may be waived if the developer submits a plan to implement channel, wetland, environmental, or other water body improvements which serve to reclaim, stabilize, revegetate, or enhance the ESA.
3. Work is proposed in the 25-foot setback area (but not within the ESA boundary), the work is considered minor (no permanent structures) in the setback area, and acceptable measures are implemented to prevent an increase of sediment or other contaminants that exceeds historical rates as determined by the Town Engineer.
4. Areas where there are no other feasible methods for development without encroachment into the ESA setback and the encroachment is necessary for critical infrastructure. To meet this exemption, the developer must demonstrate there are no feasible alternatives to eliminate disturbance within the setback. Only infrastructure, such as roads and utilities, will be considered within the ESA. Residences and structures will generally not be granted an exemption to be constructed within an ESA.
5. The wetlands or other environmentally sensitive areas have encroached into a detention, stormwater quality, or another type of stormwater feature since the development of the feature. Maintenance activities within the stormwater feature shall be allowed in these cases.

If any of the above exemptions to the setback requirement is granted by the Town Engineer, the following requirements shall be met:

1. Acceptable measures shall be designed, installed, and maintained to prevent an increase of sediment or other contaminants that exceeds historical rates, both during construction and in the final condition.
2. If ESA improvements are approved per condition 2 above, the water body shall be hydrologically contained to limit impacts until the improvements are completed. For stream restoration improvements, a bypass channel shall be designed for the 25-year storm and for a minimum distance of 25 feet above and below the channel restoration work. The bypass channel shall either be a plastic, metal, or concrete culvert or shall be an open channel stabilized with scour protection designed for the 25-year storm.
3. If wetlands are disturbed, wetland mitigation shall be completed at a minimum of a 1:1 ratio or the ratio required by the USACE, whichever is greater. Wetland mitigation for Waters of the US shall meet all requirements of the USACE. A financial guarantee shall be submitted to the Town guaranteeing the wetlands mitigation for a minimum period of 3 years to ensure successful plant establishment for all wetland plantings. A wetland mitigation plan shall be submitted which includes the following:
 - a. The amount, location, and acreage of wetland fill, removal or other alteration proposed.
 - b. The proposed mitigation improvements.
 - c. A grading, erosion control, and revegetation plan, including plant material to be used for revegetation and soil stabilization measures.
 - d. A narrative explaining how there are no feasible alternatives to disturbing the wetlands, how the wetland disturbance is being minimized to the extent possible, how the wetlands will be mitigated, and how the project will not violate an applicable laws or regulations.

- e. Other applicable permits such as a USACE 404 permits (if site is determined to be a jurisdictional wetland).
4. Disturbed areas within the ESA or ESA setback shall be revegetated with an appropriate seed mix. Revegetation of ESA and ESA setbacks shall be monitored and certified at revegetation.

7.6.2 Wetland Delineation Surveys

Wetland boundaries shall be shown on all subdivision plats within the Town of Breckenridge. If the Town believes there is any evidence that a site subject to ~~disturbance-any sized-development~~ may contain wetlands, either not shown on the plat or with an incorrect boundary, the Town may require the developer to obtain and submit a wetlands delineation survey completed in accordance with Corps of Engineers Wetlands Delineation Manual and all USACE guidelines by an independent third party consultant specializing in wetlands delineations as recognized by the USACE.

If a developer believes that a wetland shown on a plat is incorrect, the developer may obtain a wetlands survey by an independent third party consultant specializing in wetlands delineations as recognized by the USACE in accordance with the Corps of Engineers Wetlands Delineation and submit it to the Town Engineer for review. The wetlands survey shall be conducted during the months of June, July, or August.

Wetland delineations shall be updated after 5 years to reflect current wetland conditions. Wetland boundaries shown on plats and other locations will be considered outdated after 5 years and will require a new wetlands survey delineation completed in accordance with the Corps of Engineers Wetlands Delineation Manual. by an independent third party consultant specializing in wetlands delineations as recognized by the USACE by the developer.

CHAPTER 8 INSPECTION & ACCEPTANCE

TABLE OF CONTENTS

8.1	INTRODUCTION	1
8.2	REFERENCES TO OTHER DOCUMENTS	1
8.3	INSPECTION AND ACCEPTANCE PROCESS	1
8.3.1	Infrastructure Permit	1
8.3.2	Building Permit (without associated infrastructure permit)	2
8.3.3	Right of Way Permit.....	2
8.4	ENGINEERING DIVISION INSPECTIONS	3
8.4.1	Building Permit	3
8.4.1.1	Pre-Pavement/Pre-Landscaping Inspection	3
8.4.1.2	Certificate of Occupancy Inspection	3
8.4.1.3	Stormwater Management Inspection	4
8.4.1.4	Bond Release Inspection.....	4
8.4.2	Right-of-Way Permit	4
8.4.2.1	Utility Inspection.....	4
8.4.2.2	Pre-Pavement Inspection	4
8.4.2.3	Completion Inspection	4
8.4.2.4	Stormwater Management Inspection	4
8.4.2.5	Two Year Bond Re-Inspection.....	4
8.4.3	Infrastructure Permit.....	4
8.4.3.1	Utility Inspection.....	5
8.4.3.2	Pre-Pavement Inspection	5
8.4.3.3	Initial Acceptance Inspection	5
8.4.3.4	Other Inspections.....	5
8.4.3.5	Stormwater Management Inspection	5
8.4.3.6	Final Acceptance Inspection.....	5
8.5	INITIAL ACCEPTANCE	5
8.6	WARRANTY	6
8.7	RECORD DRAWINGS	7
8.8	FINAL ACCEPTANCE	8

LIST OF ATTACHMENTS – APPENDIX F

BUILDING PERMIT INSPECTION FORM

ROW INSPECTION FORM

EXAMPLE ENGINEER'S IMPROVEMENT SUMMARY LETTER

EXAMPLE TESTING FIRM LETTER

8.1 INTRODUCTION

This chapter includes information about the Engineering Division inspection and acceptance procedures and protocols for different types of projects. It also includes information on occupancy requirements and how different types of permits and projects may be closed. This information is intended to apply to activities that occur after initial permits are issued.

8.2 REFERENCES TO OTHER DOCUMENTS

Titles 9 and 10 of the Town Code offer additional information on inspections and acceptance. Chapter 2 of these Standards includes information on the types of permits required by the Town and the submittals required to receive those permits. This chapter only includes the inspection and acceptance procedures of the Engineering Division; permit holders shall reference the Town Code and contact the Community Development Department for additional requirements. Permit holders shall also reference County, State, and Federal regulations for procedures on inspection and acceptance requirements relating to those permits.

8.3 INSPECTION AND ACCEPTANCE PROCESS

The Engineering Division inspection and acceptance process for each type of permit, from permit issuance to final acceptance, is outlined below. Section 8.3.1 to Section 8.3.3 provides an overview of the inspection and acceptance steps for each type of permit; the subsequent sections provide additional detail on the inspections and acceptance steps outlined in Section 8.3. The intent of this section is to provide a summary of steps that must be completed once each permit is issued.

8.3.1 Infrastructure Permit

The infrastructure permit holder shall follow the steps below after receiving an infrastructure permit:

1. Preconstruction Meeting – A preconstruction meeting with the Engineering Division is required prior to beginning construction activities.
2. Begin Construction – Construction activities may begin only after permit holder has obtained all necessary permits, satisfied all requirements of the Breckenridge Town Code and these Standards, and attended a preconstruction meeting with the Engineering Division.
3. Subdivision Improvement Agreement – A Subdivision Improvement Agreement (SIA) will be required if the project requires a subdivision plat and all subdivision improvements are not completed prior to the subdivision plat being recorded. See Title 9 of Town Code for more information on Subdivision Improvement Agreements.
4. Inspections Prior to Initial Acceptance – The Engineering Division shall complete inspections throughout the construction process. See Section 8.4 below for the Engineering inspections required for different permit types.
5. Completion of Work – Permit holders shall notify the Engineering Division once all improvements required by the construction plans and all agreements have been completed.
6. Initial Acceptance Inspection – The Engineering Division shall inspect the improvements for compliance with Standards, plans, specifications, and agreements.
7. Correction of Deficiencies – If the Engineering Division finds any improvements not to be in compliance with the Standards, plans, specifications, or any agreements, the Engineering Division will notify the permit holder who then must correct the deficiencies and notify the Engineering Division when the site is ready for another inspection.

8. Record Drawings – The permit holder shall submit record drawings (also referred to as As-Built Drawings) to the Engineering Division in accordance with the requirements in Section 8.7.
9. Initial Acceptance – After the permit holder satisfactorily corrects deficiencies, submits record drawings and the warranty surety, the Engineering Division shall grant Initial Acceptance.
10. Warranty Period – The warranty period shall last for two years after initial acceptance. The permit holder shall maintain the improvements during this period. Private infrastructure shall not require a warranty period.
11. Final Acceptance – The permit holder shall request a final inspection of improvements no later than 45 days prior to the end of the warranty period. The permit holder shall repair any deficiencies prior to the end of warranty period. Once deficiencies are corrected, the Engineering Division shall grant final acceptance and release the warranty surety.

8.3.2 Building Permit (without associated infrastructure permit)

The building permit holder shall follow the steps below after receiving a building permit when there is no associated infrastructure permit:

1. Begin Construction – Construction activities may begin only after permit holder has obtained all necessary permits and satisfied all requirements of the Breckenridge Town Code and these Standards.
2. Inspections Prior to Certificate of Occupancy – The Engineering Division shall complete inspections throughout the construction process. See Section 8.4 below for the Engineering Division inspections required for different permit types.
3. Certificate of Occupancy – The Certificate of Occupancy inspection shall be requested when all improvements are completed.
4. Completion Guarantee – Permit holders are encouraged to complete all site work prior to October 31st. If the permit holder does not complete all improvements by October 31st, and desires to obtain the certificate of occupancy prior to May 1st, a preliminary Certificate of Occupancy inspection shall be scheduled by the permit holder with Engineering. Engineering will require a financial guarantee (surety) in the form of a letter of credit, bond, or cash deposit shall be submitted to the Engineering Division. The Town Engineer shall determine the financial guarantee amount by either assessing 125% of the remaining work value or assessing a general completion amount of \$5,000 if the scope of the uncompleted work cannot be determined. Once all improvements are complete, the permit holder shall request an a final inspection. The surety will be released once the Engineering Division determines improvements are complete.

Commented [JP1]: Planning does not do anything other than a cash deposit unless Engineering does something separate in the SIAs etc...

Commented [CM2R1]: Agreed

8.3.3 Right of Way Permit

The right-of-way permit holder shall follow the steps below after receiving a right-of-way permit:

1. Begin Construction – Construction activities may begin only after permit holder has obtained all necessary permits and satisfied all requirements of the Breckenridge Town Code and these Standards.
2. Inspections Prior to Initial Acceptance – The Engineering Division shall complete inspections throughout the construction process. See Section 8.4 below for the Engineering Division inspections required for different permit types.
3. Completion Inspection – The completion inspection shall be requested when all improvements are completed.
4. Warranty Period – The warranty period may begin once the completion inspection has been passed.

5. Two Year Bond Re-Inspection - The permit holder shall request a final inspection of improvements no later than 45 days prior to the end of the warranty period. The permit holder shall repair any deficiencies prior to the end of warranty period. Once deficiencies are corrected, the Engineering Division shall grant final acceptance and release the warranty surety.

8.4 ENGINEERING DIVISION INSPECTIONS

Inspections are required at key steps of the construction process to help provide general compliance with plans and specifications. However, inspections completed by the Engineering Division do not provide final assurance of compliance with specifications and do not preclude the Engineering Division from imposing corrective actions in the future. The Engineering Division may require the permit holder to remove, replace, or repair items, or to perform other corrective actions if improvements are ever found to not comply with plans, specifications, or Town Standards.

The permit holder is required to schedule all inspections with the Engineering Division, other than those for stormwater management, at the time indicated for each permit using the contact information on the applicable permit. Failure of the permit holder to schedule inspections at the appropriate time may result in stop work orders, removal and replacement of improvements, fines, or other penalties. The stormwater management inspections shall be scheduled by the Engineering Division. The sections below detail the permits that will require an inspection from the Engineering Division.

8.4.1 Building Permit

A Building Permit may require up to four separate inspections from the Engineering Division, as detailed in this section. Inspections from the Community Development Department will also be required. The Community Development Department shall be contacted to confirm the required inspections. Inspections for building permits are encouraged to be completed between May 1 and November 1. If a final inspection is required outside these dates, a ~~completion bond~~ cash deposit (surety) may be required. Building permit inspections shall be scheduled through the contact information provided on the building permit form. Permit holders may request additional inspections at critical steps during construction if needed.

8.4.1.1 Pre-Pavement/Pre-Landscaping Inspection

The building permit holder shall schedule a pre-pavement/pre-landscaping inspection with the Engineering Division prior to placement of pavement, final topsoil, seeding, and landscaping. Inspection shall generally include the items shown on the inspection form included in Appendix H.

Commented [AG3]: Add drywell/ foundation drain?

8.4.1.2 Preliminary Certificate of Occupancy Inspection

The preliminary Certificate of Occupancy inspection only applies to projects completed between November 1st and April 31st of each year. If site work cannot be completed by November 1st, the permit holder shall schedule a preliminary inspection prior to November 1st. Any incomplete work shall require a financial guarantee per Section 8.3.2.

8.4.1.2.3 Certificate of Occupancy Inspection

The building permit holder shall schedule a certificate of occupancy inspection with the Engineering Division after completion of all grading, pavement, landscaping, site stabilization, and all other site work. Inspection shall generally include the items shown on the inspection form included in Appendix H.

8.4.1.34 Stormwater Management Inspection

The Engineering Division will conduct stormwater management inspections of sites to ensure that stormwater controls have been installed per the approved plans and are functioning adequately. Inspections will be scheduled periodically throughout construction and may occur without notice.

8.4.1.45 Bond Release Inspection

If there is completion bond for the project, the building permit holder will schedule a bond release inspection with the Engineering Division for any work completed after the issuance of the certificate of occupancy.

Commented [JP4]: Surety?

8.4.2 Right-of-Way Permit

A Right-of-Way Permit may require up to four separate inspections from the Engineering Division. No work in the right-of-way or right-of-way inspections shall occur between November 1 and May 1. The types of inspections from the Engineering Division that may be required for a right-of-way permit are detailed in the sections below. Right-of-way permit inspections shall be scheduled through the contact information provided on the permit form.

8.4.2.1 Utility Inspection

The Engineering Division will determine utility inspection requirements prior to start of the project. Utility inspections may be required prior to backfill of utilities to ensure utilities are constructed in accordance with the appropriate construction specifications. Major features shall be inspected prior to utility backfill. The right-of-way permit holder shall call to schedule an inspection at least 48 hours prior to the utility being backfilled.

8.4.2.2 Pre-Pavement Inspection

The right-of-way permit holder shall call to schedule a pre-pavement inspection at least 48 hours prior to the placement of concrete, asphalt, or other types of pavement. Inspection items shall include grading, subgrade, and concrete forms for sidewalks, curbs, curb ramps, and driveway curb cuts.

Commented [AG5]: This is in there twice

8.4.2.3 Completion Inspection

The right-of-way permit holder shall call to schedule a completion inspection after completion of all improvements, pavement, site stabilization, and restoration. Inspection shall generally include the items shown on the inspection form. Once the site passes the completion inspection, the 2-year bond and warranty period process can be initiated.

Commented [CM6R5]: This is for ROW permits and then one above is for SFH

8.4.2.4 Stormwater Management Inspection

The Engineering Division will conduct stormwater management inspections of sites to ensure that stormwater controls have been installed per the approved plans and are functioning adequately. Inspections will be scheduled periodically throughout construction and may occur without notice.

8.4.2.5 Two Year Bond Re-Inspection

The Engineering Division will schedule an inspection of all improvements one month before the end of the two-year warranty bond period. If defects are found in any of the improvements, the right-of-way permit holder shall be notified, and defects shall be repaired by the permit holder.

8.4.3 Infrastructure Permit

The types of inspections that may be required for an infrastructure permit are detailed below.

8.4.3.1 Utility Inspection

The Engineering Division will determine utility inspection requirements prior to start of the project. Utility inspections may be required prior to backfill of utilities to ensure utilities are constructed in accordance with the appropriate construction specifications. If an inspection is required prior to utility backfill, the right-of-way permit holder shall call to schedule an inspection at least 48 hours prior to the utility being backfilled.

8.4.3.2 Pre-Pavement Inspection

The infrastructure permit holder shall call to schedule a pre-pavement inspection at least 48 hours prior to the placement of concrete, asphalt, or other types of pavement. Inspection items shall include grading, subgrade, and concrete forms for sidewalks, curbs, curb ramps, and driveway curb cuts.

8.4.3.3 Initial Acceptance Inspection

The infrastructure permit holder shall call to schedule an initial acceptance inspection after all improvements, pavement, site stabilization, and restoration are complete. Inspection shall include all infrastructure, public improvements to be conveyed to the Town, private improvements, utilities, detention and permanent stormwater quality features, and all other site work. Once the site passes the initial acceptance inspection, the 2-year bond and warranty period process can be initiated. The initial acceptance process is discussed in more detail in Section 8.5.

8.4.3.4 Other Inspections

The Engineering Division will determine if additional inspections are necessary during the pre-construction meeting and will establish those with the developer. The Engineering Division also may require additional inspections throughout the project duration. These may include structural concrete, structural steel, reinforcing steel, and backfill compaction inspections.

8.4.3.5 Stormwater Management Inspection

The Engineering Division will conduct stormwater management inspections of sites to monitor that stormwater controls have been installed per the approved plans and functioning adequately. Inspections will be scheduled by the Engineering Division periodically throughout construction and may also occur without notice.

8.4.3.6 Final Acceptance Inspection

The Engineering Division will schedule an inspection of all improvements at the end of the two-year warranty bond period. If defects are found in any of the improvements, the infrastructure permit holder shall be notified, and defects shall be repaired by the permit holder.

8.5 INITIAL ACCEPTANCE

For all projects that are issued an infrastructure permit, initial acceptance generally indicates that the project has been completed to the satisfaction of the Engineering Division and that the 2-year bond (surety) process (warranty period) can be initiated. Initial acceptance requires the following at a minimum:

1. Construction Plans – Plans shall be submitted for approval clearly identifying public improvements to be conveyed to Town.
2. Preconstruction Meeting – A pre-construction meeting between an Engineering Division representative, the Project Engineer, developer, and contractor shall be held prior to the start

of construction. The meeting shall confirm the scope of work, inspection requirements, and testing requirements for the project.

3. Initial Acceptance Submittals:

- a. Material testing reports & testing firm letter – Material testing shall be completed in accordance with the Town specifications. An example testing firm letter is included as an attachment to Appendix H and shall be signed and stamped by a Colorado Professional Engineer to certify that all test procedures were in conformance with the approved plans and specifications.
- b. Inspection & construction observation reports – Inspection and construction observation required to be performed by the Project Engineer shall be established during the pre-construction meeting. Reports shall be certified by the Project Engineer and shall certify that construction was in conformance with approved plans and specifications.
- c. Engineering Record Drawings – Prior to issuance of initial acceptance, record drawings shall be submitted to the Engineering Division that meet the requirements of Section 8.7.
- d. As-built survey of detention and water quality facilities and certification by a professional engineer licensed in the state of Colorado certifying the facility meets the detention and water quality requirements.
- e. As-built survey of main features of underground utilities. Examples include utility surface locates, manholes, valves, inlets, hydrants, junction boxes, and other exposed features. Survey of underground facilities prior to backfill may be required at critical locations. The surveyed features shall be drawn electronically and submitted in DWG and PDF formats.
- f. Other documentation – Additional documentation, as required by Town Engineer, shall be submitted to the Engineering Division prior to initial acceptance.

4. Initial Acceptance Request – An initial acceptance request shall be submitted in writing to request an initial acceptance inspection after all initial acceptance submittals have been submitted. An improvements summary letter shall be submitted with the initial acceptance request. An example improvements summary letter is included as an attachment to Appendix H. The initial acceptance request shall only be submitted if the work has been fully completed in accordance with the approved plans and specifications. All work and known punch list items must be complete prior to submitting the request.

- a. Work Acceptable. If the work has been completed satisfactorily for initial acceptance, the Town Engineer will issue a written notice of initial acceptance to the permit holder.
- b. Work not Acceptable. If the work has not been completed satisfactorily, the Town Engineer will provide the permit holder with a punch list of items to be completed. Once the punch list items are completed, the permit holder may request a subsequent inspection.

5. Warranty Surety – If the permit holder fails to complete punch list items satisfactorily within 30 days, the Town may utilize the warranty surety to complete improvements. The Town may also withhold additional permits or certificates of occupancy.

8.6 WARRANTY

For permits requiring a warranty, the permit holder shall warrant that all public improvements shall remain free from defects for a period of two years from the date the Town issues initial acceptance of the improvements. This period may be referred to as the two-year warranty period, warranty period, the two-year bond period, or initial acceptance period. During the two-year warranty period, any defect determined to exist with respect to such improvements shall be repaired or the improvement replaced at the sole cost of the permit holder.

The permit holder shall be required to file a warranty surety in the form of a warranty bond, cash bond, or irrevocable letter of credit with the Town in a form acceptable to the Town Attorney, prior to initial acceptance of any public improvements, in an amount equal to 25% of the original cost of the public improvements, in order to assure the satisfactory maintenance of the improvements for a period of two years after the date of initial acceptance by the Town. Such bond shall guarantee all public improvements constructed by the permit holder remain free from defect for the required two-year period.

If initial acceptance is reached prior to obtaining final site stabilization (70% revegetation), the permit holder shall be responsible for maintenance of all temporary and permanent stormwater quality features until final stabilization of the site is achieved. This shall include sweeping of street and sidewalks, and maintenance of detention ponds, water quality features, and storm sewer infrastructure. The permit holder shall be responsible for the maintenance of trees, shrubs, and other landscaping features during the two year warranty period.

8.7 RECORD DRAWINGS

Record drawings, also called as-built drawings, are to be submitted to and accepted by the Town Engineer prior to final acceptance of any public improvements. As-built drawings shall be produced under the direction of and stamped by a Colorado registered professional engineer to assure compliance with original design drawings. Certification shall be presented along with the as-built drawings stating such compliance.

One set of as-built drawings shall be submitted to the Engineering Division within 30 days of completion of construction (initial acceptance). Drawings shall be submitted electronically in DWG and PDF format so that they will print to scale on 11" x 17" paper. Each drawing sheet shall include a title block, scale, north arrow, original and revision dates, and professional engineer's stamp when applicable. Title blocks shall be along the bottom or right margin of each drawing. Survey control and project benchmarks including datum shall be included.

Manufacturer's literature and product data, including catalog sheets, descriptive literature, product warranties, and any O&M manuals, for all materials and equipment used, shall be provided with as-built drawings.

The construction plans shall be updated with all design changes that occurred after issuance of infrastructure permit. Record drawings shall also identify actual constructed locations and dimensions of street improvements, signage, striping, street lights, swales, WQ/detention ponds, inlets, stormwater improvements, and other infrastructure. For detention and water quality facilities, record drawings shall identify the as-built locations of all inlets and outlets, the as-built grading of the site for all ponds, and as-built details of the outlet structure including the sizes and elevations of all orifices and weirs that may convey water out of the facility. Record drawings shall also document locations and elevations of underground utilities. Record drawings shall identify any other conditions that vary from the approved plans and specifications, or any other information requested by the Town Engineer.

Detention and water quality facilities shall be surveyed, added to the record drawings, and stamped by the engineer certifying the facilities are in compliance with the design.

Underground utilities shall be surveyed and added to the record drawings submitted by surveying surface utility locates, manholes, valves, inlets, hydrants, junction boxes, and other exposed features. Survey of underground facilities prior to backfill may be required at critical locations.

8.8 FINAL ACCEPTANCE

Final acceptance requires the following at a minimum:

1. Final Acceptance Inspection Request – The permit holder shall request a final acceptance inspection in writing within 45 days of the expiration of the warranty period.
2. Final Acceptance Inspection and Punch List – The Engineering Division shall inspect all public improvements for the project and shall compile a written final punch list of items requiring repair or replacement and any defective or unsatisfactory conditions resulting from materials or workmanship that are defective, inferior, or not in accordance with project plans and specifications.
3. Re-Inspection – If repair or replacement of public infrastructure is required, the permit holder shall complete such repair or replacement within 30 calendar days. Once completed, the permit holder shall contact the Engineering Division for re-inspection.
4. Notice of Final Acceptance – Once all punch list items are completed to the satisfaction of the Engineering Division, and after the record drawings have been submitted and accepted by the Town Engineer, the Town Engineer shall issue a written notice of final acceptance of improvements and shall release warranty surety.
5. Warranty Surety – If the permit holder fails to complete the punch list items satisfactorily within 30 calendar days, the Engineering Division may utilize the warranty surety to complete the punch list items. The Engineering Division may also withhold additional permit approval or certificates of occupancy.

CHAPTER 9 CONSTRUCTION SPECIFICATIONS

TABLE OF CONTENTS

9.1	PURPOSE	1
9.2	TOWN CONSTRUCTION SPECIFICATIONS.....	1
9.3	REVISIONS AND REPLACEMENTS OF CONSTRUCTION SPECIFICATIONS	1
9.4	TOWN STANDARD DETAILS	2

LIST OF TABLES

Table 9.1.	Town Construction Specifications by Type of Construction	1
Table 9.2.	Town Standard Details.....	2

LIST OF ATTACHMENTS – APPENDIX G

TOWN STANDARD DETAILS

LIST OF ATTACHMENTS – APPENDIX H

TOWN REVISIONS AND REPLACEMENTS OF ROAD AND BRIDGE CONSTRUCTION
STANDARDS

9.1 PURPOSE

This chapter of the Engineering Standards establishes the construction specifications that shall be used within the Town for various categories of construction. These specifications shall be used for all public projects in the Town, as well as all private projects constructing public infrastructure to be owned by the Town. Construction specifications are not design standards. Construction specifications, also known as construction standards, include items such as materials requirements, construction procedures and tolerances, and required testing and performance metrics. ~~The Town expects to update this chapter and the attachments over time as the unique goals and values of the Town and local physical conditions dictate.~~ Project special specifications may be submitted by the developer for unique or project-specific conditions. The Town Engineer may also require additional specifications for different projects.

9.2 TOWN CONSTRUCTION SPECIFICATIONS

The most recent edition of the documents included in Table 9.1 are hereby adopted by reference as the Town of Breckenridge Construction Specifications, except as specifically amended by the provisions of this chapter, for the types of construction shown in Table 9.1.

Where the Town of Breckenridge Construction Specifications in Table 9.1 do not include a specification required for the type of construction listed, the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction shall apply.

The documents in Table 9.1 shall apply unless they are superseded by revisions or replacements the Town develops included herein. The most recent revision of each document listed in Table 9.1 shall be used. Each user of these Engineering Standards is encouraged to review this chapter frequently as it may be updated regularly.

Where two different construction specifications overlap or conflict, the more stringent specification shall apply. Consult with the engineering division for any conflicts or inconsistencies between different specifications.

Table 9.1. Town Construction Specifications by Type of Construction

Type of Construction	Town Construction Specifications
Water Line	Town of Breckenridge Water Construction Standards
Sanitary Sewer	Upper Blue Sanitation District Construction Standards
Open Channels	Mile High Flood District (MHFD) Construction Specifications (Division 3 – 33)
Vegetation	Mile High Flood District (MHFD) Construction Specifications (Division 3 – 33) Appendix H of these Standards (Seed Mixes)
Residential Building	Title 8 of Town Code
Commercial Building	Title 8 of Town Code
Industrial Facility	Title 8 of Town Code
Streets	CDOT Standard Specifications for Road and Bridge Construction

9.3 REVISIONS AND REPLACEMENTS OF CONSTRUCTION SPECIFICATIONS

To reflect the Town's unique goals and values or address local physical conditions, the Town may choose to amend, revise, or replace some or all of any of the Town Construction Specifications included in Table 9.1 per the sections below.

9.3.1 Town of Breckenridge Water Construction Standards

Retain all sections.

9.3.2 Upper Blue Sanitation District Construction Standards

Retain all sections.

9.3.3 MHFD Construction Specifications (Divisions 3 – 33)

Retain all sections.

9.3.4 Title 8 of Town Code

Retain all sections.

9.3.5 CDOT Standard Specification for Road and Bridge Construction

Revisions and replacements of the CDOT Standard Specification for Road and Bridge Construction are included in Appendix [H](#).

9.4 TOWN STANDARD DETAILS

The Town uses the standard construction details listed in Table 9.3. It is anticipated this list will be updated as new standard details are developed. The Town's standard details are included as attachments to this chapter.

Table 9.3. Town Standard Details

Detail	Title	Number of Pages
Drawing 1	Transit Turnouts	1
Drawing 2	Cul-De-Sac	1
Drawing 3	Driveway Details	3
Drawing 4	Curb, Gutter, Sidewalk, and Pavement Details	5
Drawing 5	Curb Ramp Details	26
Drawing 6	Asphalt Details	2
Drawing 7	Utility Trench Details	3
Drawing 8	Lighting Details	7
Drawing 9	Typical Roadway Sections	4

CHECKLIST 7

BUILDING PERMIT (WITHOUT INFRASTRUCTURE PERMIT) REQUIREMENTS

This is the checklist of items to be submitted to the Engineering Division for building permit applications without an associated infrastructure permit. Refer to the Town Code for other Town Division submittal requirements.

All applicable items shall be included with the submittal. The table below may not contain all information necessary for a project, and the Town Engineer may require additional information. Any items not applicable shall be specified and justified in the comments section at the bottom of the checklist.

Building permit applications shall be obtained and submitted through the Town of Breckenridge Building Department. Town of Breckenridge Community Development Department and Building Department shall be contacted for a list of their submittal requirements.

For questions about these requirements or to schedule a meeting, please email the Town of Breckenridge Engineering Division at engineeringinspection@townofbreckenridge.com

Project Name: _____

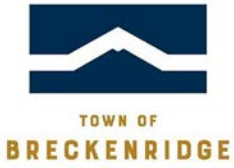
Project Address: _____

Submittal (circle one): Preliminary Final

Provided	Not Applicable	Plan Items	Office use
		General Formatting (all plan sheets)	
		Project title in which project is to be filed	
		Date of drawing preparation & revisions	
		North arrow & drawing scale	
		Site Plan	
		<i>Plat Compliance</i>	
		Legal description of property & physical street address. Legal description may be found through the Summit County online GIS parcel query tool	
		Existing & proposed property lines	
		Existing & proposed right-of-way & dimensions	
		Existing & proposed easements & dimensions	
		Temporary & permanent survey monuments	
		Building footprint (show foundations & roof eaves), envelope, & building setbacks	
		<i>Utilities</i>	
		Existing & Proposed Utilities. Show existing & proposed location of all utilities & connections including all boxes, poles, structures, & utility alignments for electric, gas, cable, telephone, fiber, sewer, & water. Utility structures shall be in easements	
		<i>Wetlands, Floodplains, & other Hazard Areas</i>	

Provided	Not Applicable	Plan Items	Office use
		Wetland boundaries & 25' wetland setback boundaries	
		100-year floodplain & other flood hazard area boundaries	
		25' setback boundaries from top of stream banks, lakes, & other water bodies	
		Protective Management Area (PMA) limits & other special protective or hazard areas	
		Identification of areas with slope stability concerns	
		Identification of areas with geotechnical, environmental, archaeological, or historical significance	
		Identification of any hazardous concerns	
		<i>Grading & Drainage</i>	
		Existing topography (1-foot contours) prepared by a registered surveyor	
		Proposed Topography (1-foot contours showing finished grade)	
		Maximum 2:1 slope allowed on all finished grading (3:1 preferred)	
		Retaining wall heights & locations (retaining walls > 4 feet in height require design by Colorado licensed Professional Engineer)	
		Culvert locations, material, & dimensions. (18" minimum diameter & 1% minimum slope for culverts in ROW)	
		Foundation drain locations & daylight	
		Drywell location (10' minimum from building) and detail . See drywell fact sheet in Chapter 6 for additional requirements & guidance.	
		Proposed outfall locations of developed drainage, drainage arrows, & swale locations	
		Positive drainage shown around building	
		Detention & permanent water quality features shown (if required)	
		CDPHE Stormwater Discharge Permit (for projects resulting in at least one acre of disturbance)	
		<i>Driveway & Parking</i>	
		Maximum 8% grade at any point along centerline of driveway alignment	
		Maximum 4% grade for first 20' from roadway intersection	
		Match cross slope of roadway for first 5' of driveway from roadway intersection	
		Driveways dimensions meet requirements of Chapter 5 (12' min width & 20' max width for SFH)	
		Sidewalk driveway cut meets Town standard detail	
		Driveway intersections roadway at 90 degrees	
		Driveway surface & section dimensions shown	
		One driveway access allowed (no duplicate or circular driveway cuts)	
		Minimum driveway separation met from neighboring driveway (30' min for SFH)	

Provided	Not Applicable	Plan Items	Office use
		Snow storage areas shown (see Town Code for snow storage requirements)	
		Parking spaces & vehicle turnaround areas shown (see Town Code for parking requirements). Vehicles able to turnaround/back out of garage	
		Minimum Sight Distance for driveway access (200' min)	
		Easement submitted for shared driveway access with neighboring property	
		<i>Landscaping</i>	
		Landscaping plan shall be submitted in accordance with requirements in Town Code	
		Landscaping in snow storage easements shall not obstruct ability to stack snow	
		Landscaping not located in ROW	
		Landscaping located in easements meets requirements of Chapter 3	
		<i>ROW</i>	
		No retaining walls, boulders, stone headwalls, or small rock located in ROW	
		No address monuments or mail boxes in ROW	
		Snowmelt system in or near ROW meets requirements of Chapter 5	
		No fences, private lighting, trees, landscaping, signage, or any other structures shown in ROW without Engineering approval & encroachment license submitted	
		<i>Other</i>	
		Existing & proposed sidewalks, trails, street lights, signage, & any other structures or significant features shown on plans	
		Construction details as required for construction of improvements	
		Construction Management Plan	
		Construction Stormwater Management (wattles, silt fence, tracking pads, etc.)	
		Construction Stormwater BMP Details (wattles, silt fence, etc.)	
		Revegetation notes or other final stabilization plans	
		Construction fencing location	
		Material & equipment staging locations	
		Dumpster & portalet locations	
		Vehicle parking locations & construction access location	
		Other Submittals	
		Soils report & other site reports	
		Floodplain Development Permit	
		Encroachment License Agreement (required for any permanent improvements proposed within Town ROW)	



Application ID Number: _____

TOWN OF BRECKENRIDGE INFRASTRUCTURE PERMIT APPLICATION

This application form shall be filled out and submitted to the Engineering Division before an Infrastructure Permit will be issued.

Project Name: _____ Development Permit #: _____

Property Owner: _____

Applicant/Agent (If different than Owner): _____

Mailing Address: _____ Phone Number: _____

Email Address: _____

Street Address of Property: _____

Legal Description of Property: _____

Project Description:

Approximate area of disturbance: _____

Will there be development or grading in a floodplain? Yes___ No___

Will there be work within a Town Right-of-Way? Yes___ No___

Will there be work within CDOT Right-of-Way? Yes___ No___

Will there be wetlands disturbance? Yes___ No___

Will there be utility work? If yes, describe utility types, approximate lengths, and if there is a planned connection to the Town of Breckenridge water or storm sewer system:

Is stormwater detention required? Yes___ No___

Is permanent water quality required? Yes___ No___

Anticipated construction start date: _____

Is preconstruction meeting scheduled with the Engineering Division? Yes___ No___

Anticipated length of construction: _____

The applicable items in the table below must be included with the Infrastructure Permit application. Failure to do so will result in denial of the Infrastructure Permit and a requirement to resubmit. Any items not applicable to the project shall be noted and justified below. Additional details on the requirements of the Infrastructure Permit are in Chapter 2.

Provided	Not Applicable	Infrastructure Permit Items	Office use
		Infrastructure Permit application form	
		Completed a Applicable checklists 1 – 6 for various submittals	
		Final civil construction drawings	
		Technical specifications	
		Final Drainage Report	
		Final Traffic Impact Study	
		Method of Handling Traffic (MHT) or Traffic Control Plan (TCP)	
		Stormwater Management Plan (SWMP) and/or CSMP	
		Development Permit	
		Building Permit	
		Right-of-Way Permit	
		Floodplain Development Permit	
		CDPHE Stormwater Construction Permit	
		ACOE, CDOT, Summit County, or other permits as applicable	
		Subsurface Utility Engineering documentation	
		Permanent Survey Monumentation documentation	

Application ID Number: _____

List of submittal items not applicable to project and justification for non-applicability:

The undersigned certifies that the information provided is correct and that this application does not authorize work until an infrastructure permit is granted. The undersigned further certifies that s/he will comply with all inspections and acceptance procedures in the Town's Engineering Standards:

Applicant Signature: _____ Date: _____

Permit Status: Granted _____ Denied _____

Reason for denial: _____

Staff Signature: _____ Title: _____

Printed Name: _____ Date: _____

FACT SHEET

SUBSURFACE INFILTRATION FACILITIES

1.0 Definition

This fact sheet provides design standards for drywells, infiltration trenches, infiltration galleries, and other subsurface infiltration structures used for permanent stormwater treatment facilities in areas with natural high infiltration rates. These types of subgrade infiltration facilities will collectively be known as drywells by this document. Drywells provide either stormwater quality treatment or stormwater detention by collecting surface stormwater runoff, temporarily storing it underground, and then discharging it primarily through infiltration into the surrounding soils. Drywells vary in form and include underground concrete structures, trenches or other excavations filled with granular material.

2.0 Purpose

The purpose of drywells is to provide stormwater quality treatment or stormwater detention through temporary subsurface storage and subsequent infiltration into surrounding soils. Drywells are typically selected for single family homes, small or constrained sites, and steep sites. On sites where space and topography permits, above ground detention and water quality facilities are preferred over drywells for ease of inspection and maintenance.

3.0 Drywell Advantages

1. Utilize the typically highly permeable soils in Breckenridge to provide groundwater recharge
2. Meet the stormwater detention and permanent water quality requirements of Chapter 6
3. Filter contaminants through filtration
4. Utilize site area efficiently
5. Provide environmental benefits by augmenting low flows in streams and reducing the thermal impacts of above ground detention facilities

4.0 Drywell Disadvantages

1. Susceptible to clogging and reduced infiltration rates
2. Difficult to inspect and maintain, increasing the potential for clogging or reduced performance
3. Risk being neglected because they are not readily visible, reducing maintenance frequency
4. Create potential for groundwater contamination issues
5. Require pretreatment to reduce high sediment loads quickly reducing infiltration capacity

5.0 Site Suitability

Drywells are not suitable for all sites where they may have negative impacts to other structures and properties. Drywells will not meet the requirements of Chapter 6 or function adequately for their full life cycle unless the site and the drywell meet certain requirements. Drywells and sites must meet the following criteria to be allowable as detention or stormwater treatment facilities:

1. Area draining to the drywell must be less than one acre.
2. A pretreatment facility is required upstream of the drywell.
3. Existing soils must be hydrological group A or B and infiltration must be at least 1 inch per hour as tested at the proposed elevation of the bottom of the drywell.

4. Drywells must be located at least 10 feet from building foundations or other structures, at least 10 feet from water lines and at least 100 feet from water source wells.
5. Drywells must be located at least 300 feet from an active waterway.
6. Drywells must be located a sufficient distance (at least 25 feet) from wetlands and other sensitive areas to prevent harmful effects.
7. Runoff draining to the drywell must not be contaminated with pollutants other than sediment. Runoff exposed to other pollutants such as oils, fuels, detergents, industrial or agricultural chemicals, etc. may not drain to a drywell.
8. Bottom of drywell shall be at least 3 feet above the seasonally high groundwater as measured by a geotechnical investigation.

6.0 Design

The following design guidelines are typical standards required for drywell design. Special site conditions may lead to additional requirements as determined by the Town Engineer. Each drywell design, ~~except those used for an individual single family home site,~~ shall be designed and stamped by a Colorado Licensed Professional Engineer. ~~Drywells for an individual single family home, which primarily receive runoff from foundation and roof drains, are exempted from several of the requirements below.~~ Drywells serving multiple single family homes are not exempt from the requirements.

7.0 Infiltration Test

Testing shall be conducted by a geotechnical engineer on the site to determine infiltration rates and soil types at the location and depth of the proposed drywells. Infiltration tests shall be conducted at a minimum of every 75 feet for infiltration trenches. The lowest infiltration rate shall be used for design. Drywells for single family home sites may be exempt from an infiltration test; however, soils shall be analyzed from soils reports and other sources to evaluate their suitability to infiltrate runoff. Single family homes may be exempted from the infiltration test requirement if the drywell only receives water from roof drainage and foundation drains.

8.0 Pretreatment

Drywells cannot receive stormwater that has not been pretreated, unless the only source of the stormwater is roof runoff and/or foundation drainage. Pretreatment is required to allow coarse sediment and trash to settle out and prevent premature clogging and failure of drywell. Examples of pretreatment include forebays, concrete manholes with BMP snout and bioskirt, sediment basins, and vegetated buffer strips. Single family home sites are exempt from pretreatment. Single family homes are exempted from the pretreatment requirement if the drywell only receives water from roof drainage and foundation drains.

9.0 Depth and Location

Drywells shall be located at least 10 feet from building foundations and 100 feet from water wells. The bottom of each drywell shall be at least 9 feet below the surface or extend to clean cobble rock without fines (minimum rock size greater than 2 inches in diameter) -to prevent freezing during winter.

10.0 Design Details

Drywells designs vary widely and include concrete manholes without a bottom and drain holes in the walls, excavated pits backfilled with clean rock, linear trenches backfilled with clean rock, and



underground perforated pipes surrounded by a clean aggregate layer. [An engineered drywell detail shall be designed and submitted for all installations, including single family homes.](#) Below is a list of design considerations for various drywells:

1. Drywells in areas receiving vehicular traffic shall be HS-20 rated.
2. Drywell manholes shall have 24-inch inlet grates. If grates are located near a roadway or pedestrian area, the grate shall meet AASHTO bicycle and ADA guidelines.
3. Drywell manholes shall be backfilled outside the structure with 1.5-inch to 3-inch crushed and washed stone with a minimum of 40% porosity for a minimum distance of 18 inches.
4. Drywell manholes shall contain perforations with a 1-inch minimum diameter and shall not have a bottom.
5. Trenches shall be backfilled with 1.5-inch to 3-inch crushed and washed stone with a minimum of 40% porosity.
6. Trenches may have filter fabric installed 12 inches below surface to assist with maintenance.
7. Filter fabric shall not be installed at the bottom of drywells.
8. A 6-inch to 12-inch sand layer shall be installed under the bottom of drywells if infiltration rates exceed 4 inches per hour or if the drywell is installed near a sensitive area, such as wetlands, the Blue River, perennial streams, or Cucumber Gulch PMA.
9. Overflow outlets are required to convey flows that exceed the capacity of the drywell. Overflow outlets shall convey runoff to a swale or storm sewer and shall be designed to prevent erosion and damage to neighboring properties.

11.0 Volume

The appropriate WQCV or detention volume shall be calculated using the guidance in Chapter 6. A factory of safety of 1.5 shall be applied to the calculated volume to account for clogging and reductions in the infiltration rate. Drywells shall be designed to infiltrate the entire design volume within 72 hours.

12.0 Maintenance

An Operations and Maintenance Plan (O&M Plan) shall be submitted that meets the requirements of Chapter 6. Minimum requirements include:

- Drywells shall not be placed in service until construction is complete and revegetation of the site is established.
- Drywells shall be inspected and maintained annually for sediment and debris.
- Drywells shall be inspected after storms exceeding 1 inch to ensure it is functioning properly and that no water is ponding above the drywell.
- Pretreatment facilities shall be inspected twice annually and sediment and debris shall be removed.
- If a drywell clogs or fails, complete rehabilitation is required to restore storage capacity and infiltration rates.

TOWN OF BRECKENRIDGE, COLORADO
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION
ROAD AND BRIDGE CONSTRUCTION SPECIFICATIONS

GENERAL STATEMENT

Sections 100 through 717 of the Standard Specifications for Road and Bridge Construction, 2022 edition, or most recent version, published by the Colorado Department of Transportation (CDOT), State of Colorado, supplemented or amended by the State and by these specifications, shall govern all road and bridge construction work within Town jurisdiction or ownership. In cases of conflict between the CDOT specifications and other specifications, the supplements and amendments listed below or in the project Special Provisions shall govern. The Special Provisions (if any) contained in the Bid Documents shall have precedence over all other specifications.

When a reference is made to ASTM, AWWA, AASHTO, or other specifications or methods, it shall be understood to mean the latest edition or revision of said specification as amended and issued at the time of the Invitation to Bid.

The Method of Measurement and Basis of Payment for the items of work specified herein and in the CDOT specifications apply only to Town of Breckenridge projects and are not required to be used on projects which are administered and paid for by private developers or other agencies. References to the Town of Breckenridge General Conditions apply only to Town of Breckenridge projects are not required to be used on private development projects.

The Method of Measurement and Basis of Payment will be based on CDOT specification except where modified in these Documents.

The current CDOT Standard Specifications for Road and Bridge Construction can be accessed here:

<https://www.codot.gov/business/designsupport/cdot-construction-specifications/2022-construction-specifications/2022-specs-book/2022-standard-specifications-book>

STANDARD SPECIAL PROVISIONS

All CDOT Standard Special Provisions published at the time of construction commencement shall apply and be included as part of these specifications.

PROJECT SPECIAL PROVISIONS

The following Project Special Provisions apply to this project and shall take precedence over specifications or plans and supplement or amend the CDOT Standard Specifications and the Town modifications listed below:

DIVISION 100

GENERAL PROVISIONS

SECTION 101: DEFINITION AND TERMS

Retain Section 101 and add the following:

Where Department, Department of Transportation, CDOT or any other reference to the Colorado Department of Transportation is used within these Specifications, replace with "Town". Any reference to CDOT engineer, personnel, or form shall be replaced with the appropriate Town engineer, personnel, or form. Town Engineer refers to the Town of Breckenridge Town Engineer or Town Engineering Representative selected by the Town Engineer. Where these Specifications reference Section 100, replace with "Town of Breckenridge General Contract Conditions."

101.01 Abbreviations. Add the following abbreviations:

CAPA	Colorado Asphalt Pavement Association
HMA	Hot Mix Asphalt
SSFRB	Town of Breckenridge Standard Specifications for Road and Bridge Construction (latest edition)
TEDS	Transportation Engineering Design Standards (latest edition)
QAT	Quality Assurance Technician

101.02 Definitions, alphabetically

ADD or REVISE Definitions as Follows:

Award. REPLACE "Department" WITH "Town".

Bidder. In the CDOT definition REPLACE "Department" WITH "Town".

CDOT Resident Engineer. DELETE in its entirety and REPLACE WITH: "Town Engineer".

Contract. DELETE in its entirety. See definition in the *Town General Contract Conditions*.

Contract Modification Order. DELETE in its entirety. See "change order" definition in the *Town General Contract Conditions*.

Contract Time. DELETE in its entirety. See definition in the *Town General Contract Conditions*.

Contractor. DELETE in its entirety. See definition in the *Town General Contract Conditions*.

Department. REVISE to read: "Department of Public Works, Town of Breckenridge, Colorado."

Engineer. DELETE in its entirety and REPLACE WITH "The Project Engineer, who may be a Town employee or hired consultant who has been appointed or authorized by the Town to oversee the technical aspects of the work and to administer the Contract on behalf of the Town. The term "Engineer" may also apply to a Professional Engineer hired by a developer to design and/or administer the construction of public infrastructure in accordance with a development approved by or contracted for/or with the Town."

Force Account Work. REVISE to read: "Work paid for on the basis of actual costs plus approved additives, in accordance with the General Contract Conditions."

Laboratory. REVISE to read: "Any testing laboratory designated by the Engineer."

Planned Force Account. DELETE in its entirety.

Plans. REPLACE "Department" WITH "Town".

Pre-construction Conference. DELETE in its entirety. See definition in the *Town General Contract Conditions*.

Project. DELETE in its entirety. See definition in the *Town General Contract Conditions*.

Project Engineer. REPLACE "Chief Engineer's" WITH "Town's". REPLACE "CDOT" WITH "Town".
REPLACE "Resident" with "Town."

Proposal Form. REVISE to read: "The documents furnished by the Town on which the offer of a bidder is submitted. Also called Bid Proposal or Bid Form."

Proposal Guaranty. REVISE to read: "Bid guaranty as defined in the *Town General Contract Conditions*."

Region Transportation Director. DELETE in its entirety.

Shop Drawings. DELETE in its entirety. See definition in the *Town General Contract Conditions*.

Specifications. DELETE in its entirety. See definition in the *Town General Contract Conditions*.

State. DELETE and replace with Town of Breckenridge acting through its authorized representative.

Supplemental Specifications. DELETE in its entirety. See definition of Supplementary Conditions in the *Town General Contract Conditions*.

TOWN. Town of Breckenridge, Colorado.

Work. DELETE in its entirety. See definition in the *Town General Contract Conditions*.

Workplace Violence. REPLACE "CDOT" WITH "Town".

SECTION 102: BIDDING REQUIREMENTS AND CONDITIONS

Retain Section 102.03

DELETE and REPLACE remainder of Section 102 with the Town of Breckenridge, General Contract Conditions.

SECTION 103: AWARD AND EXECUTION OF CONTRACT

DELETE and REPLACE with the Town of Breckenridge, General Contract Conditions.

SECTION 104: SCOPE OF WORK

DELETE and REPLACE with the Town of Breckenridge, General Contract Conditions.

SECTION 105: CONTROL OF WORK

DELETE and REPLACE with the Town of Breckenridge, General Contract Conditions.

SECTION 106: CONTROL OF MATERIAL

DELETE and REPLACE with the Town of Breckenridge, General Contract Conditions.

SECTION 107: LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

DELETE and REPLACE with the Town of Breckenridge, General Contract Conditions.

SECTION 108: PROSECUTION AND PROGRESS

DELETE and REPLACE with the Town of Breckenridge, General Contract Conditions.

SECTION 109: MEASUREMENT AND PAYMENT

109.01 RETAIN and ADD: "Measurement and payment shall be made per the contract and technical specifications. The contractor shall be responsible, in the presence of the Owner, or Owner's representative, for verifying all measurements and quantities required for payment by the unit price method. Contractor shall provide necessary equipment, workers, and survey personnel as required for measurements.

Payment shall not be made for defective work and rejected work.

Items paid by Lump Sum shall not be measured. Unit price shall include all costs to complete all work shown in plans, regardless of whether all items are written in work description.

Quantities stated in the contract are estimated quantities only and it is understood the actual quantities in the field may vary from those estimated. Actual quantities will be measured in the field, unless specified otherwise in the bid item descriptions. Work required in this section includes all expenses to complete the individual bid items per the plans and specifications. Unit bid prices, as quoted in the bid schedule, shall constitute full compensation for materials, labor, equipment, rentals, permits, overhead, profit, incidentals, risk, loss, damage, and all other items of work and expense required for the complete construction of each pay item per the plans and specifications. Any items or like item not specifically mentioned as a bid item is considered incidental to the project and all costs associated with these items must be included in the bid items listed."

DELETE and REPLACE remainder of Section 109 with the Town of Breckenridge, General Contract Conditions.

DIVISION 200

EARTHWORK

SECTION 201: CLEARING AND GRUBBING

201.02 DELETE the first paragraph of 201.02 and replace with “The Contractor shall meet with Town Representative and designate all trees, shrubs, and plants to be removed. Every object not designated for removal shall be protected by Contractor. Any object not designated for removal that is damaged shall be repaired or replaced as directed at the Contractor’s expense.”

ADD: “Trees designated to be cleared, removed or limbed shall be the property of the Contractor.

As the property of the Contractor, all cleared stumps, roots, willows, shrubs, and limbs shall be disposed of by the Contractor.

Hand grubbing may be required in roadway sections to ensure that no organic materials will be present in the road section.

Any tree, shrub, or other object that is designated to remain and is damaged shall be repaired or replaced as directed by the Town Engineer, at the Contractor’s expense. All surface objects, trees, stumps, roots, and other protruding obstructions not designated to remain shall be cleared and grubbed, including mowing, as required. Undisturbed stumps, roots, and nonperishable solid objects located two feet or more below subgrade or embankment slope may remain in place. Except in areas to be excavated, all holes resulting from the removal of obstructions shall be backfilled with suitable material and compacted. No material or debris shall be disposed of within the project limits. Branches or shrubs shall be removed as directed. All trimming shall be done in accordance with good tree surgery practices, and Town of Breckenridge direction.”

SECTION 202: REMOVAL OF STRUCTURES AND OBSTRUCTIONS

202.02 ADD: “Excess material generated by the installation of the drains, sewers and water mains shall be removed and disposed of by the Contractor. Final grade at the trenches shall match subgrade of the road reconstruction.” This work shall be incidental of paying for installation services.

202.03 ADD: Any salvable material, including signs, sign poles, street light poles, luminaires, hydrants, and other materials shall be hauled and delivered by the Contractor to Town’s Public Works Yard at 1095 Airport Road. The Town Representative shall determine if materials encountered during the work are salvable and whether the Town desires to keep the material. The Town reserves the right to retain ownership of any materials encountered, including boulders, excavated material, gold, historic materials, and any other materials, artifacts, or equipment encountered.

202.07 ADD: New concrete shall match existing concrete. The vertical difference between new and existing concrete shall be less than 1/16”. The Contractor shall grind existing concrete where needed to provide a smooth transition with no vertical differences greater than 1/16”. Existing concrete shall be doweled into new concrete.

202.09 ADD: “Milling is the same operation as planing.

The designated asphalt shall be removed and disposed of by the Contractor.

Irregularities and distresses on the milled or unfinished surface, such as, but not limited to, delamination, raveling, and potholes that are identified by the Project Manager shall be

repaired as soon as possible. Asphalt identified by the Town Engineer as distressed after milling shall be removed and patched as directed by the Town Engineer. Additional patching shall be paid separately. Milled surfaces shall be drivable and shall not have any vertical drops (temporary asphalt shall be tapered at edges of milled areas). Milled edges shall be clean vertical faces and may require re-milling, saw cutting, or other methods to reestablish vertical edges prior to paving.

New asphalt shall match existing asphalt. The vertical difference between new and existing asphalt shall be less than 1/16". The contractor shall grind existing asphalt pavement where needed to provide a smooth transition with no vertical differences greater than 1/16".

SECTION 203: EXCAVATION AND EMBANKMENT

203.06 DELETE the first paragraph of Section 203.06 and REPLACE with the following:

"When Contractor Process Control is required, the Contractor's Process Control Representative shall be certified with CDOT's Excavation, Embankment, and Soil Inspection certification course."

DELETE the third paragraph of Section 203.06 and REPLACE with the following

"Unless a thickness is otherwise specified in the Contract, the upper 3 inches of the ground surface will be considered topsoil and shall be removed in accordance with Section 207 prior to placement of embankment fill."

203.12 DELETE Pay Item "Blading", "Dozing", and "Proof Rolling". Costs of Blading, Dozing, and Proof Rolling shall not be paid separately. All costs associated this work shall be included in Unclassified Excavation and Embankment Material unit costs.

SECTION 206: EXCAVATION AND BACKFILL FOR STRUCTURES

206.06 DELETE paragraph (b) and replace with the following:

For pipes, a profile will be made along the bottom of the center line extending 18 inches beyond the end of the structure, including end sections. Material excavated between this profile and existing grade will not be measured for payment but shall be included in the pipe unit cost. Backfill placed between the pipe profile and the existing grades will not be measured for payment but shall be included in the pipe unit cost. In embankment sections, fill placed above the existing ground will be paid through the embankment unit cost.

206.07 Delete pay item "Bed Course Material" and "Filter Material". All costs of bed course material and filter material shall be included in the unit cost of the pipe/structure.

SECTION 207: TOPSOIL

RETAIN all sections.

SECTION 208: EROSION CONTROL

208.03 ADD the following:

“The Town Engineer may combine the Environmental pre-construction conference with the project pre-construction meeting”

208.04 DELETE paragraph (c)

208.12 DELETE section in its entirety and replace with the following:

“Erosion Control items will not be paid separately but shall be paid as a Lump Sum. The Erosion Control unit cost shall include all equipment, materials, labor, and other costs to complete all erosion control shown on the plans and to comply with Town and CDPHE standards. Unit cost shall include wattles, silt fence, aggregate bags, erosion logs, vehicle tracking pads, inlet protection, concrete washouts, sweeping, and all other work required.”

SECTION 209: WATERING AND DUST PALLIATIVES

209.07 ADD the following:

“Water will be provided by the Town of Breckenridge Water Division through its bulk water station at 1095 Airport Road, Breckenridge, CO or through a hydrant near the site. If an on-site hydrant is to be used, a hydrant valve and meter shall be obtained from the Town of Breckenridge Water Division. The Contractor will be responsible for obtaining a meter and all paperwork from the Water Division. Water will be metered. Payment shall not be made separately for water.

209.08 DELETE “Water” and “Water (Landscaping)” pay items. Water will not be paid for separately but shall be included in the cost of the work.

SECTION 210: RESET STRUCTURES

210.10 ADD the following:

The Contractor shall replace all valve boxes, manholes, and other structures damaged during construction at the cost of the Contractor. Contractor shall remove and clean any debris that enters valve boxes and manholes during construction.

210.13 ADD the following:

Payment will be made under:

Pay Item	Pay Unit
Adjust Valve Box/ Manhole	Each

Adjustments that include adding, removing, or replacing a manhole cone or barrel section will be paid for under the Section 210 pay item, Modify Manhole.

Cleaning designated valve boxes will be paid for under the Section 202 pay item, Clean Valve Box.

ADD the following section immediately after 210.13:

210.14 Heated Pavement Systems. Heated pavement systems, also referred to as snowmelt systems, damaged or modified from construction, shall be reset and repaired by Contractor. Contractor shall place two layers of welded wire fabric, 25 psi insulation, pex tubing, expansion joint and dowels at connection to existing. Contractor shall charge the system with glycol, pressure test for 24 hours and complete all other concrete and mechanical work required. If the snowmelt system is required to be modified per the contract documents, the work will be paid under repair snowmelt system or heated pavement pay item. If the Contractor damages a snowmelt system not intended for removal, repair, or modification per the contract documents, the Contractor shall be responsible

for all costs of repair. The Contractor shall be responsible for the following mechanical requirements:

1. PEX tubes shall be spliced and pressure tested for a minimum of 24 hours by a licensed mechanical contractor.
2. Pressure test shall be at least 1.5 times operating pressure and 100 psi minimum.
3. Piping and splices shall be per Town Building Code and current edition of International Mechanical Code.
4. Town Engineering and Town Building Divisions to inspect splices and pressure test.
5. Insulation and welded wire fabric to be installed beneath tubing.
6. Snowmelt system to be under pressure during placement and cure of concrete.

SECTION 212: SEEDING, FERTILIZER, SOIL CONDITIONER, AND SODDING

212.05 ADD the following at the end of paragraph (a):

“6” of approved topsoil shall be placed on the prepared ground prior to placing any sod.”

212.06 ADD the following at the end of paragraph (a):

“3” minimum of approved topsoil shall be placed on the prepared ground prior to planting native grass.”

SECTION 213: MULCHING

213.03 ADD the following to paragraph (e):

Wood chip mulch shall be a natural, non-stained, shredded cedar mulch. Non-plastic weed control fabric, 5 oz minimum weight, shall be installed beneath the mulch and included in the unit cost of the mulch.

SECTION 214: PLANTING

214.02 ADD the following:

After delivery of plant material, the Contractor shall contact the Engineer for approval of all plant material. The Contractor shall remove and replace rejected materials immediately from the site at their expense.

214.03 ADD the following to paragraph (a):

Installation of plant materials will not be permitted until earthwork, topsoil and adjacent site improvements are substantially complete.

ADD the following to the end of section 214.03:

No trees shall be removed from the project site until marked for removal with Town Representative. All new landscaping, including trees, shrubs, grass, perennials, and mulch, shall be marked with flags or marking paints and approved by Town Representative prior to planting.

Contractor shall implement weed control measures to prevent and remove weed growth from all disturbed areas throughout the establishment period. Weed control measures may include the following:

- i. Watering topsoil prior to seeding and applying acceptable herbicides to topsoil prior to planting
- ii. Installation of weed control barriers in mulch beds
- iii. Application of localized herbicides to eliminate weed growth
- iv. Mechanical removal of weeds

214.04 DELETE “Establishment period begins immediately and lasts a period of 12 months” and replace with:

”The establishment period shall be two years, or the duration of time from installation until all plant material maintains a healthy and vigorous growing condition, whichever is greater. The warranty period for plantings shall equal the establishment period.”

REPLACE paragraph (1) with the following:

- (1) “Watering in Irrigated Areas. Trees and shrubs planted at all locations on the project shall be watered within four hours of planting and then daily for the first month. After the first month, trees and shrubs shall be watered twice a week until the end of the establishment period. Between the months November through April, watering is not required.”

214.06 DELETE Pay Item “Landscape Maintenance” and add the following:

Landscape maintenance and all associated costs for the establishment period per Section 214 shall be included in the tree, shrub, perennial, or other individual landscape pay item.

SECTION 215: TRANSPLANTING

RETAIN all sections.

SECTION 216: SOIL RETENTION COVERING

RETAIN all sections.

SECTION 217: HERBICIDE TREATMENT

RETAIN all sections.

SECTION 250: ENVIRONMENTAL, HEALTH AND SAFETY MANAGEMENT

RETAIN all sections.

DIVISION 300
BASES

SECTION 304: AGGREGATE BASE COURSE

304.04 DELETE AND REPLACE with: "Following utility construction, base materials shall be placed to the minimum depth as shown on the plans. If the required compacted depth of the aggregate base course exceeds 6 inches, it shall be constructed in two or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches. When vibratory or other approved types of special compacting equipment are used, the compacted depth of a single layer may be increased to 8 inches upon approval of TOB representative, provided that specified density is achieved.

SECTION 306: RECONDITIONING

RETAIN all sections.

SECTION 307: LIME TREATED SUBGRADE

307.04 DELETE and REPLACE the first sentence of the first paragraph so that it reads: "The Contractor shall construct one or more compacted courses of treated material, to the depth specified in the Contract and/or Construction Drawings."

307.12 REPLACE Table 307-1 with the following:

Table 307-1

SCHEDULE FOR MINIMUM SAMPLING AND TESTING

In Place Soil Density and Moisture Content	AASHTO T 191 ASTM D 2167	One test for each 1,000 square yards (not less than one test per day).
	AASHTO T 239 AASHTO T 238 ASTM D 2216 AASHTO T 191 and ASTM D 2216	Shall be performed every tenth nuclear method density test
Atterberg Limits	AASHTO T89 & T90	One test per 2,000 tons
Moisture-Density	AASHTO T180	One test per soil type Relationships
Gradation	AASHTO T27 and T11	One test per 2,000 tons
Thickness		One test per 5,000 square yards
Resilient Modulus	AASHTO T 294	Upon request by the Agency

SECTION 308: MECHANICAL STABILIZED SUBGRADE

DESCRIPTION

308.01 Item includes mechanically stabilized subgrade of base, subbase course and/or subgrade improvement in the construction of paved or unpaved roadways. Design details for geogrid reinforcement, such as geogrid type, fill thickness, pavement cross-section and associated details, shall be as shown on the contract drawings. Work consists of:

A. Purpose

The purpose of the work shall be to provide a stabilized paving platform section on which paving materials can be placed. This Item shall not be used to retain moisture in subgrades unless retaining moisture in the section can be assured. This specification shall be used for a construction platform and not as a means of mitigating swell.

MATERIALS

308.02. Definitions

Mechanically Reinforced: Placement of a geogrid immediately over a soft subgrade soil in order to improve the bearing capacity and mitigate deformation of the subgrade soil. The goal of this application may be to reduce deeper excavation requirements, improve construction efficiency, reduce the amount of aggregate subbase or base material required, provide a stiff working platform for pavement construction, or combination of these.

Geogrid: A biaxial polymeric grid formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth to function primarily as reinforcement.

Multi-Layer Geogrid: A geogrid product consisting of multiple layers of grid which are not integrally connected throughout.

Extruded Geogrid: A geogrid product formed by extrusion of a polypropylene or polypropylene/polyethylene copolymer sheet followed by its perforation with a precise arrangement of holes and subsequent stretching, or drawing, into the finished product.

Woven Geogrid: A geogrid product formed by weaving discrete strips of polymer into a network. These geogrids usually require a protective coating to protect the polymer from pre-mature degradation.

Minimum Average Roll Value (MARV): Value based on testing and determined in accordance with ASTM D4759-92.

True Initial Modulus in Use: The ratio of tensile strength to corresponding zero strain. The tensile strength is measured via ASTM D6637 at a strain rate of 10 percent per minute. Values shown are MARVs. For multi-layer geogrid products, rib tensile testing shall be performed on the multi-layer configurations, as prescribed by ASTM D6637

Junction Strength: Breaking tensile strength of junctions when tested in accordance with GRI-GG2 as modified by AASHTO Standard Specification for

Highway Bridges, 1997 Interim, using a single rib having the greater of 3 junctions or a minimum 8-inch machine direction sample and tested at a strain rate of 10 percent per minute based on this gauge length. Values shown are MARVs. For multi-layer geogrid products, junction strength testing shall be performed across junctions from each layer of grid individually, and results shall not be assumed as additive from single layers to multiple layers.

Flexural Stiffness (also known as Flexural Rigidity): Resistance to bending force measured via ASTM D1388-96, Option A, using specimen dimensions of 864 millimeters in length by 1 aperture in

width. Values shown are MARVs. For multilayer geogrid products, flexural stiffness testing shall be performed directly on the multi-layer configuration without using any connecting elements other than those used continuously throughout the actual product, and results shall not be assumed as additive from testing performed on a single layer of the multi-layer product.

Aperture Stability Modulus (also known as Torsional Rigidity or Torsional Stiffness): Resistance to in-plane rotational movement measured by applying a 20 kg-cm (2.0 m-N) moment to the central junction of a 9-inch by 9-inch specimen restrained at its perimeter. Values shown are MARVs. For multi-layer geogrid products, torsional stiffness testing shall be performed on each layer of grid individually, and results shall not be assumed as additive from single layers to multiple layers.

Granular Fill Material: The preferred gradation for base reinforcement application is well-graded crushed aggregate fill with a maximum particle size (100 percent passing) of 1 ½ inches, and less than 10% fines (passing the #200 sieve). Recycled concrete may be used as granular fill to stabilize subgrade. Recycled concrete shall have a sulfate content of less than 3000 ppm. Recycled concrete shall be mixed and placed per the contract documents or the guidance of the project geotechnical engineer.

308.03 Manufacturers. All manufacturers will be considered provided they meet the submittal process as per Item 6.6 and per Table 308.04 (All values are minimum average roll values unless a range or characteristic is indicated):

308.04 Geogrid Material Properties

A. Structural Soil Reinforcement Geogrid: The geogrid shall be integrally formed and deployed as a single layer having the following characteristics according to Table 308.04

Table 308.04

Property	Test Method	Units	Type 1	Type 2
Aperture Stability Modulus at 20 cm-kg (2.0 m-N)	Kinney (2001)	m-N/deg	0.32	0.65
Rib Shape	Observation	N/A	Rectangular or Square	Rectangular or Square
Rib Thickness	Calipered	In	0.03	0.05
Nominal Aperture Size	I.D. Calipered	In	1.0 to 1.5	1.0 to 1.5
Junction Strength	GRI-GG2-2000 ¹	ratio	NOTE 1	NOTE 1
Flexural Rigidity	ASTM D1388-96 ²	Mg-cm	250,000	750,000
Minimum Tensile Strength @ 2% Strain:	ASTM D6637-01 ⁴			
- MD ³		Lb/ft	280	410
- CMD ³		Lb/ft	450	620
Minimum Tensile Strength @ 5% Strain:	ASTM D6637-01 ⁴			
- MD ³		Lb/ft	580	810
- CMD ³		Lb/ft	920	1,340

NOTES:

1. The ratio of Junction Strength/Ultimate Tensile Strength must meet or exceed 75%.
2. Resistance to bending force measured via ASTM D-5732-95, using specimens of width two ribs wide, with transverse ribs cut flush with exterior edges of longitudinal ribs (as a "ladder"), and of length sufficiently long to enable measurement of the overhang dimension.
3. MD = machine direction (along roll length); CMD = cross-machine direction (across roll width).
4. True resistance to elongation when initially subjected to a load determined in accordance with ASTM D6637 without deforming test materials under load before measuring such resistance or employing "secant" or "offset" tangent methods of measurement so as to overstate tensile properties.

B. Geotextile materials shall not be considered as an alternate to geogrid materials for subgrade improvement or base or sub-base reinforcement applications. A geotextile may be used in the cross-section to provide separation, filtration or drainage; however, no structural contribution shall be attributed to the geotextile.

308.05 Execution

A. Examination

The CONTRACTOR shall check the geogrid upon delivery to verify that the proper material has been received. The geogrid shall be inspected by the CONTRACTOR to be free of flaws or damage occurring during manufacturing, shipping, or handling.

308.06 Delivery, Storage, and Handling

A. Storage and Protection

Prevent excessive mud, wet concrete, epoxy, or other deleterious materials from coming in contact with and affixing to the geogrid materials.

Store at temperatures above -20 degrees F (-29 degrees C).

Rolled materials may be laid flat or stood on end.

Geogrid materials should not be left directly exposed to sunlight for a period longer than the period recommended by the manufacturer (as per ASTM D4355).

B. Preparation

The subgrade soil elevation shall be prepared at the proper elevation and alignment as directed by the engineer or as indicated on the construction drawings.

C. Installation

The geogrid shall be installed in accordance with the installation guidelines provided by the manufacturer or as directed by the engineer.

The geogrid may be temporarily secured in place with ties, staples, pins, sand bags or backfill as required by fill properties, fill placement procedures or weather conditions or as directed by the engineer.

D. Granular Fill

Compaction – Standard compaction methods may be used unless the soils are very soft. In these cases, static instead of vibratory compaction is prudent, particularly over silty subgrades.

Compaction is then achieved using a light roller. Keeping fill moisture content near optimum will make compaction more efficient. Water spray is most effective with sand fill. Compact aggregate fill to project specifications, after it has been graded smooth and before it is subject to accumulated traffic.

Vehicle Operation Over Geogrids- A minimum loose fill thickness of 6 inches is required prior to operation of vehicles over the geogrid. Turning of vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid. When underlying substrate is trafficable with minimal rutting, rubber-tired equipment may pass over the geogrid reinforcement at slow speeds (less than 10 mph) when integrally-formed geogrids are used.

This shall not be allowed with coated geogrids and sharp turning movements shall be avoided.

E. Inspection

The owner or owner's representative may randomly inspect geogrid before, during and after (using test pits) installation.

Any damaged or defective geogrid (i.e. frayed coating, separated junctions, separated layers, tears, etc.) will be repaired/replaced in accordance with Item 308.06F.

F. Repair

Any roll of geogrid damaged before, during and after installation shall be replaced by the CONTRACTOR at no additional cost to the OWNER.

Proper replacement shall consist of replacing the affected area adding 3ft (1m) of geogrid to either side of the affected area.

308.07 Submittals

A. Submittal Procedure – 30 days prior to Notice to Proceed.

1. Submit geogrid product sample approximately 4 inches by 7 inches or larger three days prior to installation.

2. Submit geogrid product data sheet, certification, and/or independent full scale laboratory testing from the manufacturer that the geogrid product supplied meets the requirements of Table 6.4-1
3. Submit manufacturer's installation instructions and general recommendations.
4. A list of 5 comparable projects that are similar in terms of size and application, within the state of Colorado, and where the results of using the specific geogrid material can be verified after a minimum of 1 year of service life.
5. Additional information as requested by the engineer to fully evaluate the product.

B. Quality Assurance

Pre-Construction Conference - Prior to the installation of the geogrid, the CONTRACTOR shall arrange a meeting at the site with the geogrid material supplier and, where applicable, the geogrid installer. The OWNER and the ENGINEER shall be notified at least 3 days in advance of the time of the meeting. A representative of the geogrid supplier shall be available on an "as needed" basis during construction.

308.08 Construction Platform Design

Construction platform design shall be performed under supervision of and signed by a Professional Engineer registered in the State of Colorado. The recommended procedure shall be derived by the Giroud-Han, Method (ASCE, August 2004).

Appropriate partial safety factors shall be applied to results obtained using geogrids having properties or characteristics outside the range of rigorous model validation (Giroud and Han, 2004). This method has been endorsed by numerous Departments of Transportation and Government Agencies such as the Federal Highway Administration and Army Corps of Engineers.

For general guidance purposes only, Table 308.08-1 and 308.08-2 present a guide for estimating subgrade soil strength and minimum construction platform recommendations based on a range of subgrade strengths, respectively. A piping ratio analysis(D15fill/D85subgrade) shall be performed to determine the need of a separation fabric. If the piping ratio is less than 5 then no separation fabric is required. If the piping ratio is greater than 5 then a separation fabric is required below the geogrid. Final determination of construction platform shall be approved by the engineer.

Table 308.08-1

Guide for Estimating Subgrade Soil Strengths (Fine Grained Soils)

Estimate Consistency by:		Test by:				Correlates to:			
Feel	Equipment/Visual	Standard Penetration Test (blows/ft)	Dynamic Cone Penetrometer (mm/blow)			Shear Strength c_u		R Value	CBR
			SC, SM, SP	CL	CH	(kPa)	(tsf)		
Very Soft	Man standing sinks > 3"	< 2	—	—	—	< 12	< 0.125	—	< 0.4
Soft	Man walking sinks ≈ 2 - 3"	2 - 4	—	—	—	12 - 24	0.125 - 0.25	< 0.36	0.4 - 0.8
Medium	Man walking sinks ≈ 1"	4 - 8	—	> 66	—	24 - 48	0.25 - 0.50	0.36 - 2.5	0.8 - 1.6
Stiff	Pickup truck ruts ≈ 1/2 - 1"	8 - 15	> 100	66 - 46	—	48 - 96	0.50 - 1.0	2.5 - 6.8	1.6 - 3.2
Very Stiff	Loaded dump truck ruts ≈ 1 - 3"	15 - 30	100 - 56	46 - 33	> 109	96 - 193	1.0 - 2.0	6.8 - 15.5	3.2 - 6.4
Hard	Insignificant rutting by loaded dump truck	> 30	56 - 27	33 - 23	109 - 54	> 193	> 2.0	> 15.5	> 6.4

References: After Portland Cement Association, E.I. Dupont Literature and McCarthy, David F., "Essentials of Soil Mechanics and Foundations," 1977, and Tensar 1998. Webster, Personal Communication 2001, "DCP vrs. CBR Correlations". AASHTO, "1993 Guide for Design of Pavement Structures," Van Till et. al. NCHRP 128.

Table 308.08-2

Recommended Aggregate Fill Thickness Feel / CBR Value with Geogrid Mechanical Reinforcement				
Soil Strength ¹	CBR	Aggregate Fill Thickness (in.) ²		
Feel	approx.	Type 1 Geogrid ³	Type 2 Geogrid ³	Unreinforced
Very Soft	< 0.4	37"	34"	52"
Soft	0.6	30"	26"	42"
Medium	1.2	20"	16"	29"
Stiff	2.5	14"	9"	22"
Very Stiff	4	12"	6"	20"

Notes:

1. Soil Strength is based in Table 308.08-1. The soil strength used is general for these purposes.
2. Results of aggregate fill thickness were derived using the published Giroud-Han (2004) Methodology. Average values for fill thickness are used. Aggregate fill was assumed to have a minimum R-value of 30.
3. Type 1 and Type 2 geogrid structural properties used were a minimum as derived from Table 308.04-1.

308.09 Payment. Payment shall be made at the contract unit price per square yard based upon plan quantities for the stabilization. The price shall be full compensation for furnishing all material and for all preparation of the subgrade, delivering, installation, and incidentals necessary to complete this item. Paving platform found deficient shall be removed and replaced. At the option of the TOWN, the

pavement structural section shall be adjusted to compensate for any deficiency in the paving platform thickness and strength at the CONTRACTOR's expense as noted in Item 308.06F. Granular fill will be paid for at the contract unit price per cubic yard. Unit price will be held constant regardless of deviation from actual quantities.

308.10 Wicking Geotextile

A. Submittals. Submit the following:

1. Certification: The contractor shall provide to the Engineer a certificate stating the name of the manufacturer, product name, style number, and chemical composition of the filaments or yarns and other pertinent information to fully describe the geotextile. The Certification shall state that the furnished geotextile meets MARV requirements of the specification as evaluated under the Manufacturer's quality control program. The Certification shall be attested to by a person having legal authority to bind the Manufacturer. Certifications from Private Label distributors will not be accepted.
2. If an alternate product is submitted full scale performance testing performed by an Independent testing Town shall be completed.
3. Coefficient of Interaction (C_i) test results performed by a lab with GRI accreditation should be provided to confirm conformance to the specified value.
4. Manufacturer's installation Guidelines shall be provided.
5. One 1' x 1' sample shall be provided.
6. Quality Standards: The contractor shall provide to the Engineer the Manufacturer's Quality Control Plan along with their current GAI-LAP and ISO 9001:2015 certificates.
7. Alternate products must be submitted to the Town 15 days prior to bid date and should include information on five similar projects in size and scope.

B. Quality Assurance

Manufacturer Qualifications:

1. The geotextile Manufacturer shall have all the following credentials:
 - a. ISO 9001:2015 Quality Management System
 - b. Geosynthetic Accreditation Institute (GAI) Laboratory Accreditation Program (LAP)
2. The geotextile Manufacturer shall have a GAI-LAP accredited laboratory at the location of production capable of performing the ASTM tests as outlined in the specification.

C. Delivery, Storage, and Handling

1. Geotextile labeling, shipment, and storage shall follow ASTM D4873. Product labels shall be color-coded to specifically identify each product and clearly show the Manufacturer's name, style name, and roll number.
2. Each geotextile roll shall be wrapped with a material that will protect the geotextile from

damage due to shipment, water, sunlight, and contaminants.

3. During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, excess temperatures, and any other environmental conditions that may damage the physical property values of the geotextile.

D. Products

1. The geotextile shall be woven from super high-tenacity polypropylene yarns in conjunction with wicking yarns with a weave pattern to maximize strength, water flow, soil interaction, wicking capabilities and soil retention. The yarns shall be from high-tenacity long-chain synthetic polymers composed of at least 95 percent by weight of polyolefins or polyamids. They shall form a stable network such that the filaments or yarns retain their dimensional stability relative to each other, including selvages.
2. Geosynthetic must be able to directionally draw water via capillary action.
3. The geotextile shall meet the requirements of Table 1. All numeric values in Table 1 except AOS represent MARV in the specified direction. Values for AOS represent maximum measured opening size.

TABLE 308.10 – SOIL STABILIZATION AND WICKING GEOTEXTILE

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Wide Width Tensile Strength	ASTM D4595	lbs/ft (kN/m)	5280 (77.0)	5280 (77.0)
Wide Width Tensile Strength @ 2% strain	ASTM D4595	lbs/ft (kN/m)	480 (7.0)	1080 (15.8)
			Maximum Opening Size	
Apparent Opening Size (AOS)	ASTM D4751	U.S. Sieve (mm)	40 (0.425)	
			Minimum Roll Value	
Permittivity	ASTM D4491	sec ⁻¹	0.4	
Flow Rate	ASTM D4491	gal/min/ft ² (l/min/m ²)	30 (1222)	
			Minimum Test Value	
Pore Size (050)	ASTM D6767	microns	85	
Pore Size (095)	ASTM D6767	microns	195	
Wet Front Movement ¹ (24 minutes)	ASTM C1559 ²	inches	6.0 Vertical direction	
Wet Front Movement ¹ (983 minutes) Zero Gradient	ASTM C1559 ²	inches	73.3 Horizontal direction	

¹ 'STP': Standard Temperature and Pressure, Tested Value

² Modified

When sewn, seams are required, refer to Manufacturer's Installation Guidelines for overlap / seam requirements.

E. Quality Control

1. Manufacturing Quality Control: Testing shall be performed at an on-site laboratory accredited by GAI-LAP for tests required for the geotextile, at frequency meeting or exceeding ASTM D4354.
2. Manufacturer's certifications and testing of quality assurance samples obtained using Procedure B of ASTM D4354. A lot size for conformance or quality assurance sampling shall be the shipment quantity of the given product or a truckload of the given product, whichever is smaller.

F. Execution. See Manufacturer's Installation guidelines provided in the submittal.

SECTION 309 FULL DEPTH RECLAMATION

ADD Section 309 Full Depth Reclamation to these specifications.

ADD the following:

DESCRIPTION

309.01 This work consists of pulverizing the existing asphalt mat and mixing the pulverized asphalt mat with the existing base course, to the specified depth, and grading and compacting the mixed material in accordance with, and at locations as shown in the Contract.

CONSTRUCTION REQUIREMENTS

309.02 The Contractor shall develop a written method to maintain the centerline geometry, profile elevations, and cross slope of the existing roadway. The plan shall be submitted to the Engineer for approval a minimum of two weeks prior to starting work. The plan shall include, but is not limited to, the following:

1. Mobilization of equipment to haul and place material
2. The estimated length of roadway (both travel lanes) that can have existing pavement structure removed, embankment cut to new elevation, and placement of Aggregate Base Course material so that the difference in elevation between lanes is 1 inch or less at the end of the work shift
3. Contractor's plan to address stabilization of soft spots
4. Contractor's method to keep the road open for two-way traffic after the pavement and/or base is removed, and before or during a major precipitation event
5. Method of Handling Traffic to be used during the operation
6. Contractor's implementation of Revision of Section 104.04 - Maintaining Traffic

Reclamation of the existing asphalt pavement shall not commence until the Contractor has an approved design mix for Hot Mix Asphalt.

The existing asphalt mat shall be cut at neat lines as shown in the plans by the use of a cutting wheel attached to a blade or by another approved method. The existing asphalt mat shall be pulverized and mixed with the existing base course to a specified depth or as directed by the Engineer, with a self-propelled rotary type mixing machine. *Optimal speed for the reclaimer shall be 11.5 feet per minute, and it shall be the responsibility of the Contractor to assure the Town this rate is not exceeded.* Deviations must be made by the Engineer in the field.

The mixing machine shall make as many passes as required to uniformly mix the asphalt and existing base course to the required thickness. Mixing of the different materials shall create a homogenous mixture. The particle size of the pulverized asphalt mat shall be a minimum of 99 percent passing the 1-1/4 inch sieve. When the addition of water is necessary for initial compaction purposes it shall be added through the mixing machine with the capability to uniformly distribute water through the mixed materials.

When proper mixing has been accomplished, the mixture shall then be bladed, shaped, wetted or dried, and rolled to meet a minimum of 95 percent of the maximum wet density determined in accordance with AASHTO T-180 Method D. The soils moisture-density curve will be developed using wet densities and the percent compaction will be calculated using wet density.

The maximum depth to be compacted in one lift is 8 inches. If the depth of the reclaimed material exceeds 8 inches, the Contractor shall remove the material in excess of 8 inches and compact the material in layers not exceeding 8 inches. Thickness will be determined in the field with the Engineer at the beginning of work.

Grading equipment used to establish the final surface elevations shall have automatic controls for transverse slope. The transverse slope controls shall be capable of maintaining the final surface within 0.1 percent of the specified slope. Variations from the subgrade plane shall not be more than ¼ inch. The work shall be maintained and tested for conformance to these requirements immediately prior to placing additional pavement layers.

The minimum quantity for acceptance testing will be based on a random schedule of 1/1000 square yards of reclaimed material. Every 5,000 square yards a verification point will be tested to confirm the accuracy of the moisture-density curve.

The maximum time a portion of the roadway will be unpaved is ten (10) working days unless otherwise specified. The exposed longitudinal joint between the existing asphalt mat and the processed mat shall not remain in place for more than one day unless approved by the Engineer. When additional aggregate base course is imported and placed before processing begins, the full width of the roadway shall be completed daily. Joint construction and maintenance shall conform to subsection 401.16.

METHOD OF MEASUREMENT

309.03 Full Depth Reclamation of Hot Mix Asphalt Pavement will be measured by the square yard of roadway treated, completed and accepted.

BASIS OF PAYMENT

309.04 The accepted quantities of Full Depth Reclamation of Hot Mix Asphalt Pavement will be paid for at the contract unit price per square yard for Full Depth Reclamation of Hot Mix Asphalt Pavement, for the depth shown in the project plans. The depth shown in the plans is based on cores obtained from the existing pavement, and the Contractor should be aware that the depth will vary and, in some locations, will be either less or more than the depth range shown in the plans. The pay item shown in the plans shall be that used for the entire project, regardless of variations discovered during construction.

Pay Item	SY	Pay Unit
Full Depth Reclamation of Hot Mix Asphalt Pavement	SY	Square Yard

Payment for Full Depth Reclamation of Hot Mix Asphalt Pavement will be full compensation for all work necessary to complete the item including cutting of the existing asphalt mat, pulverizing the existing asphalt mat, mixing the pulverized asphalt mat into the existing base course, moving the pulverized material and existing base course, wetting and compacting the mixed pulverized asphalt mat and base course, blading, shaping, haul, water, and maintenance of the riding surface.

DIVISION 400 PAVEMENTS

SECTION 401 PLANT MIX PAVEMENTS - GENERAL

401.07 RETAIN the first paragraph and Table 401-3. DELETE the remainder of Section 401.07 and REPLACE with the following:

“Temporary asphalt ramps shall be placed at all vertical milled edges greater than 1”. The Contractor shall maintain the temporary asphalt throughout the project. Distress in milled surfaces which affects the ride, safety, or serviceability of the road shall receive a temporary asphalt layer. Asphalt shall not be placed between November 1st and April 30th. When emergency work requires asphalt placement between November and April the asphalt will be considered temporary and shall be replaced the following year after May 1st.”

401.08 ADD the following sentence to the end of paragraph one:

“Asphalt mixing and storage plant operations shall comply with ASTM D995 for materials storage, control, mixing, and for plant equipment and operation.”

401.11 DELETE AND REPLACE with: “A tack coat shall be applied between pavement courses, at vertical edges of pavement, and at all vertical faces of concrete abutting the pavement at a rate of 0.05 to 0.15 gal/sq. yd. and paid for in accordance with Section 407. A prime coat at the subgrade shall not be required.”

401.12 ADD the following: “All manholes and valve boxes shall be set to ½ inch below final grade prior to paving of streets.”

401.17 Add the following to the end of paragraph one:

“After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Asphalt surface temperature shall be below 160 degrees.

Erect barricade to protect paving from traffic until mixture has cooled and attained its maximum degree of hardness.”

DELETE all references to compaction pavement test section (CTS). ADD the following: “Compaction pavement test section not required. Unless specified by the Contract, pavement cores are only required for longitudinal joints.”

401.20 DELETE and REPLACE entire section with following:

Town representative will inspect paving operations to ensure surface smoothness. On roads below 35 mph, the Town will not inspect small deviations in smoothness. On roads above or equal to 35 mph, Town will inspect smoothness using 10 foot level and measure any deviations greater than 3/16”. Contractor will be required to grind deviations. If smoothness is excessively poor, the Town will require Contractor to mill and replacement pavement.

SECTION 403 HOT MIX ASPHALT

ADD the following Table

Table 403.01

**Minimum Materials Sampling and Testing
for Process Control and Owners Acceptance**

Test	Standard	Minimum Frequency
Sampling	AASHTO T168, ASTM D 979 and ASTM D3665	One test per day, per mix design.
Density (Nuclear Gauge)	AASHTO T 166, T 355	One test every 250 lineal feet, per lane, per mix design.
Total Thickness (Core or non destructive method)	ASTM D3549 or approved non destructive method	IF requested by the AGENCY , not to exceed one test per day.
Gradation	AASHTO T 27, T 11	One test per day, per mix design.
Binder Content	AASHTO T 308 or other methods agreed upon between Agency and Contractor. AASHTO 308	One test per day per mix design.
Maximum Theoretical Specific Gravity (Rice)	AASHTO T 209	One test per day, per mix design.

SECTION 405 HEATING AND SCARIFYING TREATMENT

RETAIN all sections.

SECTION 406 COLD ASPHALT PAVEMENT (RECYCLE)

DELETE Section 406

SECTION 407 PRIME COAT, TACK COAT, AND REJUVINATING AGENT

RETAIN all sections.

SECTION 408 JOINT AND CRACK SEALANT

RETAIN all sections.

SECTION 409 CHIP SEAL

DELETE Section 409

SECTION 410: SLURRY SEAL

DESCRIPTION

410.01 The slurry seal shall consist of a mixture of an approved emulsified asphalt, mineral aggregate, water and specific additives, proportioned, mixed and uniformly spread over a properly prepared surface in accordance with the plans and specifications. The complete slurry seal shall leave a homogeneous mat, adhere firmly to the prepared surface, and have a friction resistant surface texture throughout its service life.

MATERIALS

410.02

A. Emulsified Asphalt

The emulsified asphalt shall conform to Grade SS-1h, CSS-1h, CQS-1h as specified in ASTM D 977, D 2397, AASHTO M 140 and M 208. The cement mixing test is waived. Each load of emulsified asphalt shall be accompanied with a Certificate of Compliance.

Table 410.02-1 Emulsified Asphalt

Test	Quality	Specification
AASHTO T59	Residue after distillation	60% Min.
AASHTO T49 ¹	Penetration at 77° F (25° C)	40 to 90
AASHTO T 59	Saybolt Furol Viscosity 77° F (25° C)	15 to 90 Sec.

¹Test on Residue

B. Aggregate

The aggregate shall be manufactured 100 percent crushed stone such as granite, slag, limestone, chert, or other high quality aggregate, or combination thereof. All aggregates shall have at least two fractured faces.

Table 410.02-2 Aggregates

Test	Quality	Specification
AASHTO T176*	Sand Equivalent	55 Min.
AASHTO T104	Soundness	15% Max. using NA ₂ SO ₄ or 25% Max. using MgSO ₄
AASHTO T96	Abrasion Resistance	25% Max. Grading D

* Moisture condition sample at least 24 hours prior to running the test.

When tested in accordance to AASHTO T 27 and AASHTO T 11, the aggregate gradation (including the mineral filler) shall be within the following bands. Note: Selection of Type II or Type III shall be designated by the Town and shown on the plans.

Table 410.02-3 Aggregate Gradation

Sieve Size	Percent Passing		Job Tolerance
	Type II	Type III	
1/2"	100	100	± 0
No. 4	90 to 100	70 to 90	± 4
No. 8	65 to 90	45 to 70	± 4
No. 16	45 to 70	28 to 50	± 3
No. 30	30 to 50	19 to 34	± 3
No. 50	18 to 30	2 to 25	± 3
No. 100	10 to 21	7 to 18	± 3
No 200	5 to 15	5 to 15	± 2

The stockpile shall be accepted based on an average of five gradation tests according to AASHTO T 2. Note requirement of 26.2E.

C. Mineral Filler

Portland cement, hydrated lime, limestone dust, fly ash or other approved filler meeting the requirements of AASHTO M 17 or ASTM D 242 shall be used if required by the mix design. They shall be considered as part of the dry aggregate.

D. Water

The water shall be free of salts and contaminants and shall be tested and conform to AASHTO T 26. Potable water testing is not required.

E. Additives

Liquid additives may be used to accelerate or retard the break-set of the slurry seal, or improve the resulting finished surface. The use of liquid additives in the slurry mix (or individual materials) shall be made initially in quantities predetermined by the mix design with field adjustments if required, after approval by the Town.

410.03 Mix Design

The CONTRACTOR shall submit to the Town, for approval, a mix design prepared and signed by a Professional Engineer registered in the State of Colorado, performed by a laboratory who has experience in designing Emulsified Asphalt Slurry Seal Surfacing. Compatibility of the aggregate, emulsion, mineral filler, and other additives shall be verified by the mix design. The mix design shall be made with the same materials and gradation that the CONTRACTOR will provide on the project. After the mix design has been approved, no substitution will be permitted. Minimum requirements are as follows:

Table 410.03-1 Recommended Mix Properties

Test	Description	Specification
ISSA T106	Slurry Seal Consistency	--
ISSA TB-139 (for quick-set systems)	Wet Cohesion 30 minutes Min. (set) 4 hour Min. (traffic)	12 kg-cm Min. 20 kg-cm Min.
ISSA TB-139 (for quick- traffic systems)	Wet Cohesion 60 minutes Min	20 kg-cm Min.
ISSA TB-109	Excess Asphalt by LWT Sand Adhesion	50 g/ft ² Max.
ISSA TB-114	Wet Stripping 10 minutes boiling water	Pass (90% Min.)
ISSA TB-100	Wet Track Abrasion Loss One hour soak 6-Day soak	50 gm ² Max. 75 g/ft ² Max.
ISSA TB-113	Mix Time	*
Residual Asphalt	6.5% to 12.0%	---
Mineral Filler	0.5% to 2.0%	

*The mixing test and set time test shall be done to anticipate the highest temperatures expected during construction. This will include 180 seconds mix time at 77° F and 70 seconds mix time minimum at 100° F.

The laboratory shall also report the quantitative effects of moisture content on the unit weight of the aggregate (bulking effect). The report must clearly show the proportions of aggregate, mineral filler (minimum and maximum), water (minimum and maximum), additive(s) (usage), and asphalt emulsion based on the dry weight of the aggregate. The report shall be sealed and signed by a Professional Engineer registered in the State of Colorado.

410.04 Equipment

A. General

All equipment, tools, and machines used in performance of this work shall be maintained in satisfactory working condition at all times to ensure a high quality product.

B. Mixing Equipment

The machine shall be specifically designed and manufactured to lay slurry seal. The material shall be mixed by a self-propelled slurry seal mixing machine of either truck mounted or continuous run design. Continuous run machines are those that are equipped to self load materials while continuing to lay slurry seal. Either type machine shall be able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, control setting additive, and water to a revolving mixer and discharge the mixed product on a continuous flow basis.

The machine shall have sufficient storage capacity for aggregate, emulsified asphalt, mineral filler, control additive and water to maintain an adequate supply to the proportioning controls. If continuous run equipment is used, the machine shall be equipped to allow the operator to have full control of the forward and reverse speed during application of the slurry seal. It shall be equipped with a self-loading device, opposite side driver stations, and forward and reverse speed controls.

C. Proportioning Devices

Individual volume or weight controls for proportioning each material to be added to the mix (i.e. aggregate, mineral filler, emulsified asphalt and additive) shall be provided and property marked.

The proportioning devices are required to be in working order and shall be capable of determining the material output at any time.

D. Spreading Equipment

The mixture shall be spread uniformly by means of a conventional surfacing spreader box attached to the mixer and equipped to agitate and spread the material evenly throughout the box. A front seal shall be provided to ensure no loss of the mixture at the road contact point. The rear seal shall act as final strike-off and shall be adjustable. The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off. The spreader box shall have suitable means provided to side shift the box to compensate for variations in the pavement geometry. A burlap drag or other approved screed may be attached to the rear of the spreader box to provide a uniform, highly textured mat. The drag pulled behind the spreader box shall not be stiffened or hardened by slurry or asphalt.

E. Auxiliary Equipment

Suitable surface preparation equipment, traffic control equipment, hand tools, power brooms, sweepers, and any other support equipment shall be provided as necessary to perform the work.

Equipment shall be approved by the TOWN. All equipment and machinery shall be kept in good working order, free of leaks and properly muffled. All taxes, licenses and fees shall have been paid and proper licenses and permits shall be posted as required by law.

410.05 Calibration

Each mixing unit to be used in performance of the work shall be calibrated in the presence of the engineer prior to construction. Previous calibration documentation covering the exact materials to be used may be acceptable, provided they were made during the calendar year. A one-point calibration check may be required at the start of production. The documentation shall include an individual calibration of each material at various settings, which can be related to the machine's metering devices. No machine will be allowed to work on the project until the calibration has been completed and/or accepted.

A. Verification

Test strips will be made by each machine after calibration and prior to construction. Test strips shall be a portion of the project. Samples of the slurry seal will be taken and verification made as to mix consistency and proportioning. Verification of rate of application will also be made. Upon failure of any of these tests, additional test strips, at no cost to the TOWN, will be required until each unit is authorized to work. Any unit failing to pass the tests after the third trial, will not be permitted to work on the project. Test strips must be accepted or rejected within 24 hours after application.

410.06 Weather Limitations

The slurry seal shall not be applied if either the pavement or air temperature is below 50° F and falling, but may be applied when both pavement and air temperature are above 45° F and rising. No slurry seal shall be applied when there is danger that the finished product will freeze before 24 hours. The mixture shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.

410.07 Surface Preparation

A. General

Immediately prior to applying the slurry seal the surface shall be cleared of all loose material, oil spots, vegetation, and other objectionable material. Any standard cleaning method will be acceptable. If water is used, cracks shall be allowed to dry thoroughly before slurry surfacing.

Manholes, valve boxes, drop inlets and other service entrances shall be protected from the slurry seal by a suitable method. The TOWN shall approve the surface preparation prior to surfacing.

B. Tack Coat

If a tack coat is required it should consist of one part emulsified asphalt and three parts water. The emulsified asphalt should be the same as used in the mix. The distributor shall be capable of applying the dilution evenly at a rate of 0.05 to 0.10 gallons per square yard (0.15 to 0.35 liters per square meter). The tack coat shall be allowed to cure before application of the slurry seal.

C. Joint and Crack Sealant

Joints and crack shall be sealed in accordance with the requirements in Item 23.

410.08 Application

The slurry seal mixture shall be of proper consistency at all times so as to provide the application rate required by the surface condition. The average application rate shall be 18 to 30 pounds per square yard (8.16 to 13.6 kgs/m²).

Application rates are affected by the unit weight of the aggregate, the gradation of the aggregate and the demand of the surface to which the slurry seal is being applied.

A. General

When required by local conditions, the surface shall be pre wetted by fogging ahead of the spreader box.

The rate of application of the fog spray shall be adjusted during the day to suit temperatures, surface texture, humidity, and dryness of the pavement.

The slurry seal shall be of the desired consistency upon leaving the mixer. A sufficient amount of material shall be carried in all parts of the spreader at all times so that a complete coverage is obtained. Overloading of the spreader shall be avoided.

No lumping, balling, or unmixed aggregate shall be permitted.

No streaks, such as those caused by oversized aggregate shall be left in the finished surface. If excess oversize develops, the job will be stopped until the CONTRACTOR proves to the engineer that the situation has been corrected.

Some situations may require screening the aggregate just prior to loading it into the units going from the stockpile area to the laydown operations.

410.09 Joints

No excess buildup, uncovered areas, or unsightly appearance shall be permitted on longitudinal or transverse joints. The CONTRACTOR shall provide suitable width spreading equipment to produce a minimum number of longitudinal joints throughout the project. When possible, longitudinal joints shall be placed on lane lines. Half passes and odd width passes will be used only in minimum amounts. If half passes are used, they shall not be the last pass of any paved area. A maximum of 4 inches (152 mm) shall be allowed for overlap of longitudinal lane line joints. The paper shall be used at transverse joints to ensure a straight line.

410.10 Mix Stability

The slurry seal shall possess sufficient stability so that premature breaking of the material in the spreader box does not occur. The mixture shall be homogeneous during and following mixing and spreading. It shall be free of excess water and emulsion and free of segregation of the emulsion and aggregate fines from the coarser aggregate.

Spraying of additional water into the spreader box or addition of excess water will not be

permitted.

410.11 Hand Work

Areas which cannot be reached with slurry seal machines shall be surfaced using hand squeegees to provide complete and uniform coverage. The area to be hand worked shall be lightly dampened prior to mix placement and the slurry worked immediately. Care shall be exercised to leave no unsightly appearance from handwork. The same type finish as applied by the spreader box shall be required. Handwork shall be completed during machine applying process.

410.13 Lines

Care shall be taken to ensure straight lines along shoulders. No runoff on these areas will be permitted. Lines at intersections will be kept straight to provide good appearance.

410.14 Rolling

At the option of the TOWN, the roadway shall be rolled by a self propelled 10 ton pneumatic roller with a tire pressure of 50 psi (3.4 atms.) and equipped with a water spray system. The surfaced areas shall be subjected to a minimum of two full coverage passes by the roller.

Rolling should not commence until the slurry has cured enough so that it will not pick up on the tires of the roller.

410.15 Clean-up

All areas, such as manways, gutters and intersections, shall have the slurry seal removed as specified by the Town. The CONTRACTOR shall remove any debris associated with the performance of the work on a daily basis.

410.16 Tolerances

Tolerances for individual materials as well as the slurry seal mixture are as follows:

After the designed residual asphalt content is determined, a plus or minus one percentage point variation will be permitted.

The percentage of aggregate passing each sieve shall be within stockpile tolerance range as stated and within the master range of Table 26.2B-2.

The percentage of aggregate passing shall not go from the high end to the low end of the specified range of any two successive sieves.

The slurry consistency shall not vary more than ± 0.5 cm from the job mix formula after field adjustments.

The rate of application once determined by the engineer shall not vary more than +2 pounds per square yard, while remaining within the design application rate.

If any two successive tests fail on the stockpile material, the job shall be stopped. It is the responsibility of the CONTRACTOR, at his own expense, to prove to the TOWN that the conditions have been corrected. If any two successive tests on the mix from the same machine fail, the use of the machine shall be suspended. It will be the responsibility of the CONTRACTOR, at his own expense, to prove the TOWN that the problems have been corrected and that the machine is working properly.

410.17 Measurement

The area of slurry seal shall be measured by the square yard per plan quantities completed in place and accepted.

410.18 Testing and Inspection

Testing and inspection shall be performed in accordance with Table 410.18-1.

Table 410.18-1 Schedule for Minimum Slurry Seal Materials Sampling and Testing

Test Type	Test Standard	Minimum Frequency of Tests
Residue after distillation	AASHTO T 59	One test each 5,000 square yards of slurry seal
Extraction and Gradation	AASHTO T 164 AASHTO T 30	One test each 5,000 square yards of slurry seal
Application Rate		One test each 5,000 square yards of slurry seal

410.19 Payment

The slurry seal shall be measured and paid for by the contract unit price per square yard (SY). The price shall be full compensation for furnishing all materials and for preparation, mixing and applying these materials, and for all labor, equipment, tools, test design, clean-up and incidentals necessary to complete and warrant the job as specified herein.

SECTION 411 ASPHALT MATERIALS

DELETE Section 411.05 and REPLACE with the following: "Asphalt cement, emulsified asphalt, and other asphalt materials will not be paid separately but shall be included in the unit price for TONS of Hot Mix Asphalt or other appropriate mix."

SECTION 412 PORTLAND CEMENT CONCRETE PAVEMENT

- 412.17 REVISE as follows "Roadway smoothness will not be tested on roads with speed limits below 35 mph. On roads at or above 35 mph, Town shall use a ten foot level to measure high spots greater than 3/16". Contractor shall diamond grind areas exceeding 3/16".
- 412.21 DELETE and REPLACE with the following: "Pavement thickness shall be measured by Town measuring the depth prior to placement of pavement. Contractor shall assist with setting string lines, forms, and other methods to measure thickness. Cores shall not be used unless requested by the Engineer."

SECTION 420 GEOSYNTHETICS

- 420.02 DELETE the first sentence and replace with the following: "Geotextiles and geomembranes shall meet the applicable requirements of subsection 308."

DIVISION 500 STRUCTURES

SECTION 501 STEEL SHEET PILING

RETAIN all sections.

SECTION 502 PILING

RETAIN all sections.

SECTION 503 DRILLED SHAFTS

RETAIN all sections.

SECTION 504 WALLS

ADD the following to Section 504.01: "For stone or boulder walls, Contractor shall deliver samples of stone to the site for approval by Town. Contractor shall construct a short section of wall as a mockup for Town review and approval. If mockup does not meet requirements of contract documents, the Contractor shall removal and replace wall at their expense."

SECTION 506 RIPRAP

RETAIN all sections.

SECTION 507 SLOPE AND DITCH PAVING

RETAIN all sections.

SECTION 508 TIMBER STRUCTURES

RETAIN all sections.

SECTION 509 STEEL STRUCTURES

RETAIN all sections.

SECTION 510 STRUCTURAL PLATE STRUCTURES

RETAIN all sections.

SECTION 512 BEARING DEVICE

RETAIN all sections.

SECTION 514 PEDESTRIAN AND BIKEWAY RAILING

RETAIN all sections.

SECTION 515 WATERPROOF MEMBRANE

RETAIN all sections.

SECTION 516 DAMPPROOFING

RETAIN all sections.

SECTION 517 WATERPROOFING

RETAIN all sections.

SECTION 518 WATERSTOPS AND EXPANSION JOINTS

RETAIN all sections.

DIVISION 600
MISCELLANEOUS CONSTRUCTION

SECTION 601 STRUCTURAL CONCRETE

ADD the following to Section 601.02: "w/cm ratio for Concrete Class B,D, and P shall be 0.38 to 0.42."

SECTION 602 REINFORCING STEEL

RETAIN all sections

SECTION 603 CULVERTS AND SEWERS

ADD the following to Section 603.01: "For any sanitary sewer work, delete Section 603 in its entirety and replace with the Upper Blue Sanitation District Sewer Standards."

ADD the following to Section 603.13: "Structure excavation and backfill shall not be paid separately, but shall be included in the cost of the pipe."

SECTION 604 MANHOLES, INLETS, AND METER VAULTS

RETAIN all sections

SECTION 605 SUBSURFACE DRAINS

RETAIN all sections

SECTION 606 GUARDRAIL

RETAIN all sections

SECTION 607 FENCES

RETAIN all sections

SECTION 608 SIDEWALKS AND BIKEWAYS

ADD the following to Section 608.03: "All concrete sidewalk shall be a minimum of 5" thick. Control joints shall be placed at 6' intervals and shall be sawcut joints. Joints shall be sawcut immediately after curing. Expansion joint shall be added between new concrete sidewalk and existing concrete sidewalk"

SECTION 609 CURB AND GUTTER

RETAIN all sections

SECTION 610 MEDIAN COVER MATERIAL

RETAIN all sections

SECTION 611 CATTLE GUARDS

RETAIN all sections

SECTION 612 DELINEATORS AND REFLECTORS

RETAIN all sections

SECTION 613 LIGHTING

RETAIN all sections

SECTION 614 TRAFFIC CONTROL DEVICES

RETAIN all sections

SECTION 615 WATER CONTROL DEVICES

RETAIN all sections

SECTION 616 SIPHONS

RETAIN all sections

SECTION 618 PRESTRESSED CONCRETE

RETAIN all sections

SECTION 619 WATER LINES

DELETE and REPLACE with the following: "Water lines and appurtenances shall be constructed in accordance with the Town of Breckenridge Water Construction Standards."

SECTION 620 FIELD FACILITIES

RETAIN all sections

SECTION 622 REST AREAS AND BUILDINGS

DELETE Section 622 in its entirety.

SECTION 623 IRRIGATION SYSTEMS

RETAIN all sections

SECTION 624 DRAINAGE PIPE

624.02 ADD "High Density Polyethylene Corrugated Pipe with Smooth Interior" to the list of pipe materials under the Plastic Heading. ADD the abbreviation as HDPE.

Table 624-1. ADD ⁷ to the Table: "Plastic Pipe and fittings shall be manufactured from high density polyethylene resin which shall meet or exceed the requirements of Type III, Category 4 or 5, Grade P33 or P34, Class C per ASTM D1248. HDPE storm pipe shall be ADSN-12 WT-1B (water tight or approved equal."

SECTION 625 CONSTRUCTION SURVEYING

RETAIN all sections

SECTION 626 MOBILIZATION

RETAIN all sections

SECTION 627 PAVEMENT MARKING

RETAIN all sections

SECTION 629 SURVEY MONUMENTATION

RETAIN all sections

SECTION 630 CONSTRUCTION ZONE TRAFFIC CONTROL

ADD the following to Section 630.01:

"Construction Under Traffic

Contractor shall maintain a minimum of one lane of traffic to greatest extent possible. When one lane cannot safely be maintained, the length and duration of the full road closure shall be minimized to the extent possible and shall be approved by the Town Engineer.

Two lanes of traffic shall be reopened during evenings and weekends. Full road closures during nights and weekends shall be submitted for review and approval by Town Engineer. Access to all residences and businesses shall be maintained at all times during construction. Flaggers shall be used to assist with construction access and pedestrian traffic control.

Pedestrian traffic shall be maintained through the construction zones. Temporary curb ramps shall be installed consisting of compacted base course. Pedestrian routes shall be a minimum of 5' wide, meet ADA requirements, and be separated from traffic by approved barriers.

Flaggers shall be used to assist with construction access and pedestrian traffic control.

The Contractor shall provide to the Town a detailed phasing plan, schedule, Traffic Control Plan and MHT for each anticipated phase of construction.

Flagging

The contractor shall provide competent certified flaggers to direct traffic when work is being done in the street ROW or intersection that is open to traffic. The Contractor shall provide a minimum of one flagger while construction activities are occurring. The flaggers will be required to direct vehicular traffic and construction vehicles. Pedestrian and vehicular traffic shall be the priority of the "minimum" required flaggers. Certified flaggers, additional to the "minimum" required, may be utilized at the Contractor's discretion to assist with the Contractor construction activities. Flagging shall conform to the requirements of the MUTCD. The cost of the "minimum" flaggers and additional flaggers utilized by the Contractor shall be included in the unit price of the bid item, Traffic Control.

Traffic Control Supervisor (TCS)

When required by the Contract, the contractor shall provide a competent CCA or ATSSA certified Traffic Control Supervisor (TCS) on site for any set up, moving, reconfiguration, and removal of all traffic control devices required for the project. The TCS may be utilized as a flagger, and be recognized as one of the "minimum" required flaggers if the work is contained within a reasonable work zone length. The TCS shall monitor and make repairs and adjustments to the traffic control devices daily. The Traffic Control Supervisor shall conform to the requirements of the MUTCD, and will be included in the cost of the bid item, Traffic Control

Traffic Control Devices

The Contractor shall furnish, erect, and maintain all barricades, construction signing, lights, and other traffic control devices in conformity to the Manual of Uniform Traffic Control Devices for Streets and Highways and as called for in the plans and drawings. All signs and barricades to be paid for by the owner shall be in good condition and acceptable to the project engineer. All required traffic control devices, signs and flaggers shall be in place through the construction area prior to beginning and work.

The use of Type "A" low intensity warning lights shall be as shown in the contract and are incidental to the price of each barricade.

All construction signing shall be black on reflective orange and per MUTCD standards unless otherwise specified.

Maintenance

The Traffic Control Supervisor shall conduct daily inspections (three times per day minimum on working days) of all traffic control devices to ensure proper placement and condition of all signs, barricades and channelization devices, and shall log placement, inspection, maintenance, and replacement of all traffic control devices. Copies of the contractor's daily traffic control logs shall be given to the engineer once per week.

All construction signing, barricades, channelization devices, temporary pavement markings, and other construction traffic control devices shall be kept clean, legible, visible, and in proper position at all times. Damaged traffic control devices shall be repaired or replaced immediately.

Method of Handling Traffic (MHT)

To implement the Traffic Control Plan the Contractor will prepare and submit a Method of Handling Traffic (MHT) to the Engineer for approval at least one week prior to commencement of any demolition work. The Contractor shall implement the MHT in accordance with the plans and specifications. Any variance from those plans will require the approval of the Engineer.

The MHT shall be drawn specific to each project. The MHT shall be drawn reasonably close to scale and shall show representative project landmarks, streets and salient features. The Engineer, upon

request from the Contractor, will furnish to the Contractor base mapping for preparation of the MHT. An individual MHT shall be submitted for each phase of work.

The MHT shall include the following as a minimum:

1. Detailed diagrams showing the size and location of all proposed traffic control devices.
2. Access plan for all businesses.
3. Access plan for pedestrians.
4. Emergency vehicle access plan.
5. Supporting documentation as required.
6. Flagger number and locations.

The key elements of the Contractor's method of handling traffic (MHT) are outlined in subsection 630.10(a).

The components of the TCP for this project are included in Subsection 104.04 and Section 630 of the specifications.

Unless otherwise approved by the Engineer, the Contractor's equipment shall follow normal and legal traffic movements. The Contractor's ingress and egress of the work area shall be accomplished with as little disruption to traffic as possible. Traffic control devices shall be removed by picking up the devices in a reverse sequence to that used for installation. This may require moving backwards through the work zone. When located behind barrier or at other locations shown on approved traffic control plans, equipment may operate in a direction opposite to adjacent traffic.

SECTION 641 SHOTCRETE

RETAIN all sections

DIVISION 700

MATERIALS DETAILS

SECTION 701 HYDRAULIC CEMENT

Add the following to Section 701.02:

Fly ash or natural pozzolans shall conform to ASTM C618, for Class C, F, N, or AASHTO M321 for High Reactivity Pozzolans. Class C fly ash may only be used for Class 0 sulfate resistance and if the calcium oxychloride is determined to be less than 15g CaOXY/100g cementitious paste in accordance with AASHTO T 365.

SECTION 702 BITUMINOUS MATERIALS

RETAIN all sections

SECTION 703 AGGREGATES

703.07 DELETE and REPLACE Paragraph (a) as follows: “(a) Bed course material for curbing, sidewalks and bike/pedestrian paths shall be 6 inches of aggregate base course Class 6 unless otherwise approved by the Engineer.”

SECTION 704 MASONRY UNITS

RETAIN all sections

SECTION 705 JOINT, WATERPROOFING AND BEARING MATERIAL

705.01 ADD the following to paragraph (a) JOINT SEALANT WITH BACKER ROD:

“The following sealants are approved for sealing concrete joints:

Sika Group - Sikaflex-1c SL

Dow Corning - Dow 890-SL

Pecora Corporation - Pecora 300 SL

Tremco incorporated - Spectrem 900-SL

Sonneborn – Sonalastic SL1

The color of the joint sealant shall match the color of the concrete unless otherwise specified or approved.”

ADD the following to paragraph (b) PREFORMED JOINT FILLERS:

“Preformed joint fillers conforming to AASHTO M 153 Type IV – Polyurethane bonded recycled rubber, are approved.”

SECTION 706 CONCRETE AND CLAY PIPE

RETAIN all sections

SECTION 707 METAL PIPE

RETAIN all sections

SECTION 708 PAINTS

RETAIN all sections

SECTION 709 REINFORCING STEEL AND WIRE ROPE

RETAIN all sections

SECTION 710 FENCE AND GUARDRAIL

RETAIN all sections

SECTION 711 CONCRETE CURING MATERIALS AND ADMIXTURES

711.01 ADD the following: "Liquid membrane-forming curing compound shall be a V.O.C. compliant, dissipating resin, conforming to AASHTO M-148, Type 2 for uncolored concrete or Type 1 (clear) for colored concrete. The following curing compounds are approved:

Dayton Superior - Day-Chem White Pigmented Cure (J-10-W)

Dayton Superior - White Dissipating Cure EF

Euclid – Kurez DR VOX"

711.03 ADD the following:

"Accelerating Admixtures: Set accelerating admixtures shall be non-chloride liquid conforming the ASTM C 494 Type C. The following accelerating admixtures are approved:

BASF Chemical Company - Pozzolith NC 534

Grace Construction Products - Daraset 200, 400 or HES

Euclid Chemical Company – Eucon NCA or Eucon ACN

Evaporation Retardants. The following evaporation retardants are approved:

BASF Chemical Company - CONFILM

Dayton Superior - Sure Film J-74

Euclid Chemical Company - EucoBar

Color Additive for Colored Concrete shall be manufactured by DAVIS Colors, 3700 East Olympic Blvd., Los Angeles, CA or an approved substitute.

SECTION 712 MISCELLANEOUS

712.13 ADD paragraph (e) and include the following:

"High Density Polyethylene Corrugated Pipe with Smooth Interior for Storm Sewers, Culverts, and Drains.

- (1) ASTM F-405: Standard Specification for Corrugated Polyethylene Tubing and Fittings
- (2) ASTM F-667: Large Diameter Corrugated Polyethylene Tubing
- (3) AASHTO M 252-851: Standard Specifications for Corrugated Polyethylene Drainage Tubing
- (4) AASHTO M 294-851: Corrugated Polyethylene Pip, 12 to 24 inch Diameter
- (5) The nominal size of the pipe is based on the nominal inside diameter of the pipe.
- (6) The tolerance on the specified inside diameter shall be +3%, -1.5%, or ½ inch, whichever is less. Lengths shall be no less than 99% of stated quantity.
- (7) Pipe shall be joined by split corrugated couplings at least 7 corrugations wide and exceeding the soil tightness requirements of the AASHTO Standard Specification for Highway Bridges, Section 23 (2.23.3).

(8) Pipe Stiffness

The pipe shall have a minimum pipe stiffness at 5% deflection as follows:

Diameter (inches)	Pipe Stiffness (PSI)
12	45
15	42
18	40
24	34

Tests shall be in accordance with ASTM D2412 with a minimum one diameter sample length, a loading rate of 0.5"/min., and readings at 5% deflection.

(9) Hydraulics

The pipe shall have a minimum tested Mannings "n" value of 0.012.

(10) Perforations

Where perforated pipe is specified, the perforations shall conform to the requirements of Class 1, unless otherwise specified in the order. Class 1 perforations are for pipe intended to be used for subsurface drainage or combination storm and underdrain. The perforations shall be cleanly cut so as not to restrict the inflow of water. Pipe connected by couplings or bands may be unperforated within 4 inches (100 mm) of each end of each length of pipe.

- A. Class I Perforations: The perforations shall be approximately circular and shall have nominal diameters of not less than 3/16 inch (4.8 mm) nor greater than 3/8 inch (9.5 mm) and shall be arranged in rows parallel to the axis of the pipe.

The perforations shall be located in the external valleys with perforations in each row for each corrugation. The rows of perforations shall be arranged in two equal groups placed symmetrically on either side of the lower unperforated segment corresponding to the flow line of the pipe. The spacing of the rows shall be uniform. The distance between the center lines of the rows shall not be less than 1 inch (25 mm).

(11) Retest and Rejection

If any failure to conform to these specifications occurs, the pipe or fittings may be retested to establish conformity in accordance with agreement between the purchaser and seller. Individual results, not averages, constitute failure."

SECTION 713 TRAFFIC CONTROL MEASURES

RETAIN all sections

SECTION 714 PRESTRESSED UNIT MATERIALS

RETAIN all sections

SECTION 715 LIGHTING AND ELECTRICAL MATERIALS

ADD the following to Section 715.03:

"Light poles shall meet the following requirements:

Manufacturer: Mountain States Lighting or Approved Equal

Part#: 9SRS-3.5-NO TENON-11.50" BOLT CIRCLE-BLACK or Approved Equal

Height: 9' Pole or 12' Pole (near intersections)

Base: 44" Slipover decorative base cover, Die-Cast Aluminum Alloy 356HMLC, High Strength, Copper Free, 10" Hex, 10 3/4" Point to Point, Separate Anchor Bolt Covers

Handhole: 2" x 5" Handhole opening in base of pole

Ladder Rest: 4" OD, 3.5" ID ladder rest, black finish, per Town Details

ADD the following to Section 715.04:

Luminaires and Lamps shall be one of the following per the Contract Documents:

PROV-T3-32LED-3K-700-LDL-HSS-PCA-T (Providence or Approved Equal)

F660-GX919-40-277-T2 or T5 (Newport, Welsbach, or Approved Equal)

PRMD2-72L-335-3K7-3-BLT-FTG-TRA5D-MOD 4.5" (Promenade or Approved Equal)

SECTION 716 WATER LINE MATERIALS

DELETE Section 716 in its entirety and REPLACE with the Town of Breckenridge Water Construction Standards

SECTION 717 REST AREA AND BUILDING MATERIALS

DELETE Section 717 in its entirety.

CHAPTER 1 GENERAL PROVISIONS

TABLE OF CONTENTS

1.1	PURPOSE	1
1.2	AUTHORITY	3
1.3	JURISDICTION	3
1.4	AMENDMENTS & REVISIONS	3
1.5	OTHER STANDARDS	3
1.6	RIGHT TO ENFORCE OTHER STANDARDS	34
1.7	RIGHT TO REQUIRE PUBLIC IMPROVEMENTS	4
1.8	REVIEW & APPROVAL	4
1.9	CONSTRUCTION SPECIFICATIONS	4
1.10	VARIANCES	4
1.11	GLOSSARY	5

LIST OF ATTACHMENTS – APPENDIX A

VARIANCE REQUEST FORM

1.1 PURPOSE

These Engineering Design Standards and Construction Specifications, also called the “Standards” or “Engineering Standards”, are established by the Engineering Division of the Public Works Department for the design and construction of public and private improvements in the Town of Breckenridge (Town).

The purpose of these Standards is to set forth certain rules and regulations so there is reasonable degree of assurance that the development of public and private improvements will be completed so that the health, safety, welfare and property of the Town and citizens will be safeguarded and protected; and to assure there will be a certain uniformity in performance with respect to design and construction of public and private improvements; and thereby securing for the present and future residents of the Town the beneficial effects of public and private development, while protecting the community against actions that would deteriorate the quality of the natural and manmade environment. These Standards are established to serve the following objectives:

1. Update Town Standards to reflect changes in the engineering and construction industries
2. Provide greater consistency with local, state, federal, and other agency codes
3. Provide consistent design and construction basis for infrastructure within the Town
4. Ensure public welfare and promote efficient development that considers the future of the community
5. Protect the water quality of the Blue River and its tributaries
6. Protect wetlands and other sensitive habitats in a mountain environment
7. Mitigate traffic caused by development
8. Improve pedestrian and bicycle facilities
9. Provide improved access for people with disabilities
10. Provide guidelines on navigating the Engineering Division development review process
11. Protect the public by establishing the minimum acceptable level for design and construction of infrastructure

To provide consistency in the design of infrastructure within the Town, these Standards generally follow criteria or design methodology that are in conformance with regulations and laws established by the following agencies. Where no requirement is given in the Town Engineering Standards, the following documents shall govern.

1. American Association of State Highway and Transportation (AASHTO)
2. Colorado Department of Transportation (CDOT)
3. Colorado Revised Statutes (CRS)
4. Federal Americans with Disabilities Act (ADA) Regulations
5. Federal Highway Administration (FHWA)
6. Federal Statutes and Regulations (CFR)
7. Mile High Flood District (MHFD)
8. National Cooperative Highway Research Program (NCHRP)
9. U.S. Department of Transportation, Manual of Uniform Traffic Control Devices (MUTCD)
10. United States Access Board (PROWAG and ADAAG)
11. National Cooperative Highway Research Program (NCHRP)

Additionally, the following guides and manuals listed below shall be referenced and used in conjunction with these Standards. Where no requirement is given in the Town Engineering Standards, the following documents shall govern. In the event of a conflict between Town Engineering Standards and the following documents, the more stringent requirement shall typically govern. The most recent version of the documents below shall govern.

1. AASHTO Green Book
2. AASHTO Roadside Design Guide
3. CDOT Roadway Design Guide
4. CDOT Bridge Design Manual
5. CDOT Pavement Design Manual
6. CDOT Drainage Design Manual
7. FEMA National Flood Insurance Program (NFIP)
8. International Fire Code (IFC), 2018
9. ITE Trip Generation Manual, 10th Edition, Institute of Transportation Engineers, 2017
10. ITE Trip Generation Handbook, 3rd Edition, Institute of Transportation Engineers, 2017
11. Highway Capacity Manual, 6th Edition: A Guide for Multimodal Mobility Analysis, Transportation Research Board, 2016
12. State Highway Access Code, State of Colorado, March 2002
13. Manual on Uniform Traffic Control Devices, 2009 with Revisions 1 and 2, Federal Highway Administration, May 2012
14. Mile High Flood District (MHFD) Design Manuals

The following Town Documents shall be referenced and used in conjunction with these Town Engineering Standards. In the event of a conflict between Town Engineering Standards and the following documents, the more stringent requirement shall typically govern. The most recent version of the documents below shall govern.

1. Title 9 of the Breckenridge Town Code, also referred to as the Town Development Code

- ~~1-2.~~ Blue River Walkway Improvements Plan
- ~~2-3.~~ Breckenridge Free Ride Transit Master Plan (2020)
- ~~3-4.~~ Breckenridge Sidewalk Master Plan
- ~~4-5.~~ Breckenridge Transit Master Plan (2020)
- ~~5-6.~~ Cucumber Gulch Recreation Master Plan
- ~~6-7.~~ Handbook of Design Standards
- ~~7-8.~~ Joint Upper Blue Master Plan
- ~~8-9.~~ Park Ave SH 9 Roundabout Modeling and Construction Feasibility Study (2017)
- ~~9-10.~~ _____ Sustainable Breckenridge Plan
- ~~10-11.~~ _____ The Arts District of Breckenridge Master Plan
- ~~11-12.~~ _____ Town of Breckenridge Capital Improvements Program
- ~~12-13.~~ _____ Town of Breckenridge Code of Ordinances (Including the most recent versions of Titles, Chapters, and Ordinances Pending Codification)
- ~~13-14.~~ _____ Town of Breckenridge Comprehensive Plan **2008**

- ~~14-15.~~ Town of Breckenridge Goals and Objectives Report
- ~~15-16.~~ Town of Breckenridge Open Space [and Trails Master Plan](#)
- ~~16-17.~~ Town of Breckenridge Small Cell Procedures and Design Guidelines (~~May 2019~~)
- ~~17.~~ [Town of Breckenridge Trails Plan \(revised August 2008\)](#)
- ~~18.~~ [Town of Breckenridge Trail Standards and Guidelines](#)
- ~~19-18.~~ Town of Breckenridge Vision Plan (2002)
- ~~20-19.~~ Town of Breckenridge Water Construction Standards
- ~~21-20.~~ Transportation, Parking, and Urban Design Study (2016)
- ~~22-21.~~ Upper Blue Nordic Master Plan (revised 2011)

Additional standards and documents referenced for construction specifications are included in Chapter 9. See Chapter 9 for additional information on construction standards and specifications.

Several modifications were made to the criteria in the documents listed above to include flexibility, encourage context-sensitive design, and reflect the local values of the Town. The modifications recognize the constraints of the Town's topography, the desire to maintain and enhance natural drainageways, and the mountain environment of the community. The Town of Breckenridge Engineering Standards supplement or modify the above criteria.

These Standards provide the minimum acceptable standards for safe, consistent, effective, and economical infrastructure. Actual site design may require additional detail or more conservative design parameters to address site-specific issues.

1.2 AUTHORITY

These Standards have been developed by the Engineering Division of the Public Works Department of the Town of Breckenridge. Authority for review and approval required for these Standards shall be per 10-1-3 of the Town Code. Per Section 10-1-3, the Town Engineer has the authority to administratively formulate, update, amend, and add regulations to these standards.

1.3 JURISDICTION

These Standards shall apply to all projects, both private and public, in the Town of Breckenridge, except where superseded by other government regulations.

1.4 AMENDMENTS & REVISIONS

The Engineering Division may periodically update these Standards to reflect current practices or policy revisions per Section 10-1-3 of the Town Code.

1.5 OTHER STANDARDS

Where no requirement is given, the current edition of the AASHTO, CDOT, Urban Storm Drainage Criteria Manual (USDCM), Manual of Uniform Traffic Control Devices (MUTCD), Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG) design standards, or ADA Accessibility Guidelines (ADAAG) or other agency/document listed in Section 1.2 of these Standards shall govern unless otherwise approved by the Engineering Division. Where the Town's documents do not cover a specific situation, consult the Engineering Division to confirm the appropriate standards. If a specific situation is not covered by these, the applicant shall propose a design standard for the Town to review and approve before proceeding with development. In addition to these Standards, designers, developers, and contractors are responsible for following all other applicable federal, state, and local regulations. Where there is a conflict between these Standards and other codes or regulations, the more stringent standard shall generally apply unless otherwise approved by the Town Engineer.

1.6 RIGHT TO ENFORCE OTHER STANDARDS

These Standards may not include all requirements necessary for future development. Special site conditions, project types, or other conditions may warrant the use of additional standards and criteria not included in these Standards. The Town reserves the right, in the Town's best interest, to issue and enforce more stringent criteria when appropriate as determined by the Town Engineer.

1.7 RIGHT TO REQUIRE PUBLIC IMPROVEMENTS

The Town Engineer may require public improvements due to direct or indirect impacts of development. Public improvements may include utilities, streets, sidewalks, trails, open space, parks, bridges, street lights, transit improvements, detention and water quality, wetland enhancements, stream restoration, and any other public improvements as determined by the Town Engineer. Utility work may include Town water, Town fiber (supply and install of equipment), sanitary sewer, storm sewer, street lights, and other utilities as determined necessary. All construction costs of public improvements shall be the responsibility of the development. The Town shall not be responsible for any of the design, development, and construction costs of the public improvements. See the following chapters of these Standards for additional public improvement standards.

1.8 REVIEW & APPROVAL

The Engineering Division will review submittals for general compliance with these Standards per Chapter 2 of these Standards. An approval by the Town does not relieve the owner, contractor, engineer, or designer from responsibility of ensuring that calculations, plans, specifications, and construction are accurate and in compliance with these Standards, accepted engineering practices, or other applicable requirements and regulations.

1.9 CONSTRUCTION SPECIFICATIONS

Construction specifications and details are included in Chapter 9 of these Standards and may be frequently updated. If the Town does not have a required construction specification or detail, CDOT construction specifications and the CDOT M&S Standards shall be used. If neither the Town nor CDOT has a construction specification or detail required for a project, the proposed specifications and details shall be submitted to the Engineering Division for review per Chapter 2 of these Standards.

1.10 VARIANCES

All applications for designs varying from these Standards shall obtain written approval of the variance from the Town Engineer on the Town's Variance Request Form prior to final approval of the plans. The following will be considered when evaluating variances:

1. Site-specific constraints,
2. Effect on safety,
3. Right-of-way constraints,
4. Public benefit,
5. Availability of other alternatives, and
7. Need for mitigation measures.

Variances must be requested in writing using the Town's Variance Request Form (included as an attachment to this chapter) and at a minimum include plans, text, and supporting documentation as necessary to support the information provided in the Variance Request Form.

The variance request must be prepared by or under the direct supervision of a Colorado-licensed professional engineer and be stamped and signed certifying that the variance will not result in any hazard to the public or increase the likelihood of damage to any public or private properties.

Upon receipt of a written request for a variance from a particular provision of these Standards, the Town Engineer will issue a determination on whether the variance should be granted or denied given the specific circumstances for which it was requested. The Town Engineer will provide a copy of the determination to the applicant. Determinations made by the Town Engineer in interpreting and enforcing these Standards involve the considered application of professional engineering and transportation planning judgment and skill in the context of each situation. If a variance request is denied, the applicant may appeal the denial per the provisions of the Town Code.

1.11 GLOSSARY

When the following words, phrases, or abbreviations appear in these Standards, they shall have the following definition and meaning. Where a word, phrase, or abbreviation appear in these Standards, but are not defined below, the definitions and meanings shall be assigned per the Town Code, other referenced standards, or industry accepted definitions.

100-year storm and 2-year storm: These terms refer to the statistical recurrence interval of different types of storms. A recurrence interval is a statistically determined average period of time within which a given rainfall intensity and duration will be equaled or exceeded only once. For example, the 100-year storm refers to the intensity and duration of rainfall which, on the average, will be equaled or exceeded once during a 100-year period. The larger the recurrence interval, the higher the intensity. The 100-year storm will have a higher intensity and total volume than the 2-year storm.

100-year flow/flood: a peak discharge that can be expected to be equaled or exceeded once every hundred years. This event has a 1% chance of occurring during any given year. Discharge rates, water surface elevations, and floodplain boundaries for the Blue River and its major tributaries are provided in the FEMA Flood Insurance Study. .

AASHTO: American Association of State Highway and Transportation Officials

ABC: Aggregate Base Course.

acceleration lane: a speed change lane, including tapered areas, for the purpose of enabling a vehicle entering a roadway to increase its speed to a rate at which it can more safely merge with through traffic.

access: driveway or other point of access such as a street, road, or highway that connects to the general street system. Where two public roadways intersect, the secondary roadway will be the access.

acre foot: a measurement of water volume. An acre foot equals the amount of water necessary to cover an acre at a depth of one foot (43,560 cubic feet).

ADT: Average Daily Traffic. The total bidirectional volume of traffic passing through a given point during a given time period, divided by the number of days in that time period.

alley: Minor public street adjacent to the side or rear of residential, commercial, or industrial property and used for vehicle access.

applicant: The person or designated agent responsible for preparation of Town permit applications and associated permit responsibilities. The terms “applicant” and “developer” may be used interchangeably.

approach: the portion of an intersection leg which is used by traffic approaching the intersection.

auxiliary lane: the portion of the roadway adjoining the traveled way for speed change, turning, weaving, truck climbing, maneuvering of entering and leaving traffic, and other purposes supplementary to through- traffic movement.

ASTM: American Society for Testing and Materials.

basin: an area of land, so defined by a physical boundary that when rain falls upon this area, all the resulting stormwater runoff will drain by gravity toward a common watercourse (natural stream, reach,

river, or manmade channel, ditch, gutter, etc.) and ultimately exits the area at the specific point (known as the outfall).

bicycle facilities: a general term denoting improvements and provisions made by public agencies to accommodate or encourage safe and efficient bicycling or other alternative modes of transportation.

bicycle lane (bike lane): the portion of the roadway that has been designated by striping, signing, pavement markings, colored pavement, or other markings for the preferential or exclusive use of bicycles.

bridge: any structure conveying a roadway or path over a body of water or other feature. Structures shall be designed to carry a combination of loading per appropriate codes and designed by a registered professional engineer. Arch culverts, large diameter culverts, and other structures may be classified as bridges.

building permit: a written document issued by the Town Building Division to allow a developer or contractor to complete building improvements per building codes.

CAD: abbreviation for Autodesk AutoCAD software. Town requires submittals as .dwg extension electronic files compatible with the most recent version of Autodesk AutoCAD Civil 3D software.

capacity: the maximum number of vehicles that have a reasonable expectation of passing over a given roadway or section of roadway in one direction during a given time period under prevailing roadway and traffic conditions.

CDOT: Colorado Department of Transportation

commercial: an area of the Town in which all or a portion of the development is for commercial use. An area may be defined as commercial, even if the majority of the area is zoned as residential use, but there is a sufficient amount of commercial development to generate many commercial pedestrian and vehicle trips.

chicane: offset curb extensions which change the path of vehicular travel from straight to curvilinear and promote traffic calming.

civil construction drawings: detailed engineering plans required for all projects with public infrastructure.

CMP: corrugated metal pipe

CO: Certificate of Occupancy. A written document issued by the Building Division indicating that a building or site is in a condition suitable for occupancy.

code: the latest official adopted ordinance, policies, codes, and/or regulations of Town of Breckenridge or other agencies.

construction: any grading, excavation, earth disturbing activities, roadway work, paving, vertical building, utility work, directional boring, and any other alteration or modification to a site or right-of-way.

consultant engineer: a Colorado licensed professional engineer working on behalf of the Developer.

contract documents: the executed contract agreement, approved plans, technical specifications, and permits, and all other documents prepared by a Colorado licensed professional engineer for construction a facility

contractor: the person, firm, or organization to whom a construction contract is awarded by the Developer, or who has been issued a right-of-way work permit. Contractor may be the same entity as the Applicant or Developer, or may be a separate entity.

contour interval: a contour is a line drawn on a map through points of equal elevation. A contour interval is the elevation difference between contour lines.

critical volume: a traffic volume (or combination of volumes) for a given street which produces the greatest utilization of capacity for that street in terms of passenger cars or mixed vehicles per hour.

cross-section: a view of the interior or horizontal cut through a roadway, structure, or object and includes a representation of all relevant elements.

cross-slope: slope of the pavement surface, excluding gutter, measured perpendicular to the street centerline.

cross-street flow: flow of stormwater runoff across the traffic lanes of a street from external sources, as distinguished from sheet flow of water falling on pavement surface.

culvert: a covered channel or pipe that takes a watercourse under a road, through the downstream embankment of a detention facility or below ground. Some “culverts” may also be classified as “bridges”.

days: calendar days, not normal working days unless stipulated as working days.

deceleration lane: a speed change lane, including tapered areas, for the purpose of enabling a vehicle that is to make an exit turn from a roadway to slow to a safe turning speed after it has left the main stream of faster moving traffic.

design hour volume: hourly traffic volume used for street design and capacity analysis, usually one or more peak hours during a 24-hour period.

design speed: the typical vehicle rate in miles per hour (mph) which a street is designed to accommodate. Design speed shall typically match the posted street speed limit.

design vehicle: the vehicle a street must consider and accommodate for acceptable speed, turning movements, loading, and other considerations.

designer: the person, firm, or organization responsible for the creation and submission of contract documents or construction plans for the construction of a facility. Designer shall be a Colorado licensed professional engineer.

detached sidewalk: a sidewalk that is offset from the roadway and curb by a minimum distance of four feet.

detail: an engineered drawing illustrating all features and requirements for construction of a structure or facility.

detention facility: a basin or structure designed for the storage of stormwater runoff that allows for slower, controlled release during or immediately following a storm. A typical facility consists of a detention pond with an embankment on the downstream side, and a pipe or concrete box outlet. The size of the pond is based on a specific design storm and the amount of water that can be discharged through the outlet. Design features may be incorporated into detention facilities to allow them to function as sediment ponds.

developer: the private person, partnership, or corporation legally responsible for the construction of streets, subdivisions, infrastructure, or any other public or private improvement. Developer shall secure all required approvals and permits from the Town and assume full and complete responsibility for the project. The terms “owner,” “applicant,” and “permit holder” may be used in place of “developer” and hold the same definitions and responsibilities.

development: construction of improvements on land that is vacant or containing minimal infrastructure or improvements.

development code: title 9 – land use and development, of the Town of Breckenridge Code.

development permit: a written document from the Town community development department to complete development per codes, standards, and other documents.

drainageway: a route or course along which water moves or may move to drain an area. A “natural” drainageway refers to the route or course in an area prior to the construction of any urban improvements.

drainage easement: a grant to the Town of the right to control development, access, or maintenance of a drainage right-of-way or an area subject to periodic flooding.

driveway: a constructed access serving three or less units and connecting to a street or adjacent driveway. May also be called a “private access.”

easement: the portion of public or private land dedicated to the public or another entity for the installation, maintenance, and use of utilities, drainage, vehicle access, pedestrian access, snow storage, or other public uses. Easements may be granted through a subdivision plat or other legal instrument as approved by the Town Attorney. Easements shall grant the legal right of use of the property by the grantee. Easements may grant the Town the ability to complete maintenance work, but does not require the Town to complete maintenance.

Encroachment License Agreement: A written document granting a property owner the ability to construct and maintain private improvements within a Town ROW or easement. The encroachment license is revocable and sets many requirements of the property owner for the encroachment.

EPA: United States Environmental Protection Agency.

ESA: Environmentally sensitive areas. An area such as wetlands, streams, lakes, ponds, Cucumber Gulch Wildlife Preserve, and other special wildlife habitat areas which require special requirements to protect their sensitive nature during development.

fees: monetary charges which compensate the Town for services rendered or infrastructure constructed.

FEMA: Federal Emergency Management Agency.

FHWA: Federal Highway Administration, Department of Transportation.

field order: a written notice given by the Town to the Designer, Contractor, or Developer detailing a change, request, mandate, or corrective action necessary to conform to these Standards, approved plans, or other applicable Local Entity Codes.

final acceptance: the written notification from the Town, after the Town finds the warranty period to be satisfactorily completed, that all public improvements are free of defects and the Town releases the Developer from future maintenance obligations.

FIRM: Flood Insurance Rate Map.

floodplain development permit: a document granted to developers or contractors to construct improvements or complete earthwork activities within 100 feet of the 100-year floodplain.

freeboard: the elevation difference between the normal maximum level of water surface and the bottom of the confining structure, which is provided so debris may more readily pass through the structure without creating blockage and waves and other movements of the water will not overtop such confining structures.

grade: the inclination or slope of a channel, canal, conduit, street, etc., or other natural ground surface, usually expressed in terms of the percentage or number of units of vertical rise (or fall) per unit of horizontal distance.

grading plan: a detailed engineering plan showing contours, slopes, existing elevations, proposed elevations, retaining walls, and other grading features for a site.

HCM: Highway Capacity Manual. Publication of the Transportation Research Board of the National Academies of Science which defines the ideal conditions of uninterrupted traffic flow.

HMA: Hot Mix Asphalt.

HEC: Hydrologic Engineering Center, an element of the USACE, Institute for Water Resources (CEIWR) that supports the nation in its water resources management responsibilities by increasing technical capability in hydrologic engineering and water resources planning and management.

HMS: Hydrologic Modeling System (HEC-HMS) developed by the USACE to simulate the complete hydrologic processes of dendritic watershed systems.

LOS: level of service. A qualitative measures used to relate the quality of motor or pedestrian vehicle traffic service; usually measured from a LOS A to LOS F.

initial acceptance: the Town's process to initially accept ownership after the Developer has completed all proposed improvements identified in the approved plans and agreements, and after the Town has inspected and approved improvements. Initial acceptance begins the two year warranty period.

infrastructure: public roadways, sidewalks, pedestrian routes, trails, stormwater improvements, potable water improvements, sanitary sewer improvements, lighting, irrigation, fiber optic cable and conduit, other utilities, stormwater management, transit facilities, retaining walls, signage, and any other structures, improvements, or installations as determined by the Town Engineer.

inlet: 1) an opening into a storm sewer system for the entrance of surface storm runoff; 2) a structure at the upstream end of a conduit; or 3) the upstream connection between the surface of the ground and a drain or sewer for the admission of surface or storm water.

inspector: an authorized representative of the Town Engineer, assigned to make inspections to assure work is completed in compliance with plans, standards and specifications.

intersection sight distance: the minimum distance required for the driver of a motor vehicle stopped at a stop sign on a minor street or driveway to see approaching vehicles, pedestrians, and bicyclists along the intersecting major street and have sufficient space to make any allowed move to cross the major street or merge with traffic on the major street without causing vehicles, pedestrians, or bicyclists traveling at or near the design speed on the major street to slow down.

ITE: Institute of Transportation Engineers

landscaping: materials including, without limitation, grass, ground cover, shrubs, trees, perennials, annuals, non-living material commonly used in landscape development, and irrigation systems.

LTS: Level of Traffic Stress. A measure which quantifies the amount of discomfort which bicyclists experience near vehicular traffic.

MHFD: Mile High Flood District, formerly the Urban Drainage and Flood Control District (UDFCD).

MHT: Method of Handling Traffic. "MHT" may also be referred to as a "Traffic Control Plan (TCP)". Detailed drawings outlining the layout of traffic control devices for a project and signed by a TCS.

MUTCD: Manual on Uniform Traffic Control Devices.

minor storm and major storm: these terms refer to the recurrence intervals of storms used to design stormwater infrastructure. The minor storm (also called the initial storm) is the 2- to 10-year storm depending on land use at the design location. The major storm is the 100-year storm, and the uncontrolled runoff from this storm could possibly cause major property damage or even loss of life.

multimodal: inclusion of several different modes of transportation. Examples include vehicular, pedestrian, bicycle, bus transit, gondolas, and other public transit modes.

NFIP: National Flood Insurance Program.

NRCS: Natural Resource Conservation Service.

open channel: a watercourse which conveys stormwater runoff within the drainage basin to the outfall of the basin. It has a defined bed and banks that confine the runoff, but it has a surface open to the atmosphere and cannot develop pressurized flow.

ordinance: a law established by the Town of Breckenridge.

O&M Plan: operations and maintenance plan. A written document defining work and maintenance procedures to maintain infrastructure and facilities to function per the original design intent.

OSHA: Occupational Safety and Health Administration.

PAR: Pedestrian Access Route. A continuous and unobstructed path of travel provided for pedestrians with disabilities within or coinciding with a pedestrian circulation path.

PDF: Portable Document Format. Town requires electronic file submittals to be a PDF compatible with the most recent version of Adobe Acrobat.

PE: a Colorado licensed professional engineer.

peak hour: the hour in a day which produces the highest volume of vehicle or pedestrian traffic for a portion of roadway, intersection, or pedestrian route in a day.

pedestrian: a person afoot or in a wheel chair or other pedestrian mobility device.

permitee: the holder of a valid permit for the Town of Breckenridge. "Permitee" may be used interchangeably with "developer".

PHF: Peak Hour Factor. A calculation used to convert the hourly traffic volume into the flow rate that represents the busiest 15 minutes of the peak hour. PHF is calculated through the following equation: $(\text{total hourly volume}) / [(\text{peak 15-minute volume within the hour} \times 4)]$.

plans: construction plans completed and stamped by Colorado licensed professional engineer for public or private improvements.

PLS: a Colorado licensed professional land surveyor

private Improvements: any land, structures, infrastructure, or other object to be used, owned, and maintained by a private person, partnership, or corporation.

project: the public or private improvements designated in the approved plans, which are to be constructed in conformance with these standards. "project" includes private projects, public capital projects, utility projects, ROW projects, and any other improvements in the Town.

private street: a roadway serving four or more units or lots. Private streets are not owned or maintained by the Town of Breckenridge.

project engineer: the professional engineer, registered in the State of Colorado, assigned to a project by a Town permit holder to inspect and observe construction and to complete and sign and stamp construction inspection and observation reports.

public improvement: any land, structures, infrastructure, or other object dedicated to the Town, public, or other agency. Public improvements are typically conveyed to the Town and subsequently owned and maintained by the Town. Also include facilities which will be privately owned but serve the public, or private facilities serving a large number of people, such as utilities and stormwater drainage.

punch list: a written list of work items, compiled by the inspector, which do not conform to these Standards, the plans, specifications, or other codes that govern the project. The developer is responsible for completing the list of work items prior to initial acceptance.

rational method: a design method which determines a peak runoff rate based on drainage area, rainfall intensity, and imperviousness for watersheds of 90 acres or less.

record drawings: design drawings updated by a professional engineer, depicting all modifications from the design that occurred during construction.

redevelopment: removal or modification of existing improvements, remodeling, and construction of new improvements on a site which has existing improvements. Sites with minimal existing improvements is not considered redevelopment.

report: a document containing analyses, surveys, tests, exhibits, and other pertinent data prepared by a Colorado licensed professional engineer.

road: the entire width of a public right-of-way, including the roadway, pedestrian routes, landscaped areas, shoulders, and other areas within the right-of-way.

ROW: right-of-way. Land owned by the Town for the use of a public street, alley, sidewalk, path, or other use.

ROW permit: right-of-way permit. A document granted by the Town to a developer or contractor to construct any public or private improvements in the ROW, or for any equipment, materials, or encroachment in the ROW, or disruption to pedestrians or vehicles within a ROW.

SCS: Soil Conservation Service. A hydrological method that uses geographical rainfall time distributions, curve numbers and time of concentration to determine peak runoff that may be used for water sheds of any size or when hydrograph routing is required for design.

SCS method: Soil Conservation Service method.

SFHA: Special Flood Hazard Area. An area identified by FEMA as an area having flood-related hazards and where the NFIP floodplain management regulations must be enforced.

shared use path: a paved path at least 10 feet wide for pedestrians, bicyclists, and other non-motorized transportation uses.

SIA: Subdivision Improvement Agreement. A written document establishing a surety and requirements for a developer to complete improvements in the Town.

sidewalk: paved path for pedestrian use within a ROW or easement and separated from the roadway by a curb or detached at least four feet.

sight distance: the length of roadway which is visible to a vehicle operator.

site plan: a detailed engineering drawing showing proposed improvements to a site.

snow storage: additional area within a right-of-way, easements, or private property for stacking and storing snow and ice. May also be called snow stacking areas.

specifications: a written document describing in detail the scope of work, materials to be used, methods of installation, and quality of workmanship for construction work.

stable channel/ditch: a streambed, drainageway, or ditch in which sediment transport conditions are in balance, neither acquiring significant deposits of sediments nor experiencing significant erosion.

standards: these Town of Breckenridge Engineer Standards, inclusive of all attachments, amendments, and referenced/supplemental codes and standards.

stop work order: a written directive from the Town revoking the developer's and contractor's rights to continue work on the project due to nonconformance with these standards, plans, specifications, or other project documents.

SSD: Stopping Sight Distance. The minimum length of roadway required to be visible for a vehicle operator to safely recognize an object within a roadway and stop the vehicle prior to colliding with the object. SSD can also be defined as the sum of the braking distance and the distance traversed by a vehicle during the reaction time.

storage lane: additional lane footage added to a deceleration lane to store the maximum number of vehicles likely to accumulate during a critical period without interfering with the through lanes.

stormwater runoff: the water from precipitation running off from the surface during and immediately following a period of rain.

storm sewer system: also called a storm drain system; a system of inlets, manholes, and conduits that conveys runoff to drainageways and natural channels. Storm sewers are necessary whenever the street capacity to carry the design storm runoff is exceeded by either the minor or the major storm.

street: the entire width of a public right-of-way, including the roadway, pedestrian routes, landscaped areas, shoulders, and other areas within the right-of-way.

street flow: the total flow of stormwater runoff in a street, usually the sum of the gutter flows on each side of the street.

subdivision: a tract of land surveyed and divided into separate parcels or lots. "Subdivision" may also refer to a neighborhood or several adjoining lots in the Town.

subdivision permit: a type of development permit issued by the Town Community Development Department for dividing a tract of land into separate parcels or lots.

substantial completion: the period when the work has progressed to the point where it is sufficiently complete so some or all of it can be utilized for the purposes which it is intended.

SUE: subsurface utility engineering. The Colorado Senate Bill 18-167 that amended Title 9, Article 1.5 of the Colorado Revised Statutes to improve safety by modifying requirements associated with the location underground utilities prior to construction.

surcharged: a condition when the hydraulic grade line within a storm sewer rises above the elevation of an inlet.

surety: a financial instrument, such as cash, bond, letter of credit, or other instrument acceptable in form to the Town Attorney, securing the developer's responsibility to complete construction of improvements for a project. Surety shall also be a financial instrument to secure the Developer's obligations through the warranty period.

SWMM: Storm Water Management Model, developed by the EPA and used for hydrologic and hydraulic analysis.

SWMP: Stormwater Management Plan. A construction plan and associated written narrative required for construction sites to prevent pollution, contamination, or degradation of waters of the State and to prevent discharge of pollutants from a project site.

TDM: Transportation Demand Management. A set of strategies aimed at reducing travel demand or to redistribute the demand in space or in time.

TCS: certified Traffic Control Supervisor.

Town: abbreviation for the Town of Breckenridge. Town may refer to the entire municipality, the Town Engineering Division, or other Town Departments and Divisions.

Town Code: The Town of Breckenridge Municipal Code. Includes all codification and ordinances pending codification. Town Code is a collection of laws passed by the Town and have the force and effect of law for the Town. The Town Code can be found online.

Town Engineer: the Town of Breckenridge Town Engineer or Town Engineering Representative selected by the Town Engineer.

TIS: Traffic Impact Study. An assessment of the adequacy of the existing or future transportation infrastructure to accommodate additional trips generated by a proposed development, redevelopment, or land rezoning which is prepared and stamped by a Colorado licensed Professional Engineer.

Traffic calming: the combination or mainly physical measures that reduced the negative effects of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users.

trail: any path used by pedestrians or bicyclists within a ROW or easement.

UBSD: Upper Blue Sanitation District.

USACE: United States Army Corps of Engineers.

USDCM: Urban Storm Drainage Criteria Manual, published by the MHFD.

USGS: United States Geological Survey.

utility: a network of infrastructure supplying a service to the Town. Examples include gas, electric, sewer, water, and communication.

variance: an approved deviation from these Standards or other rules of the Town of Breckenridge.

vehicle: an instrument for the purpose of conveying people or objects. Vehicles are typically motorized. Wheelchairs and other pedestrian mobility devices are not considered vehicles.

warranty: a written guarantee from developer or contractor guaranteeing all improvements from material and workmanship defects.

warranty period: the two year period of time after the initiation acceptance when the developer or contractor is responsible for warranty of improvements.

wetlands: areas including lakes, streams, ponds, areas of seasonal standing water, and other bodies of water with a predominance of wetlands vegetation (such as willows, rushes, or sedges), or areas with boggy soils. Wetlands definitions and delineations shall be consistent with those of the Army Corps of Engineers.

wheel path: the three foot wide portion on both sides of a roadway travel lane starting two feet from the center of the lane.

work: all construction activity, including materials, labor, supervision, use of tools and equipment, and all other effort required to complete the project in full compliance with these standards, approved plans, specifications, and other documents.

CHAPTER 2 SUBMITTAL REQUIREMENTS & PERMITS

TABLE OF CONTENTS

2.1	INTRODUCTION	3
2.2	GENERAL FORMATTING	3
2.3	ENGINEERING SUBMITTALS	3
2.3.1	Site and Grading Plans	5
2.3.2	Civil Construction Drawings	5
2.3.3	Drainage Reports	6
2.3.4	Geotechnical Report	6
2.3.5	Traffic Impact Study (TIS)	7
2.3.6	Method of Handling Traffic (MHT)	7
2.3.7	Stormwater Management Plan (SWMP)	7
2.3.8	Construction Management Plan (CMP)	7
2.3.9	Construction Specifications	7
2.3.10	Subsurface Utility Engineering (SUE)	8
2.3.11	Permanent Survey Monumentation	9
2.3.12	Ownership and Maintenance Plan	9
2.4	PERMITS	9
2.4.1	Infrastructure Permit	10
2.4.2	Building Permit (without Infrastructure Permit)	10
2.4.3	Right-of-Way Permit	11
2.4.4	Floodplain Development Permit	11
2.4.5	Additional Local Permits	11
2.4.6	State Permits	11
2.4.7	Federal Permits	11
2.5	EMERGENCY WORK	12
2.6	ENCROACHMENT LICENSE AGREEMENTS	12
2.7	POST-CONSTRUCTION SUBMITTALS (SEE CHAPTER 8)	12

LIST OF TABLES

Table 2.1.	Engineering Division Submittal Requirements	4
Table 2.2.	Project Checklist Reference	4
Table 2.3.	Project Permits	10

LIST OF ATTACHMENTS – APPENDIX B

PERMIT PROCESS FLOW CHART

CHECKLIST 1 SITE & GRADING PLAN REQUIREMENTS

CHECKLIST 2 CIVIL CONSTRUCTION DRAWINGS REQUIREMENTS

CHECKLIST 3 DRAINAGE REPORT REQUIREMENTS

CHECKLIST 4 TRAFFIC IMPACT STUDY REQUIREMENTS

CHECKLIST 5 STORMWATER MANAGEMENT PLAN REQUIREMENTS

CHECKLIST 6 OWNERSHIP & MAINTENANCE PLAN REQUIREMENTS

CHECKLIST 7 BUILDING PERMIT (WITHOUT INFRASTRUCTURE PERMIT) REQUIREMENTS

EXAMPLE O&M PLAN

FLOODPLAIN DEVELOPMENT PERMIT APPLICATION

INFRASTRUCTURE PERMIT APPLICATION

2.1 INTRODUCTION

This chapter of the Engineering Standards establishes the requirements and review process for preconstruction submittals to the Engineering Division of the Public Works Department. The engineering submittals specified in this chapter are for Planning Development Permits, Infrastructure Permits, Floodplain Development Permits, Right-of-Way Permits, civil construction drawings, Preliminary and Final Drainage Reports, Traffic Impact Studies, and Stormwater Management Plans (SWMP).

The Infrastructure Permit issued by the Engineering Division is generally required for projects involving roadways, sidewalks and trails, stormwater infrastructure, potable water infrastructure, sanitary sewer infrastructure, lighting, irrigation, fiber optic cable and conduit, other utilities, stormwater management, transit facilities, retaining walls, signage, and any other public improvements. Single Family Homes (SFH) typically do not require an Infrastructure Permit, but one may be required by the Town Engineer depending on the project scope.

This chapter also includes the Engineering Division submittal requirements for a Building Permit and a Right-of-Way Permit. Planning submittals, including landscaping, architectural, historical, and mineral rights submittal requirements, can be found in Title 9 the Town Code. See Title 9 of the Town Code for additional information on the Town's planning process, the types of development permits listed below, how to obtain a development permit, scheduling pre-application meetings, and other planning related items. This chapter discusses the submittal and approval process prior to construction for the Engineering Division. Chapter 8 of these Standards details inspections and acceptance during and after construction.

A permit process flowchart is included as an attachment in Appendix B.

2.2 GENERAL FORMATTING

All drawing sheets, regardless of content, shall be scalable, clear and legible when printed on 11" x 17" paper. Drawings shall be prepared in AutoCAD or a compatible program approved by Town in the Colorado State Plane Central (unmodified) coordinate system for easy incorporation into the Town's GIS database.

Contents shall be drawn to a scale of multiples of ten (e.g. 1" = 10'; 1" = 30'). To preserve the scale when plotting at both full size and half size, drawings may be produced in AutoCAD with an 11" x 17" format. A larger exterior border may then be used with a 24" x 36" format, with an effective area of 22" x 34", to result in an exact doubling of the 11" x 17" half-sized drawings.

Hard copies of plans are not required. All plans shall be provided electronically, in DWG and in PDF in a format that will print to scale on 11" x 17" paper. DWG files shall be provided in a version of AutoCAD specified by the Town.

Each drawing sheet shall include a title block, scale, north arrow, original and revision dates, and professional engineer's stamp when applicable. Title blocks shall be along the bottom or right margin of each drawing.

Hard copies of reports and specifications are not required. All reports shall be provided in electronic format in PDF so that pages of report text will print to scale on 8.5" x 11" paper. Exhibits may be created to print to scale on 11" x 17" paper.

2.3 ENGINEERING SUBMITTALS

Table 2.1 summarizes the Engineering Division submittals required for subdivision permits, development permits, engineering permits, building permits, and right-of-way permits. See the Town Code for Community Development and Building Department submittal requirements. See the Town of Breckenridge Water Construction Standards for Town of Breckenridge Water Division submittals. Contact other agencies and utility companies (including Red White & Blue Fire Protection District,

Upper Blue Sanitation District, and Xcel Energy) for applicable codes and design criteria. A brief cover letter should be submitted with all Engineering Division submittals that includes the following information. A cover letter is not required for single family home projects without an infrastructure permit.

1. Project title
2. Project description including street address, subdivision, lot, and block
3. Owner contact information
4. Engineer contact information
5. Written justification for any required items omitted from the submittal.

There are several types of submittals requiring both a preliminary and a final submittal. Requirements for these are specified in Table 2.1 and the respective subsection for each submittal type. All the submittals listed in Table 2.1 may not be required for a specific project; consult with the Engineering Division to confirm which submittals are required for a project. Table 2.2 summarizes which checklists shall be referenced for different types of projects. Checklists are included as attachments in Appendix B. Any work of any nature within the Town must have at least one of the following permits before starting work: an Infrastructure Permit, a Building Permit, or a Right-of-Way Permit. All three may be required depending on the nature of the work. Permits are discussed in more detail in Section 2.4. No work of any kind, including demolition, removal, or grading, may begin until the applicable permit(s) listed above have been obtained.

Table 2.1. Engineering Division Submittal Requirements

Permit Type	Engineering Division Submittals									
	Site & Grading Plans	Civil Drawings	Drainage Report	Geotech Report	Traffic Impact Study	MHT *	SWMP **	CMP ***	Tech Specs	Other Agency Permits
Class A/B Development Permit Preliminary Submittal	X									
Class A/B Development Permit Final Submittal; Class A/B/C Subdivision Permit Preliminary & Final Submittal; & Class C/D Development Permit	X		X							
Infrastructure Permit	X	X	X	X	X	X	X		X	X
Building Permit (without Infrastructure Permit)	X	X		X		X		X		X
Right-of-Way Permit	X	X				X		X		X

*Method of Handling Traffic/ Traffic Control Plan

**Stormwater Management Plan

***Construction Management Plan

Table 2.2. Project Checklist Reference

Project or Permit Type	Checklist
Development/Subdivision Permit	Checklist 1: Site and Grading Plan Requirements
Infrastructure Permit for grading, drainage, utilities, streets, or sidewalks	Checklist 2: Civil Construction Drawings Requirements Checklist 3: Drainage Report Requirements Checklist 4: Traffic Study Requirements Checklist 6: Ownership & Maintenance Plan Requirements
Any land disturbance	Checklist 5: Stormwater Management Plan Requirements
Building Permit (without Infrastructure Permit)	Checklist 7: Building Permit (Without Infrastructure Permit) Requirements

2.3.1 Site and Grading Plans

Site and grading Plans are required to be submitted to the Engineering Division when a Subdivision or Development Permit is required by the Community Development Department. The preliminary site and grading Plans are required for preliminary Development Permit submittals. Final site and grading plans are required to be submitted with the final Development Permit submittal. Requirements for site and grading plans are listed in Checklist 1. Grading and site plans may be combined for small projects where less detail is needed to clearly understand the intent of the grading plan.

The Community Development Department lists Planning requirements for site plans in Title 9 of the Town Code. If the Applicant can satisfy the Engineering and Planning requirements on a single set, then only one site plan is required. If the Applicant cannot satisfy both sets of requirements on one set, then two submittals are required.

2.3.2 Civil Construction Drawings

Complete civil construction drawings are required for any project that includes public infrastructure. Public infrastructure includes roadways, sidewalks and trails, stormwater infrastructure, potable water infrastructure, sanitary sewer infrastructure, lighting, irrigation, fiber optic cable and conduit, other utilities, transit facilities, retaining walls, signage, and any other public improvements. Both a preliminary and a final submittal of civil construction drawings are required for the Infrastructure Permit (discussed later in this chapter). In general, the preliminary submittal of civil construction drawings shall be at least 60% complete while the final submittal shall be construction-ready and stamped by a professional engineer. For small projects that require an Infrastructure Permit, a single submittal is acceptable with prior approval from the Town Engineer.

Civil construction drawing requirements for most types of construction and grading are specified in Checklist 2, Civil Construction Drawing Requirements. The checklist is provided to guide the content and format of the construction drawings. The drawings must meet the minimum content standards so the Town can thoroughly review the design of the improvements and confirm the design is in accordance with these Standards and with all other applicable standards. Adherence to applicable design standards provides for the health, safety, welfare, and property of the Town and its citizens to be safeguarded and protected.

Depending on the scope of the project, the contents of one or more drawings specified by the checklist may be more efficiently shown on a single drawing. Required contents may be combined or separated as necessary to provide a clear and concise set of construction drawings that provides all the required information.

The design of improvements included in the construction drawings must be completed in accordance with these Standards. The plans will be reviewed for compliance and resubmittal will be required if any aspect of the design of the improvements is not in compliance with the applicable standards and criteria.

2.3.3 Drainage Reports

A drainage report is required for new public storm sewer infrastructure or for private storm sewers that connect to existing public storm sewer infrastructure. A drainage report is also required for private infrastructure if a site's impervious area increases by 0.1 acres or more from existing conditions, regardless of whether new infrastructure is constructed. ~~Both a preliminary and a final drainage report are required.~~ For small projects, an abbreviated drainage memo may be acceptable with prior approval from the Town Engineer. A drainage memo may also be required for commercial redevelopment that does not increase impervious area, but does disturb includes site disturbance of at least 0.15 acres or greater. In general, the preliminary drainage report shall be at least 60% complete while the final drainage report shall be accompanied by construction-ready drawings. Guidance on drainage and water quality design and the Town's drainage and water quality criteria are in Chapter 6 of these Standards.

Both a preliminary and a final drainage report are required. The preliminary drainage report shall be submitted with the final development and final Subdivision Permit applications and shall also meet the requirements of Section 9-1-18 of the Town Code. The final drainage report shall be submitted with the Infrastructure Permit. Requirements for drainage reports are specified in Checklist 3, Drainage Report Requirements. Chapter 6 of these Standards discusses design requirements for stormwater infrastructure within the Town.

2.3.4 Geotechnical Report

A Geotechnical Report is required for an Infrastructure Permit. The Building Department also requires documentation of the bearing capacity of the soils used for foundation design in accordance with the International Building Code (IBC) and the International Residential Code (IRC). The Town may review geotechnical reports and the associated subsurface explorations and analyses to check for slope stability or soil issues, but it shall not be the responsibility or liability of the Town to make an assessment of the soils. It shall be the responsibility of the applicant and their geotechnical engineer to make an assessment of any soil or slope stability issues. The Geotechnical Report shall generally contain the following findings and supporting data. Certain projects may not require all the items listed below depending on the scope of the work.

1. Relative density type and extent of material likely to be encountered.
2. Anticipated excavation issues and proposed solutions.
3. Location and extent of excavation.
4. Suitability of excavated materials for use as backfill or bedding.
5. Compaction characteristics of the soils.
6. Groundwater level and conditions.
7. Soils infiltration testing results if any infiltration facility is proposed.
8. Soils resistivity, moisture content, pH, degree of variation, presence of sulfates, and the likelihood of stray, direct currents.
9. Soil bearing capacity and foundation design recommendations.
10. Recommended pavement type and thickness, base course type and thickness, and any additional subgrade requirements.
11. Test holes to a depth of at least two feet below the subgrade of the proposed improvements; the spacing of test holes shall be as recommended by the geotechnical engineer to adequately define the subgrade.

2.3.5 Traffic Impact Study (TIS)

A Traffic Impact Study (TIS) may be required. Chapter 4 - Traffic Impact Studies of these Standards specifies when a TIS is required. TIS requirements are specified in Checklist 4 of Appendix B.

2.3.6 Method of Handling Traffic (MHT)

A Method of Handling Traffic (MHT) or Traffic Control Plan (TCP) prepared by a certified Traffic Control Supervisor (TCS) is required for work performed within the public right-of-way (ROW) that will impact traffic lanes, shoulders, or sidewalks. A full MHT shall be submitted to the Engineering Division that includes lane closures, vehicular and pedestrian detours, cones, barriers, signage, and any other traffic maintenance devices required. Lane closures, signage, and traffic patterns must meet MUTCD and CDOT requirements. Efforts shall be made to maintain at least one lane of traffic to the extent possible. When one lane cannot safely be maintained, the length and duration of the full road closure shall be minimized to the extent possible. See Chapter 3 of these Standards for additional requirements of when a ROW permit or MHT is required.

2.3.7 Stormwater Management Plan (SWMP)

A Stormwater Management Plan (SWMP) is required when the area disturbed during construction is one acre or more. Construction best management practices must be used to prevent erosion and control sediment. Permanent water quality best management practices are not included in the SWMP but are to be included in the civil construction drawings. Requirements for permanent water quality are specified in Chapter 6 of these Standards. Items required to be included in the SWMP are specified in Checklist 5 - Stormwater Management Plan Requirements of Appendix B. Construction Stormwater Standards are detailed in Section 6.11. See additional permitting requirements in Section 2.4 below for projects disturbing one acre or more.

2.3.8 Construction Management Plan (CMP)

A Construction Management Plan (CMP) is required for projects disturbing less than one acre during construction. Projects disturbing less than one acre, but part of a larger project or development disturbing one acre or more, will still require a SWMP to be submitted. The CMP must be developed to prevent erosion and control sediment. Permanent water quality best management practices are not included in the CMP but are to be included in the civil construction drawings. The CMP shall show the following at a minimum:

1. Best Management Practices (BMPS) to prevent erosion and control sediment from leaving site.
2. Revegetation notes or other final stabilization plans.
3. Construction fencing location.
4. Material and equipment staging locations.
5. Dumpster and portalet locations
6. Vehicle parking locations and construction access location.

2.3.9 Construction Specifications

The Town has adopted standard construction specifications that shall be used on all projects. Project special provisions that vary from the Town Specifications shall be included with the Infrastructure Permit application. For special conditions or construction types which are not addressed by the Town Specifications, the Applicant shall submit proposed specifications for the Town's review.

2.3.10 Subsurface Utility Engineering (SUE)

Colorado Senate Bill 18-167 amended Title 9, Article 1.5 of the Colorado Revised Statutes to improve safety by modifying the requirements associated with the location of underground utilities prior to construction and implementing an enforcement program associated with the new requirements. The new requirements must be met if a project meets all four of the following criteria:

1. Project involves a construction contract with a public entity, construction in the public ROW, infrastructure that will be dedicated to the Town, or other work as determined by the Town Engineer.
2. Project primarily involves horizontal construction and does not primarily involve the construction of buildings.
3. Anticipated excavation footprint exceeds two feet in depth and is at least a contiguous 1,000 square feet (excluding fencing and signing projects) or involves utility boring.
4. Project requires the design services of a licensed professional engineer.

If all the above criteria are met, subsurface utility engineering documentation shall be provided with the Infrastructure Permit application that includes:

1. Notification to 811 that there is an upcoming SUE required project.
2. Depiction of utilities on stamped plans in such a way that they meet or exceed ASCE 38 or provide documented reasons from a licensed professional engineer why they do not meet or exceed Quality Level B.
3. Meeting or exceed Quality Level A for underground facilities at the point of a potential conflict with a gravity fed system including sanitary and/or stormwater facilities.

Quality-level requirements for subsurface utility engineering vary by project phase and are as follows:

1. Project Planning – Quality Level D
2. Preliminary Design – Quality Level B
3. Final Design – Quality Level A

The above Quality Levels provide general guidance for project planning. Refer to Colorado Senate Bill 18-167 for exact Quality Level requirements. Quality Level A is generally required at potential conflicts for gravity fed utilities. Quality Level A may not be required in areas without any sanitary sewer, storm sewer, other potential utility conflicts, or grading conflicts. A Colorado licensed Professional Engineer must determine the appropriate Quality Level based on Colorado Senate Bill 18-167 and document the reasons why any facilities were not located to the particular Quality Level.

Definitions of the Quality Levels are as follows:

1. Quality Level D is the most basic level of investigation and includes verbal recollections and review of existing records such as as-built drawings, utility system drawings, permit logs, field sketches, site visit log books, old surveys, one-call marks, and prior SUE investigations by others.
2. Quality Level C includes surveying those utilities that are visible above ground and use of surface features that indicate subsurface alignment such as valve covers, fire hydrants, pull boxes, manholes, and telephone pedestals. These should be reconciled to ASCE Quality Level D records.

3. Quality Level B includes the use of geophysical methods to determine the existence and horizontal position of all subsurface utilities. Quality Level B can be assigned to a utility segment or subsurface feature whose existence and position are based upon geophysical methods combined with professional judgment and whose location is tied to the project survey datum. Quality Level B is sometimes referred to as designating.
4. Quality Level A requires precise mapping via exposure of the utility. It provides type, size, condition, and material of the utility. Quality Level A includes using nondestructive excavating equipment at critical points to determine the precise horizontal and vertical position, type, size, condition, material, and any other characteristics of underground utilities. The utility should be vertically and horizontally tied to the project datum. Quality Level A is sometimes called locating.

2.3.11 Permanent Survey Monumentation

Permanent survey monuments are required in accordance with Chapter 3 of these Standards. A brief narrative covering the procedures and pertinent information used to establish permanent monumentation must be submitted to the Town Engineer as part of the Infrastructure Permit. GPS survey data shall include a detailed description of the post processing procedure which was used to establish the monument. Permanent survey monuments shall be considered properly positioned and represented only after the Town Engineer has approved all survey procedures and calculations and has verified conformance to standards and specifications for Class 2 surveys or greater. If found to be deficient, the Land Surveyor submitting the final plat and documentation may be required to perform additional work to bring the monumentation into conformance, regardless whether the final plat is recorded or not.

Survey control points, permanent monumentation, and the basis of horizontal and vertical control shall be shown on all plans. Property corners and other survey monuments shall be shown on the plat in accordance with the Town Code.

2.3.12 Ownership and Maintenance Plan

An Ownership and Maintenance Plan (O&M Plan) is required for all detention and permanent water quality facilities. An example O&M Plan, including a template for required plan notes, is included as an attachment to this chapter. Checklist 6, O&M Plan Requirements, is also included as an attachment to this chapter. O&M plans may be required by the Town Engineer for other public or private infrastructure.

2.4 PERMITS

A development permit must be issued by the Community Development Department prior to the applicant applying for any of the permits listed below; an exception may be granted for projects consisting of work contained entirely within Town right-of-way. Any work within the Town must have at least one of the following permits before starting, and all three may be required depending on the nature of the work. Exceptions may be made for Class D minor permits; contact the Engineering Division prior to beginning work to confirm permitting requirements. Additional permits may be required in addition to the three permits listed below.

1. Infrastructure Permit
2. Building Permit
3. Right-of-Way Permit
4. Floodplain Development Permit

Additionally, work within 30' of a special flood hazard area (SFHA) will require a Floodplain Development Permit as part of the permitting process. Table 2.3 summarizes the types of permits that are required for different types of projects and the subsections below discuss each of these in more detail.

All applicable county, state, and federal permits must be obtained and submitted to the Engineering Division prior to the Town issuing the Infrastructure, Building, or Right-of-Way Permit.

Table 2.3. Project Permits

Project or Permit Type	Permit
Any infrastructure improvements	Infrastructure Permit
Any building construction, remodel, or addition	Building Permit
Any work within the public right-of-way	Right-of-Way Permit (ROW Permit)
Any work within 30' of a SFHA	Floodplain Development Permit

2.4.1 Infrastructure Permit

An Infrastructure Permit is required for projects that occur within public right-of-way, projects that disturb one acre or more, and for public & private developments that involve public roadways, sidewalks, trails, stormwater infrastructure, potable water infrastructure, sanitary sewer infrastructure, lighting, irrigation, fiber optic cable and conduit, [heated paver, asphalt, and concrete snowmelt systems](#), other utilities, stormwater management, transit facilities, retaining walls, signage, and any other improvements. If ~~storm sewer~~ infrastructure is being installed on private property and is being connected to public infrastructure, an Infrastructure Permit will be required. An Infrastructure Permit may also be required for other types of work at the discretion of the Engineering Division. An Infrastructure Permit may be obtained at the same time or prior to the Building Permit if a Building Permit is required. Refer to the permit process flow chart in the attachments to this chapter for the permitting process. The Infrastructure Permit application form is also included as an attachment to this chapter. The Engineering Division will review each Infrastructure Permit application and issue the Infrastructure Permit once the application is approved. If any work is proposed within existing Town right-of-way, a separate Right-of-Way Permit will be required in addition to an Infrastructure Permit.

[Work exempted from an infrastructure permit includes single-family homes with a building permit, driveway repaving, and minor work entirely within a right-of-way.](#)

A list of submittals required for the Infrastructure Permit is listed on the Infrastructure Permit Application form attached to this chapter.

2.4.2 Building Permit (without Infrastructure Permit)

If the Engineering Division determines that an Infrastructure Permit is not required, final construction plans shall be approved through a Town Building Permit. Refer to the Town Code for other Town Division submittal requirements. A Building Permit or Infrastructure Permit must be obtained prior to beginning any construction activities (including any staging, demolition, excavation, removals, or grading).

In cases where an applicant desires to begin demolition prior to a building permit or infrastructure permit, they shall contact the Building and Engineering Divisions for approval. Engineering will review these requests and will only allow a demolition permit if the associated site and grading work is minimal.

A checklist of Engineering Division submittals required for Building Permits (Without Infrastructure Permit) is listed in Checklist 7 at the end of this chapter.

2.4.3 Right-of-Way Permit

Any excavation or encroachment into the Town right-of-way requires a Town Right-of-Way Permit from the Public Works Department. The Right-of-Way Permit shall be obtained prior to starting any work within Town right-of-way. Right-of-way regulations are specified in Chapter 3. The permit application and guidance can be found at the Town of Breckenridge Public Works website.

A list of submittals required for the Right-of-Way Permit is listed on the Right-of-Way Permit Application form on the Town website.

2.4.4 Floodplain Development Permit

All work within a Special Flood Hazard Area (SFHA), often referred to as the floodplain, and within areas removed from the floodplain by the issuance of a FEMA Letter of Map Revision based on Fill (LOMR-F) must meet the requirements of the 2018 Breckenridge Flood Damage Prevention Ordinance. A Floodplain Development Permit is required for all work in these areas, regardless of whether a building is being constructed or redeveloped. Work includes, but is not limited to, subsurface and surface utilities, grading, changes to surfacing, infrastructure of any kind, and signage. The Floodplain Development Permit application is included as an attachment to this chapter.

If work in the floodplain will cause any increase in the regulatory floodplain elevation or any decrease in the regulatory floodplain elevation of more than 0.3 feet, a Conditional Letter of Map Revision (CLOMR) issued by FEMA is required. If a CLOMR is issued, the permittee must also submit a Letter of Map Revision (LOMR) to FEMA, and receive approval, once the work has been completed, for the work to be accepted by the Town. The CLOMR submittal and approval from FEMA is required prior to CO or final permit signoff.

A list of submittals required for the Floodplain Development Permit is listed on the Floodplain Development Permit Application form attached to Appendix B.

2.4.5 Additional Local Permits

Work within Summit County right-of-way requires a Summit County Right-of-Way Permit. The application for this permit and submittal instructions are available on the County website via an internet search for "Summit County ROW Permit." Other local permits include a Summit County Grading and Excavation Permit and Summit County Development Permits. Applicants shall review jurisdictional boundaries shown on the Summit County GIS website and determine if their property and adjacent road or the jurisdiction of Town of Breckenridge or Summit County.

2.4.6 State Permits

There are several state permits that may be required. A CDOT Utility/Special Use Permit is required for the installation of utilities and the performance of any other types of work within the state highway right-of-way. A CDOT Access Permit is required to construct or new access to a state highway or to modify an existing access to a state highway.

The Colorado Department of Public Health and Environment (CDPHE) issues several permits to maintain a high level of water quality during construction activities that include one or more acres of disturbance. The two most common permits are for stormwater discharges associated with construction activities and construction dewatering. Information on the various permits issued by the CDPHE and their applicability can be found via an internet search for "CDPHE construction permits."

The Applicant shall submit copies of all required state permits to the Town Engineering Division.

2.4.7 Federal Permits

In addition to the FEMA requirements for working on floodplains discussed above, the most common federal permit is the US Army Corps of Engineers Section 404 Permit. A 404 Permit is required to

discharge fill material into waters of the US. Waters of the US include tributaries, lakes, rivers, streams, creeks, and wetlands. The Applicant shall submit copies of all required federal permits to the Town Engineering Division.

2.5 EMERGENCY WORK

Emergency work is defined as work of an urgent nature to repair or mitigate damage that is creating an immediate hazard to the community, including hazards to the health, safety, and welfare of the Town, environment, or citizens. If emergency work is required, the Engineering Division shall be contacted immediately and all pertinent information shall be conveyed. The Engineering Division will expedite a review of the information and determine if the work qualifies as emergency work. If an emergency work determination is made, the Engineering Division will expedite the review process and may not require all submittals and reviews listed in this chapter. The permit process may be abbreviated, but permits shall still be required in most cases. The review process and required submittals will be determined on a project basis dependent on the nature of the hazard and the work.

2.6 ENCROACHMENT LICENSE AGREEMENTS

The Town does not generally allow private structures, landscaping, or other private improvements within Town right-of-way or easements. If the Town Engineer reviews and approves private improvements within the Town right-of-way or easement, a revocable encroachment license shall be submitted to the Town. The encroachment license agreement shall be acceptable in form and substance to the Town Attorney for the improvements extending into the right-of-way or easement and must be approved by the Town and executed prior to the issuance of a Building Permit, Infrastructure Permit, or Right-of-Way Permit. See Sections 10-2-1-2 and 11-6 of the Town Code for additional information on encroachment license agreements.

2.7 POST-CONSTRUCTION SUBMITTALS (SEE CHAPTER 8)

Post-construction inspections and documentation are discussed in Chapter 8.

CHAPTER 3 RIGHT-OF-WAY & EASEMENTS

TABLE OF CONTENTS

3.1	PURPOSE	1
3.2	WORK IN RIGHT-OF-WAY	1
3.3	ACCESS TO RIGHT-OF-WAY	1
3.4	RIGHT-OF-WAY RULES AND REGULATIONS	1
3.5	SNOW STORAGE	4
3.6	PERMANENT SURVEY MONUMENTS	4
3.7	RIGHT-OF-WAY WIDTHS	5
3.8	EASEMENTS	5
3.8.1	Access Easements	5
3.8.2	Drainage Easements	6
3.8.3	Utility Easements	6
3.8.4	Snow Storage Easements	6

3.1 PURPOSE

This chapter of the Engineering Standards establishes the requirements for public right-of-way (ROW) and easements. A Right-of-Way Permit is required whenever construction, encroachment during construction, installation, or disturbance is proposed within Town ROW. A Right-of-Way Permit is required to ensure utilities, roadway reconstruction, and other work is completed to Town specifications and to provide for public health, safety, and welfare. Examples of work requiring a Right-of-Way Permit are included below:

1. Utility work, including directional boring and drilling
2. Pavement cuts and installation of new roadway or sidewalk improvements
3. Installation of trails, landscaping, signs, lights, transit improvements, or any other surface or subsurface improvements
4. Traffic counts (vehicle or pedestrian) conducted in the ROW
5. Access changes for proposed or existing driveways and roadway accesses
6. Work outside of the ROW, but requiring parking, staging, or traffic control within the ROW
7. Installation of driveway culverts, swales, ponds, and storm sewer infrastructure

Replacement of driveway pavement shall not require a Right-of-Way Permit, provided the driveway cut width does not increase from existing width, no snow melt system is added to the driveway, and no culvert is being installed beneath the driveway.

ROW and easements shall be dedicated for public streets and other infrastructure as needed in accordance with current master plans and development approval requirements. Specific procedural requirements for ROW and easement dedication or vacation are listed in the Town Code. The purpose of this chapter is to provide more detail for completing work in the ROW and guidance on when an easement is required. See Titles 9 through 11 of Town Code for additional information on ROW and easements.

3.2 WORK IN RIGHT-OF-WAY

It shall be unlawful for any person, other than an officer or employee of the Town in the course of his or her employment, to make, cause, or permit any construction in, on, under, or within a public right-of-way of the Town unless such person first obtains a Right-of-Way Permit from the Town Engineer. All work in the ROW shall be performed in conformity with the permit and the terms and provisions of this chapter. For all work within the ROW, the contractor is responsible for obtaining utility locates and any other permits and approvals necessary to complete the work. Submittal requirements for a Right-of-Way Permit are specified in Chapter 2, Submittal Requirements & Permits. Any work performed in the ROW without a permit, work performed outside of allowable dates outlined below, or work not performed in accordance with these Standards is subject to fines, penalties, and enforcement as set forth in the Town Code.

3.3 ACCESS TO RIGHT-OF-WAY

Any new access or any modification of an existing access to a public street or Town ROW shall require a Town Right-of-Way Permit. A new access to a state highway, or a modification of an existing access to a state highway, requires a CDOT Access Permit. New access or modification of an existing access to a county road requires a Summit County Right-of-Way Permit. New access spacing shall meet the minimum requirements listed in Chapter 5 of these Standards.

3.4 RIGHT-OF-WAY RULES AND REGULATIONS

The sections below provide an overview of rules, regulations, and specifications for work in the right-of-way. See Town Code and Chapter 9 of these Standards for additional requirements for work within Town right-of-way.

- A. Work authorized by the Right-of-Way Permit shall be performed between the hours of 7:00 a.m. and 7:00 p.m., Monday through Friday (except holidays), unless the contractor obtains written consent from the Town Engineer to work earlier or later than the stated hours or on a weekend or holiday.
- B. Street pavement cuts will not be allowed between November 1 and April 30, except when:
 - 1. There is a public utility emergency with notification and approval by Town Engineer, or
 - 2. Special or unforeseen circumstances arise as determined by the Town Engineer.

If the Town Engineer approves a pavement cut between November 1 and April 30 due to one of the conditions above, a special provisions memo must be prepared and submitted to the Town Engineer to accommodate pavement patching during winter conditions. Pavement repairs completed during this period shall be considered temporary and be removed and replaced as soon as conditions permit after April 30.

C. TOWN OF BRECKENRIDGE 2018 DIG ONCE ORDINANCE

See Title 11, Chapter 9 of the Town Code for the TOWN OF BRECKENRIDGE 2018 DIG ONCE ORDINANCE. The purpose of this ordinance is to coordinate work in the right-of-way and to minimize the number of excavations and pavement cuts. If the Right-of-Way Permit applicant proposes utility work in the right-of-way, the Town may require the applicant to install additional conduit in the work area with the direct cost of the additional conduit installation to be paid by the Town.

- D. Work authorized by a Right-of-Way Permit shall meet the following conditions:
 - 1. Work shall be conducted in a manner which ensures the least possible obstruction and hazard to the traveling public. The permit holder shall provide for the safety and reasonable accommodation of the residents and users along the rights-of-way where work is being performed, and for the protection of persons and property at all times. The permit holder shall plan work so it does not create safety hazards or maintenance problems.
 - 2. An MHT or traffic control plan shall be submitted prior to approval of the Right-of-Way Permit in compliance with the MUTCD, CDOT S Standards, and these Standards. The plan shall be signed by a certified Traffic Control Supervisor. See the Right-of-Way Permit application for a full list of submittal requirements.
 - 3. The applicant shall provide all submittals, including the traffic control plan, at least 5 calendar days prior to the start of the scheduled roadway work. During the work, the permit holder shall notify the Town of any changes to the traffic control plan, schedule, closures, or any other changes at least 5 calendar days prior to implementing the closures. The permit holder shall provide advance signing and notify appropriate agencies of any road closures and detours at least 5 calendar days prior to actual road closure.
- E. All street pavement cuts shall meet the following conditions:
 - 1. Pavement cuts shall be mechanically cut to form a clean vertical edge. Final pavement cuts shall not be made until immediately prior to paving.
 - 2. Pavement cuts shall be a minimum width of two feet.
 - 3. Pavement cuts shall extend 12 inches minimum beyond the edge of trenching or excavation.

4. Pavement cuts shall be exactly perpendicular or parallel to the travel lane.
 5. Pavement cuts parallel to the travel lane shall not be located in wheel paths for vehicles or bicycles.
 6. If a pavement cut parallel to the travel lane exceeds 150 linear feet, the pavement for the entire lane width shall be milled or removed and overlaid.
- F. All street pavement patches shall meet the following conditions:
1. All excavations made in paved streets, sidewalks, or paths shall be completely restored within 15 calendar days of the pavement removal. In the event weather conditions preclude paving by permanent hot bituminous pavement or concrete, temporary repairs may be made by tamping and rolling into place cold mix asphalt.
 2. Pavement patch depth shall match the existing pavement depth or have a minimum depth of 4 inches, whichever is greater.
 3. Transverse joints on pavement patches shall be perpendicular to travel lane and shall be constructed using a transverse butt joint or tee patch detail.
 4. If the pavement patch is on a roadway which has been paved in the previous 36 months, then all patches shall be full lane width and shall be patched with infrared patching equipment. If a pavement patch exceeds 500 square feet, a "tee patch" detail may be used in place of an infrared patch.
 5. Joint lines and concrete control joints shall not be allowed in bicycle paths, unless joints are perpendicular to the direction of travel.
 6. The surface of the finished pavement shall be free from any depression exceeding three-sixteenths (3/16) inch in ten (10) feet as measured by a ten (10) foot straight edge measured in any direction or an automobile mounted recording profilometer. The pavement surface shall be flush with existing pavement and shall not be raised from existing pavement.
 7. Damaged pavement shall be repaired by appropriate methods as determined by the Town Engineer.
 8. Permit holder shall contract with a geotechnical engineering consultant to provide backfill density testing and pavement testing. Permit holder and tester shall confirm material testing meets Town specifications for compaction and pavement and submit all results to the Town.
- G. Utility work, potholing, and boring shall meet the following conditions:
1. Utility potholing shall be completed with non-destructive excavation methods.
 2. Utility potholes, geotechnical borings, and other subsurface exploration shall not be placed in wheel tracks of roadways, unless required to comply with SUE for a utility conflict point.
 3. Potholes and borings shall be backfilled with low strength flowable fill. Native material shall not be reused in the excavations.
 4. Pavement patching for potholes and borings shall meet the requirements above for pavement patches.
 5. Utility excavation, trenching, backfill, and compaction shall meet requirements of Chapters 5 and 8 of these Standards, the Town Standard Details, and private utility requirements.
 6. The minimum bury depth for any utility shall be 24 inches (measured from top of pavement/surface to top of utility).

5.7. The minimum trench width for any utility shall be 12 inches (measured at the narrowest section of trench).

6.8. Directional boring and drilling of utilities will be allowed with approval by Town Engineer. Directional boring requires a Right-of-Way Permit.

H. All work in the right-of-way shall meet the following additional conditions:

1. All disturbance in the right-of-way shall be repaired upon completion of work, including pavement, landscaping, utilities, irrigation, street lights, shouldering, signage, and striping.
 2. A financial guarantee (surety) shall be required for work within the right-of-way. The surety shall warranty and guarantee the right-of-way work for a period of two years after completion of improvements. See Chapter 8 for inspection requirements and see the Right-of-Way Permit application on the Town website for additional information on submittal and financial guarantee requirements.
- I. Additional requirements for coordinating construction activities within the public ROW are specified in the Right-of-Way Permit application, Chapters 8 and 9 of these Standards, and in the Town Code.

3.5 SNOW STORAGE

Snow storage areas shall be provided for all public rights-of-way. Snow storage areas shall be adequate to provide storage of average snowfalls from the months of November through April. Snow storage areas shall provide actual storage volumes of approximately 48 cubic feet per foot for each 12-foot lane of traffic. For a typical lane width, this equates to 9.6 square feet of snow storage required per linear foot of lane. Maximum snow storage height allowed will be 5 feet. Snow shall not be stored in locations that will limit sight distance at intersections in accordance with AASHTO design criteria. Consideration for extra snow storage areas at intersections and cul-de-sacs will be required. The Town Code provides additional guidance on internal site snow storage requirements.

Additional requirements for coordinating construction activities within the public ROW are specified in Title 11 Chapter 9 of the Town Code.

3.6 PERMANENT SURVEY MONUMENTS

Construction of infrastructure for all new subdivisions requires the installation of permanent survey monumentation. All external boundaries of all subdivisions, blocks, and lots shall be monumented with a permanent monument by a registered land surveyor in accordance with State of Colorado Revised Statutes. Any survey monuments established on dredge tailings by a land survey shall be solidly embedded in concrete per details approved by the Town Engineer and shall be in addition to the minimum standards for surveys set forth in the Colorado Revised Statutes. Additional requirements for the installation and documentation of survey monuments, as well as penalties for damaging survey monuments, are specified in the Town Code.

No point within the subdivision shall be more than one-half mile from a permanent survey monument. See the Town Code for additional spacing requirements. At least two survey control monuments or two corners or points on or near the perimeter of the subdivision traverse must be tied to, or monumented with, permanent survey monuments tied to the Town of Breckenridge survey network (currently under development). The location of permanent survey monuments showing ties to the network currently under development must be provided with the following:

1. Colorado State Plane Central Meridian
2. Delta Alpha and combined sea level and scale factor at the point or for the centroid of the parcel of the subdivided land

3. Vertical elevation in NAVD 88
4. Horizontal coordinates in NAD 83

Permanent survey monuments must be brass caps set in an acceptable base. Caps shall bear the registration number of the surveyor establishing the point and identifying letters or numbers approved by the Town Engineer. This information must be stamped permanently into the cap and must be shown on the final plat for which the survey is performed. Submittal requirements for permanent survey monuments are specified in Chapter 2.

3.7 RIGHT-OF-WAY WIDTHS

Minimum right-of-way widths for the various roadway classifications and sections are discussed in Chapter 5, Street Standards.

3.8 EASEMENTS

Easements shall be dedicated for all public utilities, roadways, drainage facilities, snow storage, sidewalks, shared use paths, trails, public retaining walls, public open space, and all other public improvements if they are not located within the public right-of-way. Easements shall be dedicated for the purpose of all activities associated with installing, operating, maintaining, repairing, and replacing the facility.

No new work or modifications within an easement may occur without approval granted through the Town development process. Trees and landscaping that might interfere with the operation or maintenance of, or access to, any facilities, either immediately after installation or in the future, shall not be located within an easement. Any landscaping or other improvements proposed in an easement shall be approved through a Town encroachment license. The Town is not liable for damage to any landscaping or other improvements located within the easement. No permanent structures shall be located within the easement.

Where easements are required during development, public easements shall be granted to the Town at no charge. Easements shall be granted through the subdivision plat process or other instrument acceptable to the Town Attorney.

The Town Engineer may require additional easements in addition to those listed in this section and may enforce additional requirements depending on the type of facility, location, and other factors specific to the improvements. The Town Engineer may require dedication of an easement during the Infrastructure Permit process.

Additional easement requirements are specified in Titles 9 through 12 of the Town Code.

3.8.1 Access Easements

Right-of-way shall be dedicated to the Town for all new roadways through the subdivision plat process. See Chapter 5 for minimum right-of-way widths for roadways. Where improvements are proposed to an existing roadway outside of the existing right-of-way, an easement is also required. Transit facilities, sidewalks, trails, and shared use paths shall be located within a public easement. Easement widths shall be sufficient to accommodate the facility, drainage, signage, and repair and maintenance of the

facility. The minimum width of the easement will be dependent on the facility and determined by the Town Engineer.

Access easements are required for private roads and driveways serving two or more adjoining lots. Access easements may also be required for fire and emergency access or for any other reason as determined by the Town Engineer.

Easements may be required which prohibit driveway or roadway accesses on the major road. Examples include roadway areas near curves, steep grades, limited sight distance, or other hazards.

3.8.2 Drainage Easements

Drainage easements shall be dedicated for all stormwater detention and permanent stormwater quality treatment facilities. Drainage easements are also required for all streams, channels, ditches, culverts, and storm sewers (if not in a general utility easement) conveying public drainage outside of right-of-way or conveying private drainage across two or more lots. The drainage easements shall be sufficient to allow for construction, operation, repair, and maintenance of the entire facility. The minimum drainage easement width shall be 20 feet.

While each property owner is required to maintain all facilities within the easements on his or her property, easements must be dedicated to allow the Town to maintain the facilities and invoice the owner for all costs incurred if the owner fails to complete the maintenance obligations. Chapter 6 includes maintenance requirements specific to permanent detention and water quality facilities.

3.8.3 Utility Easements

All public utilities not located within the public right-of-way shall be located within a public utility easement. Public utilities include, but are not limited to, water, sanitary sewer, storm sewer (if not in a drainage easement), electric, gas, and communication utilities. Easement widths shall be sufficient for the installation, operation, and maintenance of the utility. Easement width shall be dependent on type, number, and depth of utilities. The minimum utility easement width shall be 20 feet. Easements for shallow utilities may be reduced below 20 feet if installation, operations, and maintenance can be completed reasonably at a smaller width.

3.8.4 Snow Storage Easements

A minimum width of 10 feet shall be provided for snow storage along all roadways outside the shoulder. If the right-of-way does not provide adequate snow storage width, a snow storage easement shall be dedicated to meet the snow storage requirements of Section 3.5, or a 10' easement width, whichever is greater. Additional snow storage widths and easements may be required based on roadway classification, terrain, the presence or need for turnarounds, and roadway geometry. See Title 9 of the Town Code for internal site snow storage requirements. Easements shall be sized and located for reasonable access and use by snow removal equipment. No structures, trees, or other facilities that may impact the ability to store snow may be located within the snow storage easement.

CHAPTER 4 TRAFFIC IMPACT STUDIES

TABLE OF CONTENTS

4.1	PURPOSE	1
4.2	REFERENCE DOCUMENTS	1
4.2.1	Related Town Planning Documents	1
4.2.2	Traffic References	1
4.3	THRESHOLDS REQUIRING A TRAFFIC IMPACT STUDY	2
4.3.1	Study Not Required	2
4.3.2	Trip Generation Letter	2
4.3.3	Short-Term Traffic Impact Study.....	2
4.3.4	Long-Term Traffic Impact Study	3
4.4	TRAFFIC IMPACT STUDY REQUIREMENTS.....	3
4.4.1	Traffic Impact Study Submittals	3
4.4.2	Land Use Scenarios	3
4.4.2.1	Short-Term Traffic Impact Study.....	4
4.4.2.2	Long-Term Traffic Impact Study	4
4.4.3	Analysis Periods	4
4.4.4	Study Area.....	5
4.4.5	Multimodal	5
4.4.6	Impact Analysis	5
4.4.7	Existing Street and Access Analysis.....	6
4.4.7	Study Findings.....	6
4.4.8	Recommendations.....	6
4.4.9	Certification.....	7
4.5	TECHNICAL GUIDELINES.....	7
4.5.1	Data Collection	7
4.5.2	Trip Generation.....	8
4.5.3	Trip Distribution	9
4.5.4	Multimodal	9
4.5.5	Traffic Forecasts.....	11
4.5.6	Impact Analysis	11
4.5.7	Improvement Recommendations.....	12
4.5.8	Intersection Improvement Recommendations	12

LIST OF TABLES

Table 4.1. Monthly ADT Data Conversion Table	7
Table 4.2. Site Directness Ratio	10
Table 4.3. Bicycle Level of Traffic Stress (LTS)	10
Table 4.4. Bicycle LOS	11

LIST OF ATTACHMENTS - APPENDIX B

CHECKLIST 4 - TRAFFIC IMPACT STUDY

4.1 PURPOSE

The purpose of this document is to outline a standard format for preparing a Traffic Impact Study (TIS) in the Town of Breckenridge.

A Traffic Impact Study assesses the effects of a proposed development on the Town's transportation system. The study identifies if the transportation system can operate efficiently with the development, if there are existing conditions that need to be improved, or if improvements are required to mitigate site impacts.

The owner/developer of a project site is responsible for contracting a traffic consultant to assess project traffic impacts and for providing any necessary mitigation measures as part of the development, when required by Section 4.3 of these Standards.

The requirements listed in this document are applicable for all developments in the Town of Breckenridge. In addition to the requirements of this document, owners/developers with sites having access to or within the influence area of a State Highway (for example SH 9) must contact the Colorado Department of Transportation (CDOT) for specific requirements related to access permits, construction permits, or work in the CDOT right-of-way.

Development and installation of pedestrian systems which integrate with existing and future Town pedestrian systems and with the systems of adjacent developments is required. This will include the provision of sidewalks, where required, and the provision of pedestrian walkways pursuant to the Town trails plan.

It is the policy of the Town to require bicycle and pedestrian paths to be dedicated to the Town as a component of the town's alternative transportation network and to provide recreational opportunities. Subdivision proposals shall include, as a component of the required public improvements, a pedestrian and bicycle path system designed to preserve existing paths, integrate with existing improvements, and provide service appropriate to the character and magnitude of the proposed development.

The inclusion of or the contribution to a permanent nonauto transit system, designed to facilitate the movement of persons to and from Breckenridge or within the Town, is strongly encouraged. Nonauto transit system elements in the Town of Breckenridge include, but are not limited to, buses and bus stops, transit shelters, both public and private, gondola lifts, ski lifts, surface lifts, trams, bicycles, electric bicycles, and other alternative transit systems that have the primary purpose of providing access from high density residential areas or major parking lots of the Town to other destinations of the Town. Any development which interferes with the community's ability to provide nonauto oriented transportation elements is discouraged.

4.2 REFERENCE DOCUMENTS

Any new infrastructure or modifications to existing infrastructure and any new development plans shall be in accordance with the most current adopted version of the Town's Related Planning Documents. Traffic references used in the traffic impact study shall be the most current version available, unless otherwise authorized by the Town Engineer.

4.2.1 Related Town Planning Documents

See Chapter 1, Section 1.1 of these Standards.

4.2.2 Traffic References

1. ITE Trip Generation Manual, 10th Edition, Institute of Transportation Engineers, 2017
2. ITE Trip Generation Handbook, 3rd Edition, Institute of Transportation Engineers, 2017

3. Highway Capacity Manual, 6th Edition: A Guide for Multimodal Mobility Analysis, Transportation Research Board, 2016
4. State Highway Access Code, State of Colorado, March 2002
5. Manual on Uniform Traffic Control Devices, 2009 with Revisions 1 and 2, Federal Highway Administration, May 2012

4.3 THRESHOLDS REQUIRING A TRAFFIC IMPACT STUDY

A Traffic Impact Study may be required as part of the submittal documents for annexation, development plan, final development plan, rezoning, plat, reuse/remodel, or other development application. To determine whether a Traffic Impact Study is required, as well as the category of study, the applicant must first estimate the number of peak hour trip ends generated by the development. A vehicle that stops at a gas station, for example, results in two trip ends at the development: one entering trip and one exiting trip.

A Traffic Impact Study is required for any development, redevelopment, reuse, or remodel that increases peak hour traffic by more than 10 trips. Developments increasing commercial gross floor area by 1,000 square feet or the number of residential/lodging units by 10 may exceed this trip threshold. A Traffic Impact Study is also required where any of the following conditions exist:

1. The site increases peak hour traffic volume by more than 20% at a point of State Highway access
2. The site is part of a larger development
3. Site-specific traffic issues require evaluation, as so determined by the Town Engineer
4. Project study area includes an intersection with planned improvements such as:
 - a. South Park Ave/Main Street
 - b. Park Ave/Village Road
 - c. Park Ave/French Street
 - d. Park Ave/Airport Road
 - e. SH 9/CR 450
 - f. SH 9/Ridge Street

4.3.1 Study Not Required

A site expected to generate 10 or fewer trips per hour. Typical examples include single-family developments with fewer than 10 homes, a 5,000 square foot office, or a 2,000 square foot retail establishment (not including gas stations, restaurants, or the like).

4.3.2 Trip Generation Letter

A site expected to generate more than 10 and less than 25 trips per hour. Typical examples include single-family developments with fewer than 20 homes, an office of less than 6,000 square feet, or a retail establishment of less than 5,000 square feet (not including gas stations, restaurants, convenience stores, auto washes, or other services expected to generate more than 10 trips per hour).

In areas that have not been recently studied or located in an area with planned road improvements or identified potential lane additions, a Short-Term Traffic Study may be required.

4.3.3 Short-Term Traffic Impact Study

A site generating between 25 and 50 trips in the peak hour. The site will typically be developed in a single construction phase with anticipated completion in less than three years from the time of development plan approval. Short-term traffic studies shall be required to evaluate traffic conditions at year-of-opening, and 5 years post-development. Typical examples include single-family developments of approximately 30 homes, an office or retail establishment of 10,000 square feet.

4.3.4 Long-Term Traffic Impact Study

Development sites generating over 50 trips in the peak hour or sites that are developed in more than one phase. For phased development, a master traffic study will be prepared prior to the first phase of development and a build-out period not longer than 20 years should be assumed. All subsequent phases will need to prepare a trip generation letter comparing the proposed development with the development type and density projected for the site in the master study. The letter may need to include additional analysis if there is a significant difference between the original development concept and the newly proposed development.

In addition to meeting all the requirements for a short-term traffic study, a long-term traffic study shall evaluate traffic conditions 20-years post-development.

Typical examples include single-family developments with over 50 homes and an office or a retail establishment greater than 12,000 square feet.

The Town Engineer may require long-term traffic studies for developments smaller than the thresholds listed above, depending on the size, location, and type of development.

4.4 TRAFFIC IMPACT STUDY REQUIREMENTS

When a Traffic Impact Study is required it shall be included with the development application. Studies will not be accepted prior to development application. After the Town's initial review of the draft study, the traffic professional shall address Town comments and submit a final study for Town approval. The final Traffic Impact Study shall include the PE's stamp, date, and signature. The final Traffic Impact Study must be approved by the Town Engineer prior to Issuance of an infrastructure or building permit.

If the development application includes a proposal for an uncontrolled or mid-block pedestrian crossing, the traffic study shall include a pedestrian traffic analysis as described in Section 5.14.

Submit one PDF electronic copy of all final traffic impact studies to the Engineering Division.

For sites with access to or within the influence area of state highways, the applicant is also required to contact CDOT for requirements and to get approval for the project from CDOT.

<https://www.codot.gov/business/permits/accesspermits/regional-offices.html#Region2-3>

4.4.1 Traffic Impact Study Submittals

A checklist is provided in Chapter 2 of these Standards that delineates the requirements of the Traffic Impact Study. Not all study elements will be required for every traffic impact study. Content must be specific to the situation and determined based on professional engineering judgment. Where content is specific to a traffic impact study type, that is identified in the checklist.

4.4.2 Land Use Scenarios

Required land use scenarios for the short- and long-term traffic impact studies are summarized in the following:

4.4.2.1 *Short-Term Traffic Impact Study*

Year of Opening w/o Development: This scenario represents area land use as it presently exists. The purpose of this scenario is to identify existing deficiencies and to provide a baseline for comparison with the scenario that includes development.

Year-of-Opening w/Development: This scenario represents area land use as it is projected to exist upon year-of-opening of the development, plus the inclusion of the development. The purpose of this scenario is to identify traffic conditions as they are anticipated to exist with the development.

5-Year Horizon w/o Development: This scenario represents area land use as it is projected to exist at the study's horizon year (5 years), without the development. The purpose of this scenario is to identify anticipated transportation deficiencies and to provide a baseline for comparison with the scenario that includes development.

5-Year Horizon w/Development: This scenario represents area land use as it is projected to exist at the study's horizon year (5 years after year of opening) plus the inclusion of the development. The purpose of this scenario is to identify traffic conditions as they are anticipated to exist with the development upon full-build out.

4.4.2.2 *Long-Term Traffic Impact Study*

Year of Opening w/o Development: This scenario represents area land use as it presently exists. The purpose of this scenario is to identify existing deficiencies and to provide a baseline for comparison with the scenario that includes development.

Year-of-Opening w/Development: This scenario represents area land use as it is projected to exist upon year-of-opening of the development, plus the inclusion of the development. Only the parts of development expected to be complete upon opening year shall be included in the analysis. The purpose of this scenario is to identify traffic conditions as they are anticipated to exist upon the opening of the development.

5-Year and 20-Year Horizon w/o Development: These scenarios represent area land use as it is projected to exist 5 and 20 years after the opening year of the development if the development were not built. The purpose of these scenarios is to identify anticipated transportation deficiencies expected to occur regardless of the development, and to provide a baseline for comparison with the scenarios that include the development.

5-Year and 20-Year Horizon w/Development: These scenarios represent area land use as it is projected to exist 5 and 20 years after the opening of the development. The 5-year scenario will include the parts of the development expected to be complete 5 years after of year of opening, while the 20-year scenario will include the parts of the development expected to be completed 20 years after year of opening (typically this represents full build-out). These scenarios will be compared to the 5-year and 20-year horizon without development scenarios to assess the effects that the development will have on the traffic conditions.

4.4.3 **Analysis Periods**

Conceptually, the design hourly volume for transportation systems is based upon the 30th highest hour of the year. In other words, the traffic volumes used in the study should be sufficiently conservative to ensure that most of the time actual traffic conditions are anticipated to be less than those described in the traffic study. For this reason, traffic data taken off-peak must be factored to peak conditions as described in Section 4.5.1.

With respect to times-of-day, the most important time periods to analyze in the Town of Breckenridge are the weekday PM Peak hour, Saturday AM Peak Hour, and Saturday PM Peak Hour.

In addition to the peak hour, an analysis period should be completed for approximately the median hour in Breckenridge (the hour represent the average traffic volume on a non-peak hour). When comparing traffic conditions and proposed improvements, the peak hour and median hour shall be analyzed for LOS, safety, and other factors. One traffic solution may provide benefits at the peak hour, while a different solution provides benefits at the median hour, resulting in an analysis to compare the benefits and which solution is more favorable when considering all traffic conditions.

4.4.4 Study Area

The study area should include all intersections and access points that may experience a change in traffic operations due to the project. This typically includes all site access points, adjacent local intersections, and the nearest highway intersection(s) used by the generated trips to go to/from the site. If the generated trips are projected to increase a turning movement at a more distant intersection enough to potentially effect overall intersection operations, that intersection shall be analyzed as well.

4.4.5 Multimodal

The traffic study should consider not only potential impacts for motorized traffic, but also whether there are impacts to existing nonauto modes including pedestrian, bicycle, and transit. This section of the report should identify the potential for the project to generate nonauto traffic and to evaluate whether nonauto traffic can be accommodated by the existing environment.

In the multimodal analysis, the study should describe how the site provides opportunities for pedestrians, bicycles, and transit, and also include demand management strategies when relevant. The extent and type of existing and planned infrastructure required for multimodal connectivity to the site, such as sidewalks, trails, transit stops/routes, and alternative modes of transportation, should also be described. The multimodal Level of Service (LOS) for the site should be calculated as described in Section 4.5.4. Where multimodal LOS is not acceptable, the study should recommend on or off-site improvements that can be made to improve LOS. Off-site mitigation shall be consistent with street standards and planning documents referenced in Section 4.2.1.

4.4.6 Impact Analysis

This portion of the study evaluates the impacts that the traffic generated by the project will have on the community. In accordance with Town policy, developments which will generate a volume of vehicular trips which exceed or disproportionately consume the capacity of the external circulation system may have conditions imposed which address the need to provide sufficient traffic carrying capacity to meet this excess demand. This may include a requirement to either provide the necessary improvements at time of development or at some later date, including participating in Improvement Districts, if applicable.

Where the LOS falls below acceptable levels, mitigation will be required. Acceptable mitigation measures may include capacity and access improvements, signalization, signal operation improvements, street widening, additional connections, or other physical improvements. Where existing conditions prevent physical improvements (i.e., steep terrain, adjacent buildings, limited right-of-way, etc.), a project may be required to reduce density, implement transportation demand management (TDM) measures to minimize the demand for vehicle trips and encourage alternate mode use, and/or provide cash-in-lieu of the improvement as described in Section 4.5.7. The TDM strategies may include incentives for carpooling, transit ridership, enhanced bicycle or pedestrian facilities, provisions for telecommuting, or addition of use mixes to increase internal trips.

In addition to evaluating transportation facilities external to the development, the Traffic Impact Study shall include a discussion of the adequacy of the site accesses to accommodate projected site traffic. This may include but not be limited to a review of vehicle turning paths, stacking distances, and the design layout's ability to control speeds and provide safe and efficient circulation.

4.4.7 Existing Street and Access Analysis

This portion of the study shall evaluate the condition and configuration of the existing street providing access to the development. This section shall analyze the street access for all requirements of Chapter 5 of these standards. These requirements shall include, but are not limited to, intersection geometry, sight distance, roadway horizontal and vertical geometry, street widths, street classifications, adjacent access spacing, roadway drainage, vehicle & pedestrian lighting, signage, pedestrian route, transit access, acceleration lanes, deceleration lanes, and clear zone widths.

The Town Engineer may require improvements to existing streets, due to development impacts to the streets, increased demand on existing improvements, or existing streets serving new developments not meeting current standards. Improvements may include, but are not limited to, intersection improvements, sight distance improvements, street widening, adjustments to horizontal and vertical street geometry, drainage improvements, vehicle and pedestrian lighting, signage, pedestrian routes, acceleration lanes, deceleration lanes, clear zone widening, shoulder improvements, and transit improvements.

Existing streets providing access to a new development must be upgraded to current standards if both of the following conditions are met:

1. The existing street does not meet current Town of Breckenridge Engineering Standards.
2. The proposed development will increase the Average Daily Traffic (ADT) of the street by 25% or more.
3. Or as directed by the Town Engineer.

Existing streets must also be upgraded to current standards if a development changes the street classification. An example would be a development increasing the volume of a roadway from a local street to a collector.

4.4.7 Study Findings

This portion of the study provides an overview of the conclusions reached based upon the data and analysis performed and the professional engineering judgment of the author. It includes a factual restatement of the study's primary findings, including summaries of:

1. Development characteristics, including type and density of land use, hours of operation (if known), means of vehicular access, plan for implementation, and any other relevant data or information
2. Existing traffic conditions at study area intersections for each analysis period, including identified LOS, safety, or other operational deficiencies (auto as well as nonauto)
3. Development traffic generation, for peak hours as well as over an average weekday and weekend day for each development phase
4. Traffic impacts of the development, including identification of locations requiring mitigation to address existing or proposed LOS, safety, or other operational deficiencies
5. Extent to which study recommendations address development traffic impacts and existing or proposed deficiencies

4.4.8 Recommendations

Include a list of any improvements needed or proposed, noting who will construct and fund the improvements. Identify if right-of-way is available or is needed to construct the improvements.

Clearly identify study recommendations, including:

1. Proposed mitigation to address identified impacts
2. Other mitigation as identified
3. Improvements needed but not proposed by development

4.4.9 Certification

A short-term or long-term Traffic Impact Study shall be prepared under the responsible charge of a traffic engineer. A trip generation letter may be prepared under the responsible charge of any engineer familiar with procedures for using the *Trip Generation Manual* published by the Institute of Transportation Engineers. All traffic studies and letters shall be sealed and signed by a professional engineer licensed in the state of Colorado.

4.5 TECHNICAL GUIDELINES

4.5.1 Data Collection

The Town Engineer shall be notified at least five (5) calendar days in advance of the proposed locations, days of week and times of day that data will be collected. A Town Right-of-Way Permit shall be obtained prior to placing tubes, cameras, or any other equipment or materials in the right-of-way. Town staff will inform the applicant of any activities that may render the counts invalid such as school holidays, road work, local festivals, or other reasons, in order that the applicant may come up with an alternative plan. Tube counts are not permitted between Labor Day and Memorial Day and may otherwise only occur with prior approval of the Town Engineer.

New traffic counts shall be taken in locations where existing traffic counts are missing or over two years old. Intersection turning movement counts (a record of all vehicle movements including U-turns, left-turns, through movements, and right-turns) should capture the time periods expected to have the highest volumes, typically the weekday PM peak (4-6 PM), and the Saturday AM (8-10 AM) and PM (3-5 PM) peaks. If the changes proposed by the traffic study will have the greatest impact on traffic operations during a time period other than the typical peaks, or the highest overall network volume is expected to occur in a different time period, additional turning movement counts shall be collected during those periods. Turning movement counts shall include pedestrians and bicyclists.

Traffic volumes in Breckenridge are highly seasonal, with the winter and summer months traditionally having the highest volumes. Traffic counts shall be factored to reflect conditions typical to the month of January using the Town's ADT conversion table. This table was developed using CDOT Count Station Data for CO-9. To account for changing traffic patterns throughout the year, a separate factor shall be used for each time period (e.g., traffic counts taken during the AM and PM time periods on a Saturday in May would be multiplied by 2.37 and 2.04, respectively, to reflect volumes typically seen in January). Several types of developments, such as schools or athletic fields, often see peak volumes outside the network peak hours. If, for example, a school is being analyzed, the traffic counts shall be conducted during the school's arrival and dismissal time. If a traffic count is taken outside of one of the specific time periods shown in the table below, the counts shall be multiplied by the monthly average shown in the chart below. Continuing with the example of a school, a count taken between 2:00 and 3:00 PM on a weekday in April would be multiplied by 1.34 to approximate that same time period during a peak season (January) school day.

Table 4.1. Monthly ADT Data Conversion Table

Month	Saturday AM	Saturday PM	Weekday PM	Monthly Average
January	1.00	1.00	1.00	1.00
February	1.00	1.00	1.00	1.01

March	1.13	1.14	0.95	1.02
April	1.64	1.67	1.26	1.34
May	2.10	1.98	1.32	1.45
June	1.61	1.48	1.08	1.14
July	1.32	1.20	0.95	0.96
August	1.37	1.18	0.95	0.99
September	1.53	1.23	1.02	1.07
October	2.04	1.59	1.14	1.30
November	1.57	1.49	1.18	1.28
December	1.27	1.13	1.01	1.06

Per Highway Capacity Manual (HCM) recommendations, a peak hour shall be modeled for each time period analyzed. For studies containing multiple intersections, a system peak hour shall be selected when an intersection affects operations at adjacent intersections (e.g., coordinated signals, travel times runs, microsimulations). Individual peak hours should be used in networks where intersection operations have minimal effects on the operations of nearby intersections (e.g., stop-controlled intersections, non-coordinated signals, roundabouts). The selected peak hour should represent the hour with the worst traffic operations for the study area, typically the hour with the highest total traffic volume. If the primary focus of the traffic study is to analyze side street operations, or a critical movement whose peak may not coincide with the intersection peak (e.g., school, event hall), the selected peak hour should be based on that movement(s) highest volume, rather highest overall volume. A separate peak hour factor (PHF) shall be used for each intersection approach when possible. If the PHF is not available, a default of 0.92 shall be used. Section 4-3 of the HCM 6th Edition should be referenced for further clarification of the peak hour factor.

4.5.2 Trip Generation

Trip generation shall be calculated using the most recent version of the Institute of Transportation Engineers (ITE) Trip Generation Manual. Parts of the procedure discussed in this section cannot be completed with a ITE Trip Generation Manual older than the 10th Edition. For developments within downtown Breckenridge, the “dense multi-use urban” setting/location should be used, and for developments in more isolated locations, the “urban/suburban” setting/location should be used. If a land use option does not have a setting/location option, the default shall be used. The trip rate equation shall be used when provided, otherwise, the flat rate shall be used. The trip generation summary shall include weekday AM and PM data, as well as data for the Saturday peak period. If the exact land use of a development is not included in the ITE Trip Generation Manual, a comparable land use should be used. If the ITE Trip Generation Manual does not contain a comparable land use, other sources may be used, such as previous traffic studies or traffic counts at a similar development.

Capture trips are trips that visit multiple land uses in the same development during the same outing. In locations where this is a frequent occurrence, the number of capture trips shall be calculated and incorporated into the trip generation calculations to avoid double counting trips. Engineering judgment shall be used to determine whether a development will have capture trips (e.g. hotel & restaurant), or whether each land use will generate its own trips independently (e.g. office building & movie theatre). A spreadsheet tool which performs many of the required capture trip calculations can be downloaded in the Trip and Parking Generation section of the ITE website. Some of the land uses in the ITE Trip Generation Manual already account for capture trips, such as shopping centers or office parks with retail. In the cases where the land use from the Trip Generation Manual is mixed use, it is not necessary to calculate the number of capture trips.

Pass-by trips are defined as vehicles that stop at a development on the way to their destination without changing their originally planned route. Gas stations are an example of land uses with high

percentages of pass-by trips. While pass-by trips are added to the volume entering and exiting a site, they are not to be added to the traffic volume along the adjacent road, as they would have been traveling on that road anyway. If a development is expected to attract a high percentage of pass-by trips, a reduction factor should be applied to the generated trips on the adjacent roads. The reduction can be found in Chapter 10 of the ITE Trip Generation Handbook.

4.5.3 Trip Distribution

The distribution of site generated trips shall be based on existing turning movement data or link volumes on the adjacent roadways. In cases where trip distribution is expected to differ from the existing trip distribution through the network (e.g. if a school is located on the edge of the school zone, trips to and from the school will not follow the same directional patterns as network traffic), engineering judgment is to be used. If the trip generation calculations incorporate captured trips or pass-by trips, these assumptions shall be reflected in the trip distribution.

4.5.4 Multimodal

When evaluating operations at a signal with pedestrian crossings, the crossing times shall be compliant with the pedestrian clearance interval requirements outlined in the *Manual on Uniform Traffic Control Devices* (MUTCD). In a coordinated signal network, if there are two or more pedestrian crossings on one leg in an hour, the signal timings should be such that a pedestrian crossing will not force the signal out of coordination.

If the location of a development offers multimodal options of transportation (e.g., bus routes, bike paths/sidewalks, etc.), a portion of the trips generated from the site will likely use multimodal forms of transportation, thus reducing the number of vehicle trips generated. Selecting the appropriate setting/location in the ITE Trip Generation Manual (e.g., general urban/suburban, dense multi-use urban, center city core) will account for this. If a development is planned in an area with easy access to multimodal transportation, and the projected number of generated trips came from outside the ITE Trip Generation Manual without a multimodal factor, a multimodal reduction rate shall be used. These rates can be found in ITE Trip Generation Manual and reduce the number of vehicle trips by a factor that is specific to the location and the development, as some types of developments are more likely than others to generate multimodal trips. Prior to using the multimodal reduction rates, engineering judgment should be used to determine whether a development is in a location, and is the type of development, to generate multimodal trips. The use of a vehicle reduction rate shall be documented.

To fully account for the multimodal function of the transportation system, LOS beyond those calculations described in the *Highway Capacity Manual* shall be considered along development sites and for transportation facilities. New development shall have a minimum multimodal LOS C. LOS D – F shall not be acceptable. While LOS ~~D~~C is acceptable for multimodal LOS, site development should target the best LOS achievable. The site pedestrian and transit LOS shall be evaluated using a directness ratio, as follows:

$$D = (W + U)/C \quad (4.1)$$

Where:

- D = the site's directness ratio
- W = the total walking distance along a trail, public street, or sidewalk from the site's entrance or furthest building to the destination
- U = the distance along the walking route not designed for pedestrians. This includes areas where the pedestrian must walk in the street or shoulder, along unpaved or rough paths, paths less than 4 feet wide, and unmarked crossings of vehicular travel ways
- C = the straight-line distance from the site's entrance or furthest building to the destination

The directness ratio for residential or lodging sites will be measured to the nearest public school, park, or restaurant. For all other uses, the directness ratio will be measured to the nearest public multi-use trail or sidewalk. The directness ratio for Transit LOS will be measured to the nearest transit stop. The resulting LOS from the site directness ratio calculation is shown below. LOS is F where the walking distance exceeds ½ mile, regardless of the site directness ratio.

Table 4.2. Site Directness Ratio

Pedestrian and Transit Level of Service	Site Directness Ratio
A	≤ 1.2
B	$>1.2 - 1.4$
C	$>1.4 - 1.6$
D	$>1.6 - 1.8$
E	$>1.8 - 2.0$
F	>2.0 or walking distance greater than ½ mile

Bicycle LOS shall be evaluated by evaluating the Level of Traffic Stress (LTS) for each street or trail running along and internal to the site. LTS for each facility is rated from 1 to 5, with 1 meaning that there is low stress for cyclists and 5 meaning that it is a high stress environment. The road characteristics for each LTS is shown in the table below:

Table 4.3. Bicycle Level of Traffic Stress (LTS)

Level of Traffic Stress	Shared Lanes	Bike Lanes	Trails
1	2 lanes <2k ADT ≤ 25 mph	2-3 lanes ≤ 25 mph	Greenway
2	2 lanes 2-4k ADT ≤ 30 mph	2-3 lanes ≤ 30 mph	Sidepath (low ped volume)
3	2 lanes 4-6k ADT ≤ 35 mph	3-4 lanes ≤ 35 mph	Sidepath (high ped volume)
4	≥ 3 lanes > 6k ADT > 35 mph	> 4 lanes > 35 mph	
5	≥ 4 lanes > 6k ADT > 40 mph	> 4 lanes > 40 mph Bike lane < 4 ft	

Once LTS has been evaluated, the LOS will be determined by the length weighted average of the facilities along the site. For example, assume a particular site has a roadway bordering it on two sides. One of the roadways fronts 150-ft of the site and is a two-lane local road with 25 MPH speed limit and an Average Daily Traffic (ADT) of 1,500 vehicles per day. The other road fronts 100-ft of the site and is a four-lane collector with bike lanes and a posted speed of 30 MPH. The length weighted average LTS is:

$$[(150\text{-ft} \times 1) + (100\text{-ft} \times 3)] / (150\text{-ft} + 100\text{-ft}) = 1.8.$$

From Table 4.4 the bicycle LOS is C.

Table 4.4. Bicycle LOS

Bicycle Level of Service	Site Bicycle Level of Traffic Stress
A	1.0
B	>1.0 – 1.5
C	>1.5 – 2.0
D	>2.0 – 2.5
E	>2.5 – 3.0
F	>3.0

4.5.5 Traffic Forecasts

CDOT's Online Transportation Information System (OTIS) count stations shall be used when forecasting the background growth for state highways.

<https://dtdapps.coloradodot.info/otis>

The ITE Trip Generation Manual shall be used to calculate the number of generated trips, which will be added to the background growth. When projecting background growth on Town roads, if the road is a through street, the OTIS growth rate for SH 9 may be used. If the road is not a through street, background traffic growth should be based on the trip generation potential for any undeveloped land or known planned development along the local road in addition to the OTIS growth rate for SH 9. For the purposes of this section, "through" streets connect to other roadways and therefore may experience traffic volumes that originate from outside the street in question. If no development (or redevelopment) is expected along a local road, the background growth may be assumed to be zero.

4.5.6 Impact Analysis

Traffic analyses shall be conducted in accordance with procedures outlined in the Highway Capacity Manual, with the Level of Service (LOS) being the primary metric for evaluating intersection operations. LOS is a measure of the quality of traffic flow and ranges from LOS A (nearly ideal traffic conditions with very little delay for motorists) to LOS F (poor traffic conditions with long motorist delays). LOS C is typically considered a "good" traffic condition. LOS D or better conditions are typically desirable during peak traffic periods. A LOS of E or F during peak traffic periods is unacceptable for overall intersections; however, LOS E and F conditions are not uncommon for side street traffic movements at full movement, unsignalized intersections with high volume arterial roadways. In situations where a side street movement operates at LOS E or F, the volume to capacity (V/C) ratio shall be reported as well. If the side street is nearing or at capacity, mitigation measures shall be identified. The Town Engineer may require improvements to any street or intersection projected to operate at a LOS E or F, regardless of whether the movement is a side street. Additionally, the Town Engineer may require mitigation to any drop in LOS (e.g., a reduction from LOS A to LOS C).

A minimum of two future scenarios shall be modeled when assessing the impacts that a development or proposed roadway changes will have on traffic operations. A "w/o Development" scenario, analyzing traffic conditions without the changes proposed by the traffic study, will be compared to the "w/Development" scenario for the same year, analyzing traffic conditions with the proposed changes. If an intersection is expected to operate acceptably for the "w/o Development" scenario, but unacceptably for the "w/Development" scenario (e.g., a signalized intersection or roundabout operating at LOS E or F, or a stop-controlled intersection operating at LOS E or F as well as being near or at capacity), it is the responsibility of the developer to implement intersection improvements in order to ensure acceptable traffic operations at the intersections.

Short-term traffic studies shall be required to evaluate traffic conditions at year-of-opening and 5-years post-development. Long-term traffic studies shall evaluate traffic conditions at year-of-opening, 5-years post-development, and 20-years post-development. In addition, long-term traffic studies that include phased development shall evaluate traffic conditions at completion of each interim phase.

If an unsignalized intersection has high side street volumes, resulting in poor operational conditions, a signal warrant study shall be conducted in a manner consistent with procedures outlined in the MUTCD.

The need for auxiliary lanes on state highways shall be assessed in accordance with the State Highway Access Code requirements. Turning movements that meet the State Highway Access Code standards are required to have an auxiliary lane. If a movement does not meet the required volume, an auxiliary lane may still be installed, if deemed helpful to safety or traffic operations. On local roads, auxiliary lanes shall be installed in locations where they will provide a benefit to traffic operations or safety.

4.5.7 Improvement Recommendations

If the Town Engineer determines that the installation of a needed improvement is not feasible, a cash contribution determined based upon the magnitude of the development's impacts and the capital cost of the needed improvement shall be assessed. Feasibility shall be determined based on physical, schedule, and financial constraints, as well as consideration for other projects and proposed future improvements. The cash contribution shall be in lieu of the improvement and/or land dedications and in proportion to the impacts attributable to the development. A development's proportional share shall be determined by the percent of total trips triggering the need for an improvement that are made up of site generated trips (e.g., if there is a left turning movement of 14 vehicles per hour, warranting a left turn lane, and 7 of those trips are generated from the development, the developments share of the cost will be 50%). The higher percentage between the AM and PM peak hours will be used to determine the developments required contribution. A development's contribution towards a traffic signal will be determined by the percent of the total trips on the higher volume side street made up of development generated trips. If there is a free right turn lane, it may be excluded from the calculations. The higher percentage between the AM and PM peak hours will be used to determine the contribution.

Cash contributions shall be held by the town solely for the acquisition and improvement of transportation mobility (nonauto as well as auto) alternatives within the community. Because of the small size of the community, the provision of transportation mobility improvements anywhere within the Breckenridge Comprehensive Plan boundary shall be deemed to meet the needs of the proposed project.

4.5.8 Intersection Improvement Recommendations

If an intersection is forecasted to operate unacceptably and intersection improvements are required, the Town has a strong preference for the installation of roundabouts, mini-roundabouts, or other geometric treatments. If intersection improvements are required at an intersection identified in the 2017 Park Ave SH 9 Roundabout Modeling and Construction Feasibility Study, then the Developer will be required to construct improvements per the recommendations of that study.

Studies conducted by the Town and other agencies have identified many benefits of roundabouts, including:

- Roundabouts reduced injury crashes by 75 percent at intersections where stop signs or signals were previously used for traffic control (IIHS Study).
- Typical signalized intersections have 32 vehicle-to-vehicle conflict points and 24 vehicle-to-pedestrian conflict points. Typical roundabouts only have 8 vehicle-to-vehicle conflict points and 8 vehicle-to-pedestrian conflict points.

- Roundabouts are designed with geometric curves which force vehicles to reduce speeds through the intersection. At traffic signals, vehicles may speed up to “beat the light”, resulting in higher speeds and the potential for more serious collisions.
- Roundabouts often operate at a comparable or better level of service when compared to signalized or stop controlled intersections. Even at high traffic volumes, roundabouts permit traffic to continue moving instead of creating long stops and standing queues, as may be seen at signalized intersections.
- Roundabouts result in economic benefits for the Town, resulting in approximately \$10,000 of savings in maintenance and electrical costs when compared to a signalized intersection. Additionally, roundabouts do not suffer issues from power outages or malfunctioning due to weather.
- In many cases, roundabouts provide environmental and sustainability benefits by reducing stop and go conditions when compared to traffic signals and stop signs, resulting in less fuel consumption, vehicle wear, and improved air quality.
- Roundabouts provide aesthetic benefits by providing increased landscaped areas in intersections and providing a more natural aesthetic than traffic signals, helping to preserve and maintain the historic character of Breckenridge.

CHAPTER 5 STREET STANDARDS

TABLE OF CONTENTS

5.1	INTRODUCTION	1
5.2	OTHER STANDARDS	1
5.3	GENERAL DESIGN GUIDELINES	1
5.4	STREET CLASSIFICATION	2
5.4.1	Arterial	2
5.4.2	Major Collector	2
5.4.3	Minor Collector	3
5.4.4	Local	3
5.5	DESIGN CONTROLS	3
5.5.1	Design Vehicles	3
5.5.2	Design Speed	4
5.5.3	Right-of-Way Widths	4
5.5.4	Traffic Considerations	4
5.5.5	Capacity Considerations	5
5.6	DESIGN ELEMENTS	5
5.6.1	Sight Distance	5
5.6.1.1	Stopping Sight Distance	5
5.6.1.2	Sight Distance Measurement Criteria	6
5.6.1.2.1	Height of Driver's Eye	6
5.6.1.2.2	Height of Object	6
5.6.1.3	Sight Distance on Horizontal Curves	6
5.6.1.4	Sight Distance on Vertical Curves	7
5.6.1.5	Intersection Sight Distance	7
5.6.1.5.1	Sight Triangles	8
5.6.1.5.2	Approach Sight Triangles (Uncontrolled or Yield-Controlled Intersection)	8
5.6.1.5.3	Departure Sight Triangles (Stop Controlled Intersection)	8
5.6.1.5.4	Identification of Sight Obstructions within Sight Triangles	9
5.6.2	Horizontal Alignment	9
5.6.2.1	Traffic Calming	9
5.6.2.2	Horizontal Curves	10
5.6.2.3	Superelevation	10
5.6.3	Vertical Alignment	11

5.6.3.1	Terrain	11
5.6.3.2	Grades	11
5.6.3.3	Vertical Curves	11
5.6.3.4	Vertical Clearance to Obstructions	12
5.6.4	Cross Section Elements	12
5.6.4.1	Traveled Way	12
5.6.4.1.1	Cross Slope	12
5.6.4.1.2	Lane Widths	12
5.6.4.2	Shoulders	12
5.6.4.3	Roadside Design	13
5.6.4.3.1	Cut and Fill Slopes	13
5.6.4.3.2	Roadside Ditches	13
5.6.4.3.3	Clear Zone	13
5.6.4.3.4	Obstructions	13
5.6.4.3.5	Roadside Barriers	13
5.6.4.3.6	Retaining Walls	14
5.6.4.4	Curbs	15
5.6.4.5	Medians	15
5.7	INTERSECTIONS	15
5.7.1	Alignment and Profile	15
5.7.2	Corner Radii	16
5.7.3	Functional Intersection Area	16
5.7.4	Channelization	17
5.7.4.1	Islands	17
5.7.4.2	Medians	17
5.7.5	Auxiliary Lanes	17
5.7.5.1	Deceleration Lanes	17
5.7.5.1.1	Storage Length	18
5.7.5.1.2	Tapers	18
5.7.5.2	Acceleration Lanes	18
5.7.5.3	Two-way Left Turn Lanes	19
5.8	DEAD END STREETS (CUL-DE-SACS)	19
5.9	BRIDGES	19
5.10	ACCESS CONTROL AND MANAGEMENT	19
5.10.1	Private Access	19
5.10.1.1	Commercial	20

5.10.1.2 Residential	20
5.10.2 Access Management Principles	20
5.10.3 Access Changes	20
5.10.3.1 Number of Accesses	20
5.10.3.2 Location	20
5.10.4 Access Management Techniques	21
5.10.5 Sight Distance	21
5.10.6 Access Spacing	22
5.10.7 Access Width	22
5.10.8 Access Type	23
5.10.8.1 Curb Cut Driveway	23
5.10.8.2 Radius Driveway	23
5.10.9 Access Design Details	23
5.10.9.1 Access Profile	23
5.10.9.2 Access Geometry	23
5.10.9.3 Access Surfacing	24
5.11 PARKING AREAS (ON-STREET PARKING WITHIN RIGHT-OF-WAY)	24
5.11.1 On-street Parking	24
5.11.2 Parking Area Surfacing	25
5.11.3 Parking Grades	25
5.11.4 Parking Stall Requirements	25
5.11.5 Parking Construction Requirements	25
5.12 PEDESTRIAN AND BICYCLE FACILITIES	25
5.12.1 Pedestrian Facilities	25
5.12.1.1 Pedestrian Environmental Impact	26
5.12.1.2 Pedestrian Facility Widths	26
5.12.1.3 Pedestrian Pavement Thickness	26
5.12.1.4 Horizontal and Vertical Clearance	26
5.12.1.5 Sidewalk Widening	26
5.12.1.6 Slope	26
5.12.1.7 Sidewalk Shouldering	26
5.12.1.8 Sidewalk Stormwater	26
5.12.1.9 Sidewalk Alignment	26
5.12.1.10 Heated Sidewalks	27
5.12.1.11 Trail Connections	27
5.12.1.12 Pedestrian Bridges	27

5.12.1.13 Pedestrian Railings.....	27
5.12.1.14 Pedestrian Easements.....	28
~~All pedestrian facilities and trails not located within ROW shall be located within an access easement. Pedestrian facilities and trails shall have a 5-foot minimum distance from back of sidewalk/trail to edge of ROW/easement to accommodate drainage, signage, lighting, and utilities.....~~	
<u>Wh</u> 5.12.2 Bicycle & Shared-use Facilities	28
5.12.2.1 Shared-use Environmental Impact.....	28
5.12.2.2 Design Speed.....	28
5.12.2.3 Shared-use Facility Widths.....	28
5.12.2.4 Shared-use Pavement Thickness.....	28
5.12.2.5 Shared-use Horizontal and Vertical Clearance.....	28
5.12.2.6 Shared-use Widening.....	29
5.12.2.7 Shared-use Slope.....	29
5.12.2.8 Shared-use Shouldering.....	29
5.12.2.9 Shared-use Stormwater.....	29
5.12.2.10 Shared-use Alignment.....	29
5.12.2.11 Shared-use Bridges.....	29
5.12.2.12 Shared-use Railings.....	29
5.12.2.13 Shared-use Easements.....	29
5.13 ACCESSIBLE PEDESTRIAN DESIGN.....	30
5.13.1 ADA Accessibility Requirements, Standards, and Guidelines.....	30
5.13.2 Technical Requirements for Accessible Design.....	30
5.13.3 Curb Ramp Types.....	30
5.13.4 Curb Ramp Technical Requirements.....	31
5.13.4.1 Ramps.....	31
5.13.4.2 Landings and Turning Spaces.....	31
5.13.4.3 Cross Slopes.....	31
5.13.5 Detectable Warning Surfaces.....	31
5.13.6 Pedestrian Crossings at Controlled Intersections.....	31
5.13.6.1 Signalized Intersection Crossing Controls.....	31
5.13.6.2 Stop and Yield Crossing Controls.....	32
5.13.6.3 Roundabout Crossing Controls.....	32
5.13.7 ADA Curb Ramp Variance Process.....	32
5.14 PEDESTRIAN CROSSING CRITERIA FOR UNCONTROLLED OR MID-BLOCK CROSSINGS.....	32
5.14.1 Definitions.....	32

5.14.2 References	33
5.14.3 Pedestrian Traffic Analysis and Recommendations	33
5.14.3.1 Pedestrian Volumes and Delays.....	33
5.14.3.2 Crossing Treatment Criteria.....	34
5.14.3.2.1 Criterion A	34
5.14.3.2.2 Criterion B	34
5.14.3.2.3 Criterion C	34
5.14.3.2.4 Criterion D	35
5.14.4 Crossing Enhancement Eligibility Worksheet	35
5.14.5 Pedestrian Crossing Enhancements	36
5.14.5.1 Pavement Markings and Conventional Signs	36
5.14.5.1.1 Standard Continental Crosswalk Markings	36
5.14.5.1.2 High Visibility Markings	36
5.14.5.1.3 Advanced Yield or Stop Markings and Signs	36
5.14.5.1.4 Pedestrian Sign Assembly	37
5.14.5.2 Physical Geometric Treatments.....	37
5.14.5.2.1 Refuge Islands	37
5.14.5.2.2 Curb Extensions (Bulb-Outs)	37
5.14.5.2.3 Raised Crosswalks.....	37
5.14.5.3 Rectangular Rapid Flashing Beacon (RRFB)	38
5.14.5.4 Pedestrian Hybrid Beacon	38
5.14.5.5 Grade Separated Crossing	38
5.15 TRANSIT FACILITIES	39
5.16 PAVEMENT DESIGN	39
5.16.1 Soils Testing for Pavement Design.....	39
5.16.2 Flexible Pavement Design	40
5.16.3 Rigid Pavement Design	40
5.17 Traffic Control Devices	40
5.17.1 Street Name Signs	41
5.17.2 Stop Signs	41
5.17.3 Private Signage	41
5.17.4 Signage Requests	41
5.18 STREET LIGHTING.....	41
5.18.1.1 Equipment Type and Location	41
5.18.1.2 Positioning at Intersections.....	42
5.18.1.3 Roundabout Lighting.....	43

5.18.1.4 Light Pole Offset Distances	43
5.18.1.5 Underground Service	43
5.18.2 Pedestrian Lighting	43
5.18.3 Dark Sky Ordinance	43
5.18.4 Residential Areas	43
5.19 PRIVATE FACILITIES	43
5.19.1 Private Streets	44
5.19.2 Private Snow Melt Systems	44
5.20 UTILITIES	44
5.21 DESIGN CRITERIA TABLE BY STREET CLASSIFICATION	45

LIST OF TABLES

Table 5.1. Design Vehicles	4
Table 5.2. Right-of-Way Widths	4
Table 5.3. Stopping Sight Distance on Level Roadways	5
Table 5.4. Stopping Sight Distance on Grades	6
Table 5.5. Minimum Horizontal Curve Radius (Normal Crown)	10
Table 5.6. Minimum K Values for Vertical Curves	12
Table 5.7. Acceleration/Deceleration Lane Design Criteria	18
Table 5.8. Auxiliary Lane Storage Lengths	18
Table 5.9 Design Vehicle Selection for Access Sight Distance	21
Table 5.10 Access Spacing Requirements	22
Table 5.11 Access Width Requirements	22
Table 5.12 Crossing Enhancement Eligibility Worksheet	35
Table 5.13 Pavement Thickness Minimums	40
Table 5.14 Design Criteria by Street Classification	45

LIST OF FIGURES

Figure 5.1. Diagram Illustrating Components to Determine Sight Distance	7
Figure 5.2. Approach Sight Triangles at Intersections (Uncontrolled or Yield-Controlled) ...	8
Figure 5.3. Departure Sight Triangles at Intersections (Stop-Controlled)	9
Figure 5.4. Functional Intersection Area	17

LIST OF ATTACHMENTS – APPENDIX C

CROSSING ENHANCEMENT ELIGIBILITY WORKSHEET
BRECKENRIDGE TYPICAL SECTIONS

5.1 INTRODUCTION

Street design addresses safe and efficient movement of vehicles, pedestrians, bicycles, and transit while also incorporating landscaping, utilities, and storm drainage. Low impact drainage systems are encouraged where feasible. The street and trails network create multiple travel routes and minimize the distance required for pedestrians and bicycles to access primary activity sites. This section sets forth the minimum standards for street design and construction. Developers and engineers are encouraged to design above the minimum standards and in some cases due to site specific conditions the Town Engineer may require design above the minimum standards. The purpose and intent of this chapter is to provide safe travel for vehicles and pedestrians, efficient traffic flow which minimizes traffic congestion, and minimizes maintenance concerns.

[Chapter 5 also includes access management, which is the coordinated planning, regulation, and design of access between roadways and land development. It involves the systematic control of the location, spacing, design, and operation of accesses, median openings, interchanges, and street connections. Access management provides the means to balance good mobility along the street network with local access needs of businesses and residents. Implementation of access management principles and techniques on transportation networks can provide the following long-term benefits for highway users, communities, and businesses.](#)

These standards apply to the design, construction, and maintenance of both public and private streets, driveways, pedestrian paths, and on-street parking in the Town of Breckenridge. These standards also apply to all construction, whether completed by a private Developer or the Town of Breckenridge. All Town streets, whether new construction or upgrading of existing infrastructure, shall be built in accordance with these standards.

5.2 OTHER STANDARDS

A significant portion of the criteria used by the Town for Street Standards is taken from the 2018 edition of the American Association of State Highway and Transportation Officials (AASHTO) publication *A Policy on Geometric Design of Highways and Streets*. Throughout the rest of Chapter 5, this document will be referred to as the *AASHTO Green Book*. Where no requirement is given in this chapter, the newest additions of the following standards shall govern, unless otherwise approved by the Engineering Division:

1. AASHTO Green Book
2. AASHTO Roadside Design Guide
3. Manual of Uniform Traffic Control Devices (MUTCD)
4. CDOT Roadway Design Guide
5. CDOT Bridge Design Manual
6. CDOT Pavement Design Manual
7. CDOT Drainage Design Manual
8. United States Access Board (PROWAG and ADAAG)

Construction standards for street related improvements are outlined in Chapter [7-9](#) of the standards. Right of Way requirements for work within existing streets and Right of Ways are outlined in Chapter 3 of these standards. Off-street parking requirements are outlined in the Town Code.

5.3 GENERAL DESIGN GUIDELINES

The Town of Breckenridge is located in a mountainous valley with heavy annual snowfall. Due to the terrain, street design poses unique challenges to meet design requirements. The following guidelines shall be followed for designing in this unique environment:

1. Streets shall be designed to maximize southern exposure and minimize north facing or shaded areas, especially on steeper slopes.
2. Street grades shall be minimized to the extent possible, while also minimizing switchbacks and site disturbance.
3. Streets shall be designed to avoid impacting wetlands and other environmentally sensitive areas. Design shall minimize impacts to the environment.
4. Streets shall be designed to retain as many trees and vegetation as possible. Design shall strive to retain or create vegetative buffers between streets and adjacent properties.
5. Drainage in winter shall be considered and icing of roadways and pedestrian routes shall be considered in the design.
6. Impacts of snow and ice to striping, parking, signage, signal sensors and other improvements shall be considered in the design.

5.4 STREET CLASSIFICATION

Town streets are classified according to function. Functional classifications shall be established by the Town Engineer. The Town Engineer has the authority to make the determination for road classification. For planning purposes, the town uses the following functional categories to classify its roads.

5.4.1 Arterial

An arterial street is a high-capacity roadway. The primary function of an arterial street is to deliver traffic from collector streets to freeways or expressways and provide for travel through and between communities. These streets primarily serve through traffic, and access to adjacent property is limited.

An arterial street generally has the following characteristics:

1. Posted speed limit greater than or equal to 35 mph
2. 4-lane minimum width, plus additional turn lanes
3. 10,000 vehicles per day (vpd) expected minimum traffic volume when the land served by the arterial is fully developed
4. Limited access to adjacent parcels of land
5. No back-out drives are permitted

The only arterial street within the Town is Colorado State Highway 9. Since the Town has no existing or planned arterial streets, the design standards in this chapter will not cover their design. Consult the Colorado Department of Transportation Roadway Design Guide for design of arterial streets on the Colorado State Highway System.

5.4.2 Major Collector

A major collector street is a moderate-capacity street which serves to move traffic from local streets and minor collector streets to arterial streets. The major collector balances both through-travel needs and access to adjacent property favoring more access control and higher speeds.

A major collector street generally has the following characteristics:

1. Posted speed limit from 30 mph to 40 mph
2. Traffic volumes generally between 3,000 and 10,000 vehicles per day when the land served by the major collector is fully developed
3. Designed to handle traffic volumes loading from and onto local, other collector, and arterial streets

4. No back-out drives are permitted

Refer to typical section in Standard Details.

5.4.3 Minor Collector

A minor collector street is a low-to-moderate-capacity street which serves to move traffic from local streets and major collector streets to arterial streets. The minor collector balances both through-travel needs and access to adjacent property favoring a higher level of access and lower speeds than a major collector.

A minor collector street generally has the following characteristics:

1. Posted speed limit from 25 mph to 35 mph
2. Traffic volumes generally between 1,000 and 3,000 vehicles per day when the land served by the major collector is fully developed
3. Designed to handle traffic volumes loading from and onto local, other collector, and arterial streets
4. No back-out drives are permitted

Refer to typical section in Standard Details.

5.4.4 Local

A local street provides direct access from abutting properties to alley, major collector, minor collector, or arterial streets. While it provides for some through travel, the primary purpose is to provide access to individual properties.

A local street generally has the following characteristics.

1. Posted speed limit from 15 mph to 25 mph
2. Traffic volumes up to 1,000 vehicles per day
3. Designed for the safety of pedestrians, bicyclists, and the ease of access to adjacent parcels of land
4. Back-out drives may be permitted for single family homes and duplexes

Refer to typical section in Standard Details.

5.5 DESIGN CONTROLS

5.5.1 Design Vehicles

The street design shall accommodate the turning movements of the design vehicle as listed in Table 5.1 below. The design should allow the design vehicle to make turns at intersections without encroaching into the oncoming lanes. The need for vehicles greater than the design vehicle to turn into oncoming lanes shall be reviewed and the design modified if appropriate based on nearby land use or business operations. Existing, proposed, or potential future transit routes as determined by the Transit Superintendent shall be designed to accommodate the design transit vehicle. The design engineer shall confirm that any local fire district turning requirements are also met.

Table 5.1. Design Vehicles

Street Classification	Design Vehicle
Major Collector	Intermediate Semitrailer (WB-40)
Minor Collector	Intercity Bus (BUS-45)
Local	Single-Unit Truck (SU-30)
Transit Facilities	Intercity Bus (BUS-45)
Commercial Access	Single-Unit Truck (SU-30)*
Multi-family Residential Access	Single-Unit Truck (SU-30)
Single-family Residential Access	Passenger Car (P)

* Commercial accesses that routinely use vehicles larger than a SU-30 should select and appropriate design vehicles for the onsite operations.

Additional details on these and other design vehicles can be found in Chapter 2 of the *AASHTO Green Book*.

5.5.2 Design Speed

The choice of design speed is influenced principally by the character of terrain, roadway classifications, and traffic volume. A roadway in the valley floor justifies a higher design speed than a roadway through steep mountainous terrain.

The design speed for streets in the Town will generally be equal to the posted speed. Under certain conditions, the Town Engineer may require that a design speed exceed the posted speed. Refer to Section 5.2 for the posted speed ranges of each street classification.

5.5.3 Right-of-Way Widths

The width of right-of-way depends on the street cross section to be used, topography in the area, and other physical controls. It is important to acquire sufficient right-of-way to facilitate future widening and other improvements as traffic warrants.

Minimum right-of-way widths to be dedicated for street construction in the Town are listed in Table 5.2 below. These minimums may be increased where necessary to meet side slope requirements, roadside drainage ditch requirements, transit facilities, roundabouts, intersection improvements, and other considerations requiring additional public right-of-way for the street.

The minimum clearance from the right-of-way line to the catch point of a cut or fill slope should be 5 feet for all types of cross sections. When feasible, 10 feet of clearance should be provided. Restrictive easements may be provided in lieu of dedicated right-of-way if approved by the Town Council.

Table 5.2. Right-of-Way Widths

Street Classification	Minimum Right-of-Way Width (feet)
Major Collector	80
Minor Collector	70
Local	50

5.5.4 Traffic Considerations

The design of a street and its features should be based upon consideration of the traffic volumes and characteristics to be served. In urban areas, these characteristics usually are dominated by vehicular traffic demands, but the design should also consider pedestrian, bicycle, and transit uses. Information for all current and projected user modes should be considered jointly. Vehicular traffic volumes typically drive the need for street improvements and will affect the geometric design.

5.5.5 Capacity Considerations

The level of congestion that is considered acceptable for a street or intersection will vary. The Level of Service (LOS) is intended to characterize the operating condition of a street or intersection in terms of speed, travel time, freedom to maneuver, traffic interruptions, comfort, and convenience. The results of the LOS should be a key consideration in the design process. Consult Chapter 4 of this manual for more information regarding traffic considerations for street projects.

5.6 DESIGN ELEMENTS

The alignment of a street produces a great impact on the environment, the fabric of the community, and the street user. The alignment consists of a variety of design elements that combine to create a facility that serves traffic safely and efficiently, consistent with the facility's intended function. Principal elements of design include sight distance, horizontal alignment, superelevation, vertical alignment, and cross section elements.

5.6.1 Sight Distance

Sight distance is the length of roadway visible to a driver. Sight distance is required for safe and efficient operation of a vehicle on a highway. The path and speed of motor vehicles on streets are subject to the control of drivers whose ability, training and experience vary greatly. The available sight distance on a roadway should be sufficiently long to enable a vehicle traveling at or near the design speed to stop before reaching an object in its path.

5.6.1.1 Stopping Sight Distance

Stopping sight distance is the sum of two distances: (1) the distance traversed by the vehicle from the instant a driver sights an object necessitating a stop to the instant the brakes are applied, and (2) the distance needed to stop the vehicle from the instant the brakes application begins. These are referred to brake reaction distance and braking distance, respectively. Table 5.3 contains the stopping sight distances on level roadways based on design speed.

Table 5.3. Stopping Sight Distance on Level Roadways

Design Speed (mph)	Brake Reaction Distance (ft)	Braking Distance on Level (ft)	Stopping Sight Distance	
			Calculated (ft)	Design (ft)
15	55.1	21.6	76.7	80
20	73.5	38.4	111.9	115
25	91.9	60.0	151.9	155
30	110.3	86.4	196.7	200
35	128.6	117.6	246.2	250
40	147.0	153.6	300.6	305
45	165.4	194.4	359.8	360

The roadway grade has a significant effect on the braking distance due to gravity. The braking distances are longer for downgrades and shorter on upgrades compared to a level roadway. Table 5.4 contains the revised stopping sight distances based on grades that exceed an upgrade or downgrade of 3 feet rise or fall per 100 feet longitudinally, or 3%. For grades steeper than 9%, stopping sight distance shall be calculated using equations in the AASHTO green book.

Table 5.4. Stopping Sight Distance on Grades

Design Speed (mph)	Stopping Sight Distance (ft)					
	Downgrades			Upgrades		
	3%	6%	9%	3%	6%	9%
15	80	82	85	75	74	73
20	116	120	126	109	107	104
25	158	165	173	147	143	140
30	205	215	227	200	184	179
35	257	271	287	237	229	222
40	315	333	354	289	278	269
45	378	400	427	334	331	320

5.6.1.2 Sight Distance Measurement Criteria

Sight distance is the distance along a roadway throughout which an object of specified height is continuously visible to the driver. This distance is dependent on the height of the driver's eye above the road surface, the specified object height above the road surface, and the height and lateral position of sight obstructions within the driver's line of sight.

5.6.1.2.1 Height of Driver's Eye

For all sight distance calculations involving passenger vehicles, the height of the driver's eye is considered to be 3.50 feet above the road surface. For large trucks, including single-unit trucks and semi-trailers, the recommended value of a truck driver's eye height is 7.60 feet above the road surface.

5.6.1.2.2 Height of Object

For stopping sight distance calculations, a 2.00 feet object height is used. For intersection sight distance calculations, an object height of 3.50 feet is used.

5.6.1.3 Sight Distance on Horizontal Curves

For general use in design of a horizontal curve, the sight line is a chord of the curve, and the stopping sight distance is measured along the centerline of the inside lane along the curve. The value of the horizontal sight line offset (HSO) are determined by setting S, as shown in the diagrammatic sketch in Figure 5.1 and Equation 5.1, equal to the stopping sight distance (SSD). Alternatively, horizontal sight distance for existing conditions can be measured graphically using a computer automated drafting (CAD) program.

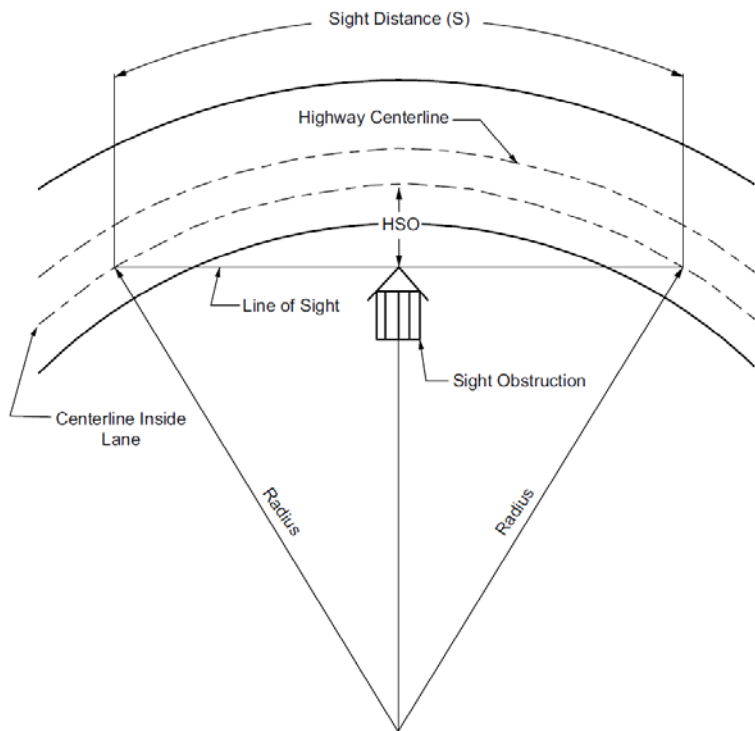


Figure 5.1. Diagram Illustrating Components to Determine Sight Distance

$$HSO = R \left[1 - \cos \left(\frac{28.65 S}{R} \right) \right] \quad (5.1)$$

Where:

HSO = horizontal sight offset (ft)

S = sight distance (ft)

R = radius of curve (ft)

5.6.1.4 Sight Distance on Vertical Curves

The controlling vertical curve design criteria found in Section 5.4.3.3 is based on sight distance. Vertical sight distance for existing conditions can be measured graphically using a computer automated drafting (CAD) program.

5.6.1.5 Intersection Sight Distance

Each intersection has the potential for several different types of vehicular conflicts. The possibility of these conflicts actually occurring can be greatly reduced through the provision of proper sight distances and appropriate traffic controls. The avoidance of conflicts and the efficiency of traffic operations still depend on the judgement, capabilities, and response of each individual driver.

Stopping sight distance is provided continuously along each roadway so that drivers have a view of the roadway ahead that is sufficient to allow drivers to stop. The provision of stopping sight distance at all locations along each roadway, including intersection approaches, is fundamental to intersection operation.

Mid-block or uncontrolled crosswalks shall meet minimum intersection sight distance requirements. Case B1 (Table 9-6 of AASHTO Greenbook) shall be used for minimum values.

5.6.1.5.1 Sight Triangles

Specified areas along intersection approach legs and across their included corners should be clear of obstructions that might block a driver's view of potentially conflicting vehicles. These specified areas are known as clear sight triangles. The dimensions of the legs of the sight triangles depend on the design speeds of the intersection roadways and the type of traffic control used at the intersection. These dimensions are based on observed driver behavior and are documented by space-time profiles and speed choices of drivers on intersection approaches. Two types of clear sight triangles are considered in intersection design—approach sight triangles and departure sight triangles.

5.6.1.5.2 Approach Sight Triangles (Uncontrolled or Yield-Controlled Intersection)

Each quadrant of an intersection should contain a triangular area free of obstructions that might block an approaching driver's view of potentially conflicting vehicles. The length of the legs of this triangular area, along both intersection roadways, should be such that the drivers can see any potentially conflicting vehicles in sufficient time to slow or stop before colliding within the intersection. Figure 5.2 shows typical clear sight triangles to the left and to the right for a vehicle approaching an uncontrolled or yield-controlled intersection.

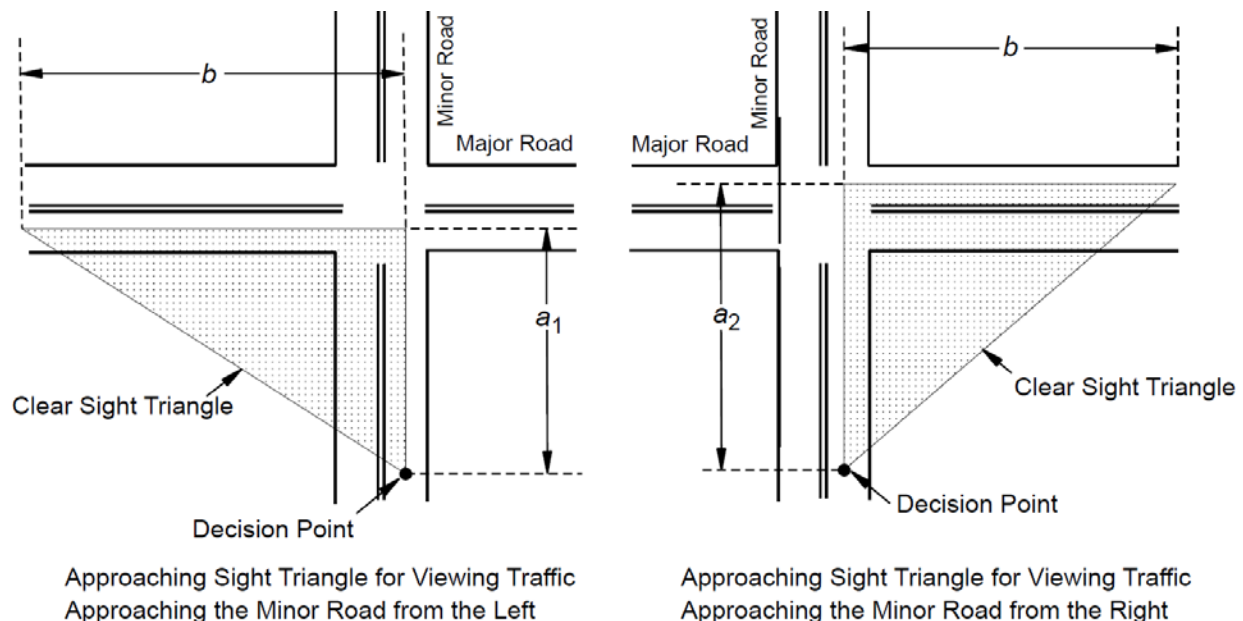


Figure 5.2. Approach Sight Triangles at Intersections (Uncontrolled or Yield-Controlled)

The length of the legs of the approach sight triangle shall be determined in accordance with the practices and standards established in Chapter 9 of the *AASHTO Greenbook*.

5.6.1.5.3 Departure Sight Triangles (Stop Controlled Intersection)

A second type of clear sight triangle provides sight distance sufficient for a stopped driver on a minor-road approach to depart from the intersection and enter or cross the major road. Figure 5.3 shows typical departure sight triangles to the left and to the right of the location of a stopped vehicle on the minor road. Departure Sight Triangles should be provided in each quadrant of each intersection approach controlled by stop or yield signs. Departure sight triangles should also be provided for some signalized intersection approaches.

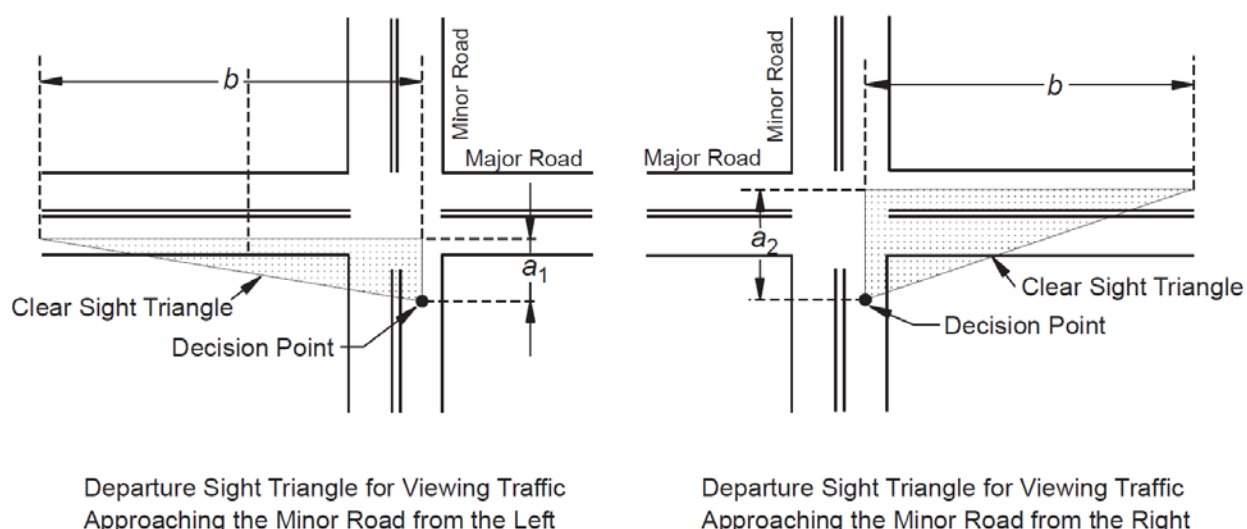


Figure 5.3. Departure Sight Triangles at Intersections (Stop-Controlled)

The length of the legs of the approach sight triangle shall be determined in accordance with the practices and standards established in Chapter 9 of the *AASHTO Greenbook*.

5.6.1.5.4 Identification of Sight Obstructions within Sight Triangles

The profiles of the intersection roadways should be designed to provide the recommended sight distances for drivers on the intersection approaches. Within a sight triangle, any object at a height above the elevation of the adjacent roadways that would obstruct the driver's view should be removed or lowered, if practical. Such objects may include buildings, parked vehicles, roadway structures, roadside hardware, hedges, trees, bushes, unmowed vegetation, tall crops, walls, fences, stored snow and the terrain itself. No objects or improvements shall be allowed over 3.5 feet tall within the sight triangles, with the exception of regulatory signs, signals, or street lights. If landscaping elements are proposed within the identified sight triangles, landscaping must be maintained so that it does not become an obstruction over 3.5 feet tall. Maintenance responsibilities must be agreed upon with the Town Engineer. Sight triangles shall be shown on all roadway and site design plans.

5.6.2 Horizontal Alignment

Street layout is designed to bear a logical relationship with the topography, connect to existing and planned area streets, and provide reasonable access to adjacent parcels. Street layout shall be designed to fit the context of the development and serve vehicle, pedestrian, transit, and bicycle users. Street layout shall avoid long, straight sections to minimize the potential for speeding.

5.6.2.1 Traffic Calming

ITE defines traffic calming as “the combination of mainly physical measures that reduced the negative effects of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users.” Local roads in residential neighborhoods shall be designed with traffic calming features. Intersection improvements and pedestrian crossing enhancements are encouraged for pedestrian safety. Major and minor collectors shall be analyzed for traffic calming and may require traffic calming features. Traffic calming encompasses a wide range of different features and methods; the appropriate features for a specific roadway is dependent on a variety of project specific features such as the design speed, traffic volume, development type, maintenance concerns, location within Town, and site constraints. The following hierarchy of traffic calming methods are listed in order from the generally most preferred method to the least preferred method.

1. Horizontal geometry (appropriate radius curves, chicanes, lane narrowing, and other geometry features to promote use of the roadway at the design speed)
2. Raised crosswalks at intersections
3. Intersection bulb-outs
4. Rectangular Rapid-Flashing Beacon or other light emitting hardware at pedestrian crossings
5. Roadway signage per MUTCD
6. Radar speed signs
7. Striping & thermoplastic markings
8. Median islands
9. Speed Humps

All traffic calming features shall be designed per MUTCD, ADA, and all other relevant standards. Features shall accommodate drainage and shall consider maintenance issues and effectiveness during winter conditions.

Traffic calming requests, studies, and design shall comply with the Town of Breckenridge Traffic Calming Policy, which may be obtained from the Engineering Division. Refer to Section 5.14 for traffic calming measures related to uncontrolled pedestrian crossings.

5.6.2.2 Horizontal Curves

Horizontal curve design should be based on an appropriate relationship between design speed, right-of-way, profile grades, and construction costs—and on their joint relationships with superelevation and side friction. Curves are not required when the delta angle (total central angle of the circular curve) is less than 1 degree. Curves should be at least 500 feet long for a central angle of 5 degrees, and the minimum length should be increased 100 feet for each 1 degree decrease in the central angle. The formula can be found in the *AASHTO Greenbook* and the CDOT M & S Standard Plans. Designers should use every effort to exceed the minimum curve radius when practical. Broken back, compound, spirals, or reverse curves are not recommended. Table 5.5 below gives the minimum horizontal curve radius for a normal crown of 2%. For superelevated roadways, refer to Section 5.4.2.3.

Table 5.5. Minimum Horizontal Curve Radius (Normal Crown)

Design Speed (mph)	Minimum Horizontal Curve Radius (ft)
15	50
20	110
25	200
30	335
35	510
40	765
45	1000

5.6.2.3 Superelevation

Local streets utilize standard crown sections and do not require superelevation. Superelevation may be considered on collector streets to address unique horizontal geometry, drainage, or grade issues. At intersections, grades of the minor street shall be warped to transition to the grades of the major street. If a street design requires the use of superelevation, factors controlling the use of

superelevation include climate conditions, terrain conditions, classification of the street, and the frequency of slow-moving vehicles on the roadway. In general, a lower rate of superelevation is used in urban areas. The maximum allowable superelevation rate is 6%.

The superelevation transition section consists of the superelevation runoff and tangent runoff sections. The superelevation runoff is the length of roadway needed to accomplish a change in outside lane cross slope from zero to full superelevation, or vice versa. The tangent runoff section is the length of roadway needed to accomplish a change in outside lane cross slope from normal cross slope rate to zero, or vice versa. Additional information pertaining to the lengths and use of transitions for simple and spiral curves can be found in the *AASHTO Greenbook*. Refer to *CDOT M Standard – Superelevation Streets* for design requirements.

5.6.3 Vertical Alignment

The design should take into consideration the impact the vertical grade has on the operation of the facility. Designers should consider stopping sight distance requirements for the given speed limit and the challenges of large cut-and-fill sections. Vertical curves are classified as either sag or crest curves. Typically, sag curves are controlled by nighttime driving conditions with headlight visibility restrictions, and crest curves are controlled by stopping sight distances. Vertical curves should be simple in application and should result in a design that is safe and comfortable in operation, aesthetically pleasing, and adequate for drainage—especially when a curb and gutter are used.

5.6.3.1 Terrain

Proposed roads shall follow the natural terrain of the existing area whenever possible.

5.6.3.2 Grades

Grade lines are typically controlled by topography and structure clearances, but very flat grade can be controlled by drainage considerations. Other factors that should be considered are street classifications, design speed, safety, and construction costs. A minimum value of 1.0% should be used for street sections with curbs and gutters. In certain conditions, 0.5% may be used. The designer should consider the ultimate design of the roadway, recognizing if a curb and gutter may be required in the future, and design for those conditions during the interim design. Grades 4% or steeper may require special consideration for drainage or erosion protection.

Maximum grades of streets shall not exceed 6%. Major collectors shall flatten to 2% slope for intersections and shall meet the requirements of vertical curves at the intersections. Minor collectors and local roads shall flatten to 4% slope at intersections and shall meet the requirements of vertical curves at the intersections.

5.6.3.3 Vertical Curves

When using combinations of horizontal and vertical curves, it is important to recognize the driver's perspective. Sharp horizontal curvature should not be introduced at or near the top of a pronounced crest vertical curve. If unavoidable, the horizontal curve should be made longer than the vertical curve to help minimize the driver's inability to perceive the horizontal change, especially at night (For further details, see *AASHTO Greenbook* and the *CDOT Roadway Design Guide*). The length of vertical curves can be determined by dividing the rate of vertical curvature by the grade change or algebraic difference in intersecting grades.

$$L = K/A \quad (5.2)$$

Where:

L = length of the vertical curve (ft)

K = rate of curvature

A = grade change (%)

A vertical curve is not required when a grade change or the algebraic difference is equal to or less than 0.2%. The preferred minimum length of a vertical curve is 300 feet. The allowed minimum is 3 times the roadway design speed. Table 5.6 below gives the minimum K values based on design speed.

Table 5.6. Minimum K Values for Vertical Curves

Design Speed (mph)	Minimum K Value (Crest)	Minimum K Value (Sag)
15	3	10
20	7	17
25	12	26
30	19	37
35	29	49
40	44	64

5.6.3.4 Vertical Clearance to Obstructions

Private overhead structures are not permitted in the public ROW and consideration of such structures shall be limited. Signal height clearances shall be per the current MUTCD. For other structures, there shall be a minimum 18-foot clearance on streets. For sidewalks and shared use paths, there shall be a minimum 10-foot clearance.

5.6.4 Cross Section Elements

5.6.4.1 Traveled Way

5.6.4.1.1 Cross Slope

Cross slope is necessary to ensure adequate drainage. The preferred value for a cross slope is 2% for paved streets. Undivided streets should have a normal crown that is a two-way cross slope, with the high point of the cross section located on the street centerline. Divided streets should have a cross slope on each side of the divide, with the high point of each section located where the pavement meets the median. Cross slopes of 2% are permissible on concrete roadways. Intersections of streets with curbs and gutters sometimes require the use of cross-pans for drainage. At these areas, the normal two-way 3% cross slope shall transition to a one-way slope adjacent to the cross pan, with a slope range of 1% to 2%. Cross-pans shall not be allowed on major collectors and are discouraged on minor collectors.

5.6.4.1.2 Lane Widths

Lane widths shall be 11 feet minimum asphalt width in the Town of Breckenridge historic district, and 12 feet minimum asphalt width outside of the historic district, [unless a variance is granted by the Town Engineer](#). The Breckenridge Historic District is defined in Title 9 of the Town Code and the "Breckenridge Handbook of Design Standards. The limits of the Historic District are shown on the Town's website. The curb, valley pan, or shoulder is not counted in the lane width dimension.

5.6.4.2 Shoulders

Shoulder width shall be 2 feet minimum of compacted aggregate base course plus 4 feet of recoverable zone with only grass vegetation (6-foot wide total clear zone).

Shoulder width for Major Collectors and Arterials shall 4 feet minimum of aggregate compacted base course plus 10 feet of recoverable zone with only grass vegetation (14-foot wide total clear zone).

5.6.4.3 Roadside Design

5.6.4.3.1 Cut and Fill Slopes

Cut and fill slopes for roadway embankment of 3:1 or flatter are preferred. Maximum cut and fill slopes shall be 2:1. Consideration should be given to snow removal problems and snow storage in slope design. It is considered advisable to use flatter slopes in cuts on the southerly side of the roadway where this will provide additional exposure of the pavement to the sun. Flatter slopes shall be considered to reduce erosion, maintenance costs, and to facilitate vegetation. If steeper slopes are needed, side slope material shall be evaluated based on drainage needs to determine appropriate material for stabilization of the slope. See Chapter 7 of these standards for further guidance on temporary and permanent stabilization measures.

The tops of all cut slopes shall be rounded where the material is other than solid rock. A layer of earth overlying a rock cut shall also be rounded.

5.6.4.3.2 Roadside Ditches

See Chapter 6 for Roadside ditch information and design.

5.6.4.3.3 Clear Zone

All fixed objects should be located outside the clear zone as defined in the *AASHTO Roadside Design Guidelines*. The design should provide a clear zone as wide as practical within constraints per the latest version of the *AASHTO Roadside Design Guidelines*. For low speed, low volume roadways a minimum clear recovery zone area of 7 feet in width shall be provided for roadways without curb and 2 feet in width for all roadways with curb.

5.6.4.3.4 Obstructions

Mailboxes, address monuments, landscaping, stone headwalls, and other objects shall not be located within the right of way. If any improvements are allowed in the ROW, an encroachment license shall be filed prior to issuance of permit.

5.6.4.3.5 Roadside Barriers

The installation of roadside barriers on embankments and adjacent to fixed objects may reduce the combined effect of severity and frequency of "run-off-road" type crashes. Roadside barriers reduce crash severity only when the overall severity of striking the guardrail is less than the severity of going down an embankment or striking a fixed object. They should not be installed if they are likely to create a greater hazard than running off the street. To the extent possible, streets shall be designed to eliminate the need for roadside barriers by eliminating obstructions, steep grades, and other hazards from the clear zone. Evaluating installation of roadside barriers shall consider crash experience, street objectives, functional classification of streets, design speed, traffic volume and type, street cross section, height of embankment, steepness of fill slope, horizontal curvature, gradient or profile conditions, street side conditions, climatic conditions, and degree of projected injury from traveling off the street. Special consideration shall be given to winter and icy conditions which might necessitate a roadside barrier that would not be needed under normal conditions. Refer to the *AASHTO Roadside Design Guide* for roadside barrier best practices. Refer to the *CDOT M Standards* for roadside barrier installation and construction requirements.

Guardrails and concrete barriers shall typically be colored brown and rails shall not be made of galvanized or reflective materials (reflector tabs and other reflective devices shall be installed per AASHTO and CDOT standards). Custom guardrails or barriers utilizing natural materials shall meet AASHTO and CDOT standards and be impact rated.

When roadside barrier is considered for installation, especially in extended lengths, provisions shall be made for adequate snow storage and removal. Flared end treatments are preferred over non-flared end treatments for snow removal operations.

5.6.4.3.6 Retaining Walls

Retaining walls and abutments are discouraged within the publicly maintained right-of-way. All designs of retaining walls, foundations, and abutments exceeding 48 inches in height (measured from finished grade) will require a sealed geotechnical design and a sealed structural design. Both designs will need to be prepared by registered professional engineers in the State of Colorado prior to the any approval of the retaining wall and abutment. Retaining wall and abutments retain earth with lateral support or at the end of a bridge span, respectively. The design of these structures depends upon type, function, and anticipated service life of retaining wall, earth pressure exerted on the wall by the retained backfill, geometry, strength and deformability of the ground, groundwater, and welling pressure in clay backfills. Four types of retaining wall systems are discussed in this section: conventional retaining walls and abutments, anchored walls, mechanically stabilized earth walls, and prefabricated modular walls.

Wall aesthetics shall be approved by the Town Engineer. Local Home Owner's Association (HOA) requirements may apply in certain instances.

Retaining walls needed to support private improvements shall not be located in the public right-of-way.

Full or partial height walls shall not be located closer than the outer edge of shoulder. When the top of the retaining wall is at the level of a roadway, the face of the parapet wall or rail shall be at least 4 feet from the edge of the traveled way.

1. **Conventional Retaining Walls and Abutments:** Conventional retaining walls and abutments are proportioned to provide stability against bearing capacity failure, overturning, and sliding. Retaining walls are discouraged within the public right-of-way. They will be allowed only when necessary to support public improvements. Design of conventional retaining walls and abutments shall satisfy the following loading factors:
 - a. Lateral earth and water pressures, including any live and dead load surcharges.
 - b. The weight of the wall.
 - c. Temperature and shrinkage effects.
 - d. Seismic loads.
2. **Anchored Walls:** Anchored walls provide additional lateral resistance with the use of anchors. Their design is based on the suitability of the subsurface soil and rock conditions. Design of anchored walls shall satisfy the following loading factors:
 - a. Lateral earth and water pressures, including any live and dead load surcharges.
 - b. The weight of the wall.
 - c. Seismic loads.
3. **Mechanically Stabilized Earth Walls:** Mechanically Stabilized Earth Walls (MSEW) are flexible composites of granular soil and tensile inclusions that behave as earth embankments with vertical or nearly vertical faces. MSEW are proportioned to provide stability against overturning

and sliding. Bearing pressure generally governs design. An MSEW should be used where substantial total and differential settlement is expected. This type of wall may also be used where conventional gravity, cantilever, or counterforted concrete retaining walls are considered. An MSEW shall not be used where utilities other than highway drainage are to be constructed within the reinforced zone or floodplain erosion or scour may undermine the reinforced fill zone or any supporting footing. An MSEW shall not be used where surface or groundwater contaminated by acid mine drainage or other industrial pollutants is present. Design of MSEWs shall satisfy the following loading factors:

- a. Lateral earth and water pressures, including any live and dead load surcharges.
 - b. The weight of the wall.
 - c. Seismic loads.
4. Prefabricated Modular Walls: Prefabricated modular walls employ soil-filled interlocking modules to resist earth pressures. Stability of modular walls depends upon the weight and strength of the fill soil. Each module level shall be investigated for sliding and overturning. A prefabricated modular wall may be used where conventional gravity, cantilever, or counterforted concrete retaining walls are considered. A prefabricated modular wall shall not be used on curves with radius less than 800 feet, unless the chord can be substituted with a series of chords, or where groundwater or surface runoff is contaminated with acid. Design of prefabricated modular walls shall satisfy the following loading factors:
- a. Lateral earth and water pressures, including any live and dead load surcharges.
 - b. The weight of the wall.
 - c. Seismic loads.
 - d. Earth pressure shall be computed on a plane surface where modules form an
 - e. irregular, stepped surface. K_a , used to compute lateral thrust, shall be computed based on the friction angle of the backfill behind the modules.

5.6.4.4 *Curbs*

Curb and gutter is required at the following locations:

1. On all streets in flat or rolling terrain within subdivision or any similar-type developments where high densities have been planned.
2. Where required by drainage, traffic, or public safety.
3. To replace existing curb.

Refer to the Street Standard Drawings for approved curb and gutter types.

5.6.4.5 *Medians*

Medians other than those listed within the street cross-sections are generally not permitted on new Town streets and must be approved by the Town Engineer. Medians shall be designed with plowable noses.

5.7 INTERSECTIONS

See Section 5.4.1.5 for intersection sight distance requirements.

5.7.1 Alignment and Profile

Streets must intersect one another at 90-degree angles or as close to 90 degrees as the topography allows. Angles less than 90 degrees must be approved by the Town Engineer. Angles less than 80 degrees are not permitted. Intersecting streets shall remain perpendicular for a minimum of 50 feet from the intersection.

In general, grades for intersecting roads should be as flat as possible to provide for storage platforms and sight distance. Grades shall not exceed 2 percent across a pedestrian access route (PAR) if the intersection is controlled by a stop sign or yield condition. Grades exceeding 2% across a PAR are permissible at signalized intersections or uncontrolled intersection legs, but every effort should be made to minimize the grade to meet 2%. Approach grades greater than 4 percent should be avoided. Grades that may need to be steeper to accommodate cases where the existing terrain does not allow for flatter intersections must be approved by the Town Engineer.

Parking shall not be located within 20 feet of an intersection.

5.7.2 Corner Radii

Radii of 15 to 25 feet are adequate for passenger vehicles. These radii may be provided at minor cross streets where there is little occasion for trucks to turn or at minor intersections where there are parking lanes. Where the street has sufficient capacity to retain the curb lane as a parking lane for the foreseeable future, parking should be restricted for appropriate distances from the crossing.

Radii of 15 feet or more at minor cross streets should be provided on new construction and on reconstruction where space permits.

Radii of 20 feet or more at major cross streets should be provided where feasible so that an occasional truck can turn without too much encroachment.

Radii of 30 feet or more should be provided where large truck combinations and buses turn frequently. Longer radii are also desirable where speed reductions would cause problems.

Curb radii should be coordinated with crosswalk distances or special designs to make crosswalks safe for all pedestrians. Designs which can minimize the corner radii for pedestrians and passenger vehicles, while still allowing trucks to make turning movements, are encouraged. Examples include truck blisters, rollover curb, and eliminating any structures or other objects behind the curb but within the truck radius.

5.7.3 Functional Intersection Area

Functional intersection area is the area upstream and downstream of an intersection where intersection operation and conflicts influence driver behavior, vehicle operations, or traffic conditions. Separation of access points should not be less than the functional area of the intersection.

The upstream distance is a combination of the storage length, deceleration and taper length, and the perception-reaction distance required for the speed of the segment. The downstream distance is measured as either acceleration length or decision sight distance. Providing acceleration length allows vehicles to accelerate to normal speed without conflict. Providing decision sight distance allows drivers to pass through an intersection before considering potential conflicts at the next intersection. Functional intersection area is demonstrated below in Figure 5.4.

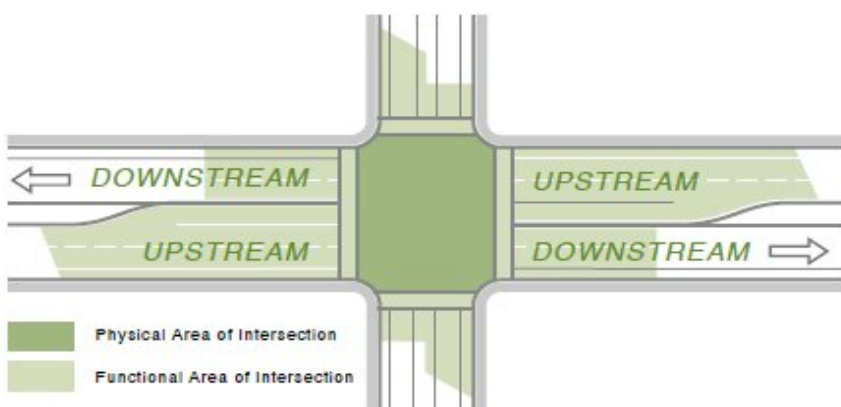


Figure 5.4. Functional Intersection Area

5.7.4 Channelization

5.7.4.1 Islands

Islands are generally not permitted on new Town streets, and must be approved by the Town Engineer. Exceptions are made for roundabouts. Islands shall be designed with plowable noses.

5.7.4.2 Medians

Medians are generally not permitted on new Town streets and must be approved by the Town Engineer. Exceptions are made for roundabouts. Medians shall be designed with plowable noses.

5.7.5 Auxiliary Lanes

Auxiliary lanes are useful in maintaining the safety, traffic flow, and operation of a roadway or access. When auxiliary lanes are required by the Town or warranted by information obtained during the development review process, the applicant is responsible for design, installation, and any purchase of right-of-way to accommodate the required lane width. Auxiliary lanes are required when unique location factors (e.g., roadway speed and traffic density, access volume, the volume of commercial trucks, the influence of nearby accesses, existing auxiliary lanes close to the proposed access, nearby traffic control devices, available stopping sight distance, and other topographic or roadway design factors) exist that determine the need for auxiliary lanes. Auxiliary lanes are required to mitigate specifically identified and documented locations with safety and operation issues.

5.7.5.1 Deceleration Lanes

A left deceleration lane, also called a left-turn lane, with storage length plus taper length, is required for any access with a projected peak hour left ingress turning volume greater than 25 vph. If the posted speed is greater than 40 mph, a deceleration lane and taper is required for any access with a projected peak hour left ingress turning volume greater than ~~10-15~~ vph. The taper length will be included within the deceleration length. A left deceleration lane is not required when the opposing projected peak hour traffic volume is less than 150 vph.

A right deceleration lane, also called a right-turn lane, with storage length plus taper length, is required for any access with a projected peak hour right ingress turning volume greater than 50 vph. If the posted speed is greater than 40 mph, a right turn deceleration lane and taper is required for any access with a projected peak hour right ingress turning volume greater than 25 vph. The taper length will be

included within the deceleration length. [A right deceleration lane is not required when the advancing projected peak hour traffic volume is less than 400 vph.](#)

5.7.5.1.1 Storage Length

The storage length for an auxiliary lane can be determined by the information summarized in Table 5.7. These lengths are based on the average length of a passenger vehicle and the estimated turning vehicles per hour. Estimated lengths for buses, larger trucks, and recreational vehicles must be determined and submitted to the Town for review. The basis for designing the length of required storage is to provide sufficient length for vehicles to queue within the lane without affecting other movements. Table 5.8 provides the required storage lengths for stop-controlled and signal-controlled intersections. If the Department of Public Works determines that meeting the required storage length is impractical or will result in an unsafe condition, the minimum storage length shall be based on the mean arrival rate. But in no case shall the minimum auxiliary lane length be less than 50 feet.

Table 5.7. Acceleration/Deceleration Lane Design Criteria

Posted Speed Limit (mph)	25	30	35	40	45
Deceleration length (ft)	180	250	310	370	435
Acceleration length (ft)	N/A	190	270	380	550
Transition taper (ratio)	7.5:1	8:1	10:1	12:1	13.5:1
Straight taper (ratio)	15:1	15:1	20:1	30:1	45:1

Table 5.8. Auxiliary Lane Storage Lengths

Turning vehicles per hour	<30	30-59	60-100	>100
Minimum required storage length (ft)	25	40	50	100

5.7.5.1.2 Tapers

Auxiliary lanes typically consist of one or more of the following: transition taper, full width auxiliary lane, and storage length. The use of these components varies based on the type of access, through street classification, and site-specific conditions (grades). To determine the required acceleration and deceleration lane and transition taper length, see design criteria presented in Table 5.7. The length of the required transition taper is determined by multiplying the distance offset by the transition taper ratio value associated with the posted speed. The beginning and ending point of all tapers shall be rounded.

Transition tapers: The purpose of a transition taper is to provide sufficient length for a vehicle to accelerate or decelerate to the appropriate speed and merge into and out of the through traffic lanes without disrupting traffic flow. The length of a transition taper is calculated by multiplying the width of the lane by a standard ratio. The beginning and ending point of all tapers shall be rounded.

Redirect or straight tapers: Redirect tapers shall be used where an exclusive turn lane, median, or other redirection of vehicles is necessary and where redirection of the flow of traffic is necessary to accommodate the exclusive turn lane or median. If the redirect taper would result in a horizontal curve design deficiency for the through movement, the horizontal curve shall be corrected. Redirect tapers should be designed as straight tapers with the beginning and ending points rounded.

5.7.5.2 Acceleration Lanes

Acceleration lanes are required at any access with a project peak hour right turn volume of greater than 50 vph and a posted speed of 40 mph or greater. The purpose of an acceleration lane and

transition taper is to provide sufficient length for a vehicle to accelerate to the appropriate speed and merge into the through traffic lanes without disrupting traffic flow. Table 5.7 above provides the required acceleration lane and transition taper lengths by design speed. Acceleration lane lengths shall be adjusted for a grade of 3% or more. The total length of the acceleration lane includes the values of both the lane and transition taper. Shorter acceleration lanes are not permitted, as they are not used properly by most of the traveling public.

5.7.5.3 Two-way Left Turn Lanes

Two-way left turn lanes should be used sparingly. Two-way left turn lanes may be considered on arterial roadways in areas where several low-volume commercial accesses are closely spaced. Two-way left turn lanes shall be 12-16 feet wide.

5.8 DEAD END STREETS (CUL-DE-SACS)

Dead-end streets are discouraged and shall be avoided unless topographic or other unique site constraints limit construction of interconnected streets. The design of cul-de-sacs will be reviewed following the Street Standard Drawings. Any public street or private street that dead ends shall terminate in a cul-de-sac. All cul-de-sacs shall include signage within fifty feet of the inlet indicating that the street is a dead-end street.

5.9 BRIDGES

Bridges, arch culverts, and other structures shall be designed per the CDOT Bridge Design Manual and AASHTO standards. Bridges shall be designed to accommodate the full lane widths, shoulders, curbs, sidewalks, ROW widths, and other improvements detailed in this chapter. Future development and improvements shall be considered when designing bridges. Pedestrian bridges shall exceed the width of the pedestrian route it is serving and shall be 8' minimum width for shared use paths and 12' minimum width for shared use paths.

See Town of Breckenridge Open Space and Trail standards for requirements on bridges for soft surface trails.

See Chapter 6 of these standards for hydrologic requirements of bridge structures.

5.10 ACCESS CONTROL AND MANAGEMENT

An access is defined as a privately owned connection to a Town street or right-of-way and may also be referred to as [an access road or driveway](#). [A Town, County, or CDOT owned roadway is not classified as an access](#). Establishing access criteria and the application of access management techniques is highly desirable on public streets. Effective access management enhances the capacity and safety of a street and preserves those elements as the corridor develops further. While access to adjacent properties are required, the Town should attempt to limit the number of access points and their locations, especially on intersection approaches.

5.10.1 Private Access

Private accesses service ~~three-four~~ or less single-family homes ~~or~~, one multi-family property, [or one commercial property](#). [An access serving five or more homes shall be classified as either a public or private street and not an access \(see Section 5.19.1\)](#). Private accesses are not owned, maintained, or plowed by the Town. They are the sole responsibility of the property owner. A private access that serves multiple lots shall be located in an easement or common area. The easement or common area width shall accommodate the access width, drainage, construction requirements (slopes, etc.), snow storage, and other appropriate design elements. Cross parcel access easement shall not be less than 30 feet wide. Private access design shall also incorporate International Fire Code (IFC), Red, White,

and Blue Fire Department, and development code parking lot design requirements, which are listed those respective standards and codes.

5.10.1.1 Commercial

A commercial private access ~~road~~ is the ~~internal access drive system~~ paved vehicle access route for a commercial lot or development and may include the access ~~drives~~ driveways, and parking areas that serve the development.

5.10.1.2 Residential

A residential private access ~~road~~ is the ~~internal access drive system~~ paved vehicle access route for four or less single-family homes, two duplexes, one triplex, or a multi-family development and may include the access ~~drives~~ driveways, and parking areas that serve the development. An access to multiple duplexes or townhomes shall be a public road.

5.10.2 Access Management Principles

~~Access management is the coordinated planning, regulation, and design of access between roadways and land development. It involves the systematic control of the location, spacing, design, and operation of accesses, median openings, interchanges, and street connections. Access management provides the means to balance good mobility along the street network with local access needs of businesses and residents. Implementation of access management principles and techniques on transportation networks can provide the following long-term benefits for highway users, communities, and businesses.~~

5.10.45.10.2 Access Changes

Access changes on Town of Breckenridge streets will typically require a Town Development Permit and a Right of Way permit. Access changes on State Highway 9 will require a CDOT access permit. Access changes on a Town Street (not directly located on a State Highway), but increasing traffic at the nearest State Highway 9 intersection by at least 20%, will also require a CDOT access permit.

5.10.415.10.2.1 Number of Accesses

Only one access shall be provided per lot for safe ingress and egress. Where topographic or other site conditions exist, shared access between lots may be required.

Additional accesses may be approved off local streets that meet the minimum spacing requirements shown in Table 5.9. Accesses for a collector or arterial street frontage wherein a traffic impact study demonstrates a need for a second access based on traffic volumes, unique site or constraints or site requirements that generates the need for the second access; No feasible design alternatives are available to eliminate the need for a second access. Additional accesses may be allowed if required per IFC code requirements, or for large commercial developments. If an additional access is allowed, the second access shall be added from the minor street. Access from the major street shall be limited to the greatest extent possible.

Where an existing access is required to be removed, the owner is required to remove the driveway, the driveway connection to the public road, driveway apron, and other associated driveway improvements. Where the access crosses a sidewalk, owner will be required to remove the driveway cut and construct curb across the access. Owner will also be required to add any landscaping or block vehicle access with grading, landscaping, or other obstructions.

5.10.425.10.2.2 Location

Access shall be from the lowest classification street. Lots with alley frontage shall have access from the alley only. When sites adjacent to an alley redevelop, propose a significant remodel or addition, or

add a secondary unit, accesses and parking on an adjacent street shall be removed and access shall be solely from the alley. Accesses on a cul-de-sac shall be located to provide room for snow storage and shared access may be required. Exception: where there is an existing garage served by the street that shall remain without changes, the street access can remain to serve the garage. If feasible that access should be upgraded to meet current standards.

One driveway shall be allowed per lot unless otherwise permitted by the Town Engineer. Circular driveways, consisting of two curb cuts onto a street, are not permitted. [A second driveway access is only allowed when required by IFC or RWB fire requirements.](#)

All intersection and driveway accesses shall intersect the roadway at a ninety-degree angle.

No backout movements shall be permitted on arterial, major collectors, and minor collectors. Driveways on minor collector streets and above shall have internal circulation provided to allow turnaround movements within the driveway.

One-way accesses are discouraged.

Access location shall be configured to optimize sight distance, separation from adjacent intersections and driveways, and grade at the intersecting road (avoid steeper portions of adjacent roadway).

Commercial or multi-family residential accesses may not be allowed on roadway grades exceeding 6%. On roads exceeding 6%

5.10.55.10.3 Access Management Techniques

Several access management techniques may be used to implement best management practices. Techniques include, but are not limited to the following:

1. Consolidate access by reducing the number of access points that serve a single property or by providing joint access for multiple properties at or near a shared property line.
2. Connect adjacent properties to provide circulation between properties and increase access opportunities for multiple properties.
3. Define driveways to provide clear identification of entrance and exit locations.
4. Locate access to a side street (local road) instead of a major road (arterial or collector) to reduce vehicle conflict on the major road.

5.10.65.10.4 Sight Distance

Sight distance at accesses must comply with Chapter 9 of the *AASHTO Greenbook*. Table 5.9 identifies the appropriate design vehicle to be used for sight distance calculations. Where existing objects obstruct the AASHTO sight distance for single family or duplex homes, the sight distance triangle may be reduced from 14 feet to 10 feet from the edge of the roadway.

Table 5.9 Design Vehicle Selection for Access Sight Distance

Land Uses Served by Access	Design Vehicles (for sight distance calculations)
Residential (Non-School Bus Route)	Passenger Cars, Pickup Trucks
Part of Any School Bus Route Regardless of Land Use	No Less Than Single Unit Trucks
Office	Single Unit Trucks

Recreational	Single Unit Trucks
Commercial/Retail	Multi-Unit Trucks*
Industrial	Multi-Unit Trucks*
Municipal Streets & County Roads	Multi-Unit Trucks*
Agricultural Field Approaches <1 Per Day	Single Unit Trucks

*If Less Than 2 Multi-Unit Truck Trips Per Day (Average), Use Single Unit Truck

5.10.75.10.5 Access Spacing

Table 5.10. provides access spacing requirements based on street classification. [Access spacing and offset requirements shall be measured from the edges of the nearest curb returns or pavement radii terminations.](#)

Table 5.10 Access Spacing Requirements

Design Element	Street Classification of Road being accessed by Driveway			
	Arterial	Major Collector	Minor Collector	Local
Minimum Street Intersection Spacing Offset between Street Intersections	$\frac{1}{4}$ - $\frac{1}{2}$ Mile	$\frac{1}{4}$ - $\frac{1}{2}$ Mile	$\frac{1}{4}$ - $\frac{1}{2}$ Mile	300'
Offset between adjacent Major Access Driveways (≥ 100 trips per day)	300'	150'	100'	50'
Offset between adjacent Minor Access Driveways or one Major Access Driveway and one Minor Access Driveway (<100 trips per day)	150'	75'	50'	30'
Offset between Major or Minor access and street intersection	300'	150'	100'	50'

5.10.85.10.6 Access Width

Table 5.11 provides access width requirements.

Table 5.11 Access Width Requirements

Layout Parameters	Residential-1 Unit	Residential-2 Units	Residential-3-4 Units	Residential (Multi-Family Greater than 4 units)	Residential Private Street	Commercial or Industrial Private Access

Minimum Width	12'	12'	12'	12'	24'	12'
Maximum Width (Includes flared pavement radius at edge of roadway)	20'**	20'**	24'	24'	24'	32'*
Pavement Return Radius	0'-5'	0'-5'	0'-10'	0'-10'	10'-20'	10'-20'
Maximum Slope (Centerline)	8%	8%	8%	8%	6%	8%

*Utilization of maximum width shall be approved by the Town Engineer.

**Maximum width shall include pavement return radius

5.10.95.10.7 Access Type

5.10.9.15.10.7.1 Curb Cut Driveway

In general, if there is a pedestrian sidewalk path along the roadway where an access is proposed, the sidewalk shall continue across the driveway. Refer to the Street Standard Drawings for curb cut driveway requirements and details. Exceptions can be made when the single unit and multi-unit truck peak hour volume is greater than 5.

5.10.9.25.10.7.2 Radius Driveway

A radius driveway is defined as an access with curb ramps and without a continuous sidewalk across the access. Radius driveways shall be designed in accordance with intersection requirements of this chapter. With a radius driveway, access radii shall be per Table 5.11. If the design vehicle intended to use the access daily is a single-unit exceeding 30 feet, multi-unit, or another vehicle requiring a larger radius, the minimum turn radius accommodating this design vehicle shall be used. Access radii shall allow safe maneuvers without intrusion into adjacent highway travel lanes. In instances where multiple larger vehicles are likely to oppose each other at the access, the radii should be adequate to accommodate both vehicles without conflict. Radius shall balance vehicle access while also promoting slowing of vehicles. Smaller radii should be used where an access crosses a pedestrian route to encourage slower speeds.

5.10.105.10.8 Access Design Details

5.10.10.15.10.8.1 Access Profile

Driveways shall match the roadway cross-slope for the first five feet, shall not exceed 4% for the following 15 feet, and shall not exceed 8% for the remainder of the driveway.

If a pedestrian access route crosses the driveway, the driveway cross-slope shall be a maximum of 2% for the width of the pedestrian access route (minimum 4 feet wide).

5.10.10.25.10.8.2 Access Geometry

Driveways shall meet adjacent streets, alleys, or driveways at a ninety degree angle and remain perpendicular for a minimum of 10 feet from the intersection. Driveways shall have a minimum inside

turning radius of 26 feet and outside radius of 38 feet for fire department access, unless an alternate fire access is provided.

5.10.10.35.10.8.3 Access Surfacing

All accesses shall be paved. Pavement placement shall occur prior to issuance of certificate of occupancy or sooner if required to meet Fire Department or utility requirements. All accesses serving more than four units or lots shall be maintained in proper working condition to prevent potholes and overall surface deterioration. All access and parking areas shall be paved with asphalt, concrete, recycled asphalt, or other all-weather drivable surface approved by the Town Engineer. Access flexible pavement sections shall match the roadway pavement section for a minimum of 10 feet from the edge of the traveled way. Concrete accesses shall either terminate 4 feet from the edge of asphalt on Public Streets with a 3-inch thick minimum asphalt apron constructed between the concrete access and the public street., or concrete can be placed to the edge of asphalt if it is even with or 1 inch lower than the top of asphalt and an expansion joint is provided between the asphalt/concrete interface.

Asphalt pavement shall be a minimum of 3" asphalt on 4" aggregate base course between the roadway and edge of right of way.

5.10.8.4 Access Drainage

Any access connecting to a road with curb and gutter or valley pans shall have a concrete cross-pan installed across the driveway. Any access connecting to a road with an existing road side ditch shall have an 18 inch culvert installed beneath the driveway. The roadside ditch shall be re-graded as needed from the ends of the culvert until the ditch daylights at a 1% slope. Where an access is added to the downhill side of a road and there is no curb, valley pans, or ditches on the existing road, the access may be exempted from the cross pan and culvert requirement.

5.10.9 Access Maintenance

An access does not typically require an encroachment license in the right-of-way. The access and all associated improvements (pavement, culvert, cross pan, flared end sections) shall not be owned or maintained by the Town. All ownership, maintenance, and replacement work shall be the responsibility of the owner. The Town is not liable for any damage incurred by the Town or others to driveway improvements within the right-of-way. The Town shall not be responsible for any damage caused by snow removal, Town vehicles, maintenance, or any other causes. The Town shall have the right to work on the access improvements within the right-of-way as required, such as clearing sediment from culverts and connecting to the access pavement when re-paving the public road, but the Town shall be under no obligation to complete any repair or maintenance.

5.11 PARKING AREAS (ON-STREET PARKING WITHIN RIGHT-OF-WAY)

Section 5.11 sets minimum standards for on-street parking. ~~See Development Code for off-street parking requirements.~~ See Chapter 3 of Title 9 of the Town Code for off-street parking requirements.

5.11.25.11.1 On-street Parking

On-Street Parking shall be provided as shown within the street classification cross sections. On-street parking may be provided along streets when approved as part of the ~~Land Development~~ permit approval ~~process~~. All eligible on-street parking areas shall be clearly depicted on a plan. Such parking areas shall not conflict with any turning movements or obstruct access to any street, sidewalk, crosswalk, alley, access, or fire hydrant. ~~To accommodate on-street parking, a credit toward satisfying minimum off-street parking requirements shall be granted can be considered for any development that creates additional on-street parking spaces along a public street through the elimination of existing curb cuts or driveways. See the Development Code for detailed parking requirements based upon existing land use.~~

5.11.35.11.2 Parking Area Surfacing

All parking areas shall be paved with asphalt, concrete, recycled asphalt, or other all-weather drivable surface approved by the Town Engineer.

5.11.45.11.3 Parking Grades

Parking areas shall have a maximum grade of 4% and a minimum grade of 1%. ADA parking spaces shall have a maximum grade of 2% in any direction.

5.11.55.11.4 Parking Stall Requirements

Minimum parking stall size requirements are described below. Parking shall not encroach onto sidewalk, bike lanes, or other pedestrian facilities.

1. The minimum stall size shall be 18 feet long by 9 feet wide for 90 degree or angled parking. Actual striping dimensions shall be adjusted for angled parking to fit the minimum stall size.
2. Parallel parking: 25 feet long by 8 feet wide. Parallel parking stall at the end of a block may be reduced to 20 feet. Accessible parallel parking spaces shall be located near a curb ramp and shall be in an area that is not obstructed by trees or other objects behind the curb.
3. Accessible parking: 18 feet long by 8 feet wide, with a 5- to 8-foot accessibility lane (8 feet is required for van parking). An ADA accessible route shall be provided from the ~~handicap~~ accessible stalls to the businesses being served or the nearest pedestrian route. ADA parking space location, frequency, slopes, and other requirements shall meet PROWAG standards.

5.11.65.11.5 Parking Construction Requirements

Construction of on street parking shall meet all standards and specifications of the adjacent street, including pavement thickness, compaction, and other construction specifications. See Chapter 9 of these standards for additional construction requirements.

5.12 PEDESTRIAN AND BICYCLE FACILITIES

Increasing congestion and mode conflict is accompanied by growing public awareness of the need of safe and convenient multi-modal facilities to promote alternative transportation and healthy lifestyles. This section provides for the design of pedestrian, bicycle and transit facilities that play a key role in providing improved accessibility, mobility, and transportation system continuity.

This section shall be used in combination with the AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities, AASHTO Guide for the Development of Bicycle Facilities, CDOT Roadway Design Guide (Chapters 12 and 14), Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG), and ADA Accessibility Guidelines (ADAAG) for the design and installation of all pedestrian and bicycle facilities. Where no requirement is given, the current edition of the design standards listed above shall govern.

Section 5.12 applies to both public and private streets. Internal circulation (outside of right-of-way or private street) for individual single family homes or duplexes, and other private development, as determined by the Town Engineer, may be exempted from the requirements of 5.12.

5.12.1 Pedestrian Facilities

All local, minor collector, and major collector roads shall have a minimum of one sidewalk. Town Engineer may require additional sidewalks, shared use paths, and other pedestrian facilities. Sidewalks and other pedestrian facilities shall be installed per the Town's Sidewalk Master Plan, these standards, and as determined by the Town Engineer.

5.12.1.1 Pedestrian Environmental Impact

Sidewalks shall be designed to fit the existing topography and vegetation and minimize site disturbance, removal of vegetation, and disturbance to sensitive environmental areas.

5.12.1.2 Pedestrian Facility Widths

Sidewalks shall be a minimum of 5 feet wide for local roads. Major and minor collector pedestrian facilities shall be a minimum of 6 feet wide.

Soft surface trails intended for ADA accessibility shall have a minimum width of 4 feet wide.

5.12.1.3 Pedestrian Pavement Thickness

Concrete sidewalks shall be a minimum of 5 inches thick. Sidewalks within a driveway shall be a minimum of 6 inches thick and reinforced with welded wire reinforcement. Sidewalks crossing a driveway with heavy commercial loading shall be a minimum of 8 inches thick. All concrete sidewalk pavement shall be placed on a minimum thickness of a 4 inch aggregate base course layer.

5.12.1.4 Horizontal and Vertical Clearance

Sidewalk vertical clearance shall be a minimum of 8 feet. Sidewalk horizontal clearance shall be 3 feet preferred and 2 feet minimum. No structures or other objects shall extend into the clearance offsets.

5.12.1.5 Sidewalk Widening

When a sidewalk is required to be widened, the widening must be a minimum width of 4 feet or more. If the required added width is less than 4 feet, the existing sidewalk shall be removed and reconstructed to the required width.

5.12.1.6 Slope

The minimum cross slope of a sidewalk is 1% and the maximum cross slope is 2%, measured perpendicular to the sidewalk or path alignment. The cross-slope shall generally be towards the roadway, unless drainage facilities are provided behind the sidewalk. The maximum running slope for sidewalk not aligned with a roadway is 5%. If the sidewalk is aligned with the roadway, the sidewalk may match the slope of the roadway. See Section 5.13 of this chapter for ADA requirements of sidewalks and curb ramps. Sidewalks shall be accessible and shall have directional curb ramps.

5.12.1.7 Sidewalk Shouldering

Sidewalks shall have a compacted aggregate base course shoulder of 1-foot minimum width. The shoulder shall be sloped at a minimum of 1% away from the sidewalk. Landscaping may extend to the edge of the sidewalk only if the area is graded at 1%, grass or plantings are selected that do not cause maintenance issues, and the landscaping does not extend horizontally into the landscaping. Short grasses are typically the only landscaping allowed in the shoulder area.

5.12.1.8 Sidewalk Stormwater

Sidewalk shall be designed to handle runoff and provide positive drainage away from the sidewalk, typically towards the roadway. Obstructions shall not be placed at the edge of the sidewalk which obstruct stormwater flow. Low points in the sidewalk should be avoided to the extent possible due to ponding and freezing conditions in the winter.

5.12.1.9 Sidewalk Alignment

Standalone sidewalks and trail connections are encouraged in developments where their additions provide a shorter connection for pedestrians. Sidewalk alignments shall strive to provide the shortest distances between locations in order to promote efficiency of pedestrian transportation and to prevent pedestrians from walking outside the sidewalks.

5.12.1.10 Heated Sidewalks

This section only applies to heated sidewalks located within the Town right-of-way. For private snow melt systems, see Section 5.19.2 of this chapter [and section 9-1-19-33A and 33R of the Town Code](#). Heated sidewalks located within Town right-of-way shall be designed by a Colorado licensed Professional Engineer. Heated sidewalks shall be designed with the following requirements:

- Snowmelt systems shall be hydronic snowmelt systems designed to produce a minimum of 125 BTU/SF and hydronic tubing loops shall be a maximum of 300 linear feet, unless an alternate design of acceptable performance is submitted by a Professional Engineer.
- Manifolds shall be located in traffic rated boxes placed outside of the concrete pavement.
- Concrete shall be a minimum of 5" thick.
- High PSI (60 psi) board insulation shall be placed beneath sidewalks which do not receive heavy traffic loads. In areas are expected to experience heavy truck traffic, astrofoam or other non-compressible insulation shall be placed beneath pavement.
- Welded wire mesh or other reinforcement shall be installed in traffic areas.
- Cold joints, where heated pavement meets non-heated pavement, shall be filled with backer rod and sealant to limit moisture infiltration.
- Heated pavement shall be doweled or connected by other means to non-heated pavement to minimize differential settlement and prevent trip hazards. Doweling is not required adjacent to curb, buildings, walls, or other locations that are not within the pedestrian path.
- Heated pavement shall be graded with a cross-slope and shall not drain onto non-heated pavement, creating any icing or safety hazards. Drainage shall be directed to an inlet, swale, drywell, or other approved connection point.

5.12.1.11 Trail Connections

Soft surface trail connections are encouraged and shall be installed per the Breckenridge [Trails-Open Space and Trails Master Plan](#) and as required by the Town Engineer. Soft surface trails provide connections to existing trails, open spaces, parks, and other community destinations for pedestrians, bicyclists, and other non-motorized uses. Soft surface trails shall be designed and installed to limit grading impacts, tree removals, and other disturbance. Additional design and install details shall be coordinated and approved by the Town of Breckenridge Open Space and Trails [Department/Division](#).

5.12.1.12 Pedestrian Bridges

Pedestrian bridges shall be a minimum width of 8 feet. Pedestrian bridges on the Blue River Rec Path shall be a minimum of 14 feet. Pedestrian railings shall be provided along bridges. See Chapter 6 for hydrologic requirements of pedestrian bridges. Pedestrian bridges on the Blue River Rec Path or bridges being maintained by the Town shall be designed to accommodate a 20 TON design vehicle. All pedestrian bridges shall be designed for the snow loads per Breckenridge Building Code. See Open Space and Trail standards for bridge requirements serving soft surface trails.

5.12.1.13 Pedestrian Railings

Hazards located near a sidewalk shall require a pedestrian railing or other barrier at the edge of the path. Examples of hazards include 2:1 slopes and vertical drops exceeding 30 inches.

5.12.1.14 Pedestrian Easements

All pedestrian facilities and trails not located within ROW shall be located within an access easement. Pedestrian facilities and trails shall have a 5-foot minimum distance from back of sidewalk/trail to edge of ROW/easement to accommodate drainage, signage, lighting, and utilities.

5.12.2 Bicycle & Shared-use Facilities

Bicycle & Shared-use facilities shall be installed per the Breckenridge [Open Space and Trails Master Plan](#), Sidewalk Master Plan, and by the direction of the Town Engineer, and any other applicable requirements. Bicycle facility design shall follow the AASHTO Guide for the Development of Bicycle Facilities, current edition and the CDOT Roadway Design Guide for Bicycle and Pedestrian Facilities. Sight distance, vertical geometry, and horizontal geometry shall meet the requirements of AASHTO and CDOT.

For this chapter, the term shared-use will apply to both shared-use facilities and bicycle facilities.

5.12.2.1 Shared-use Environmental Impact

Shared-use paths shall be designed to fit the existing topography and vegetation and minimize site disturbance, removal of vegetation, and disturbance to sensitive environmental areas.

5.12.2.2 Design Speed

The design speed for shared-use paths on grades of 4% or less shall be 20 mph. The design speed for sections of shared use-paths exceeding 4% shall be 30 mph. For shared-use paths near intersections, underpasses, or other hazards where traffic calming is warranted, a lower design speed may be submitted to the Town Engineer for approval.

5.12.2.3 Shared-use Facility Widths

Shared use paths shall be at least 10 feet wide; the Blue River Recreation Path shall be at least 14 feet wide. Underpass widths shall be at least 14 feet wide.

5.12.2.4 Shared-use Pavement Thickness

Concrete shared-use paths shall be a minimum of 5 inches thick. Shared-use paths within a driveway shall be a minimum of 6 inches thick and reinforced with welded wire reinforcement. Shared-use paths crossing a driveway with heavy commercial loading shall be a minimum of 8 inches thick. Longitudinal joints in the concrete shall not be allowed in shared use paths. Transverse joints shall be sawcut and shall not be tooled.

Asphalt pavement for shared-use paths shall be a minimum of 3 inches thick and placed in two lifts. Asphalt shared-use paths within a driveway shall be a minimum of 4 inches thick.

All concrete sidewalk pavement shall be placed on a minimum thickness of a 4 inch aggregate base course layer.

Concrete and asphalt pavements for shared use paths shall be designed by a professional engineer licensed in the state of Colorado.

5.12.2.5 Shared-use Horizontal and Vertical Clearance

Shared-use paths shall have a minimum vertical clearance of 10 feet. Shared-use paths shall have a minimum horizontal clearance of 3 feet from the edge of pavement. No structures or other objects shall extend into the clearance offsets.

5.12.2.6 Shared-use Widening

When a shared-use path is to be widened or a pavement cut is planned, the full width of pavement shall be removed and replaced. No longitudinal joints will be allowed in concrete or asphalt shared-use paths.

5.12.2.7 Shared-use Slope

The minimum cross slope of a shared-use path is 1% and the maximum cross slope is 2%. The maximum running slope for a shared-use path not aligned with a roadway is 5%. If the shared-use path is aligned with the roadway, the sidewalk may match the slope of the roadway. See Section 5.13 of this chapter for ADA requirements of curb ramps. Shared-use paths shall be accessible and shall have directional curb ramps.

5.12.2.8 Shared-use Shouldering

Shared-use paths shall have a compacted shoulder with a minimum width of 2 feet wide. The shoulder shall be sloped at a minimum of 1% and a maximum of 16% away from the shared-use path.

5.12.2.9 Shared-use Stormwater

Shared-use path design shall consider runoff and provide positive drainage away from the path. Obstructions shall not be placed at the edge of the path which obstructs stormwater flow. Low points in the path should be avoided to the extent possible due to ponding and freezing conditions in the winter.

5.12.2.10 Shared-use Alignment

Standalone shared-use paths and trail connections are encouraged in developments where their additions provide a shorter connection for pedestrians. Shared-use alignments shall strive to provide the shortest distances between locations in order to promote efficiency of pedestrian transportation and to prevent pedestrians from walking outside the sidewalks.

5.12.2.11 Shared-use Bridges

Shared-use bridges shall be a minimum width of 10 feet. Bridges on the Blue River Rec Path shall be a minimum width of 14 feet. Pedestrian railings shall be provided along bridges. See Chapter 6 for hydrologic requirements of pedestrian bridges.

5.12.2.12 Shared-use Railings

Hazards located within the clear zone of the shared-use path shall require a pedestrian railing or other barrier at the edge of the path. Examples of hazards include 2:1 slopes, vertical drops exceeding 30 inches, and structures in the clear zone.

5.12.2.13 Shared-use Easements

All shared-use facilities and trails not located within ROW shall be located within an access easement. Pedestrian facilities and trails shall have a 5-foot minimum distance from back of shared-use path/trail to edge of ROW/easement to accommodate drainage, signage, lighting, and utilities.

Where outside of the ROW, the bicycle facility shall be in a public access easement of sufficient width to allow for repairs to the facility, accommodate any drainage, and allow for installation of any required signs.

All arterial and collector street cross sections include bike lanes on both sides of the street or a shared use path. The minimum width of the bike lanes is 5 feet.

Bicycle lanes on streets without on-street parking shall be at least 5 feet wide, exclusive of the curb pan, or 6.5' from the face of any curb. On existing streets where on-street bike lanes are being added and available right-of-way or improvements space is restricted, the width of the bicycle lane may be reduced to at least 5 feet wide, inclusive of the curb pan. Bicycle lanes on streets with on-street parking shall be at least 5 feet wide, exclusive of the parking lane, or 13 feet from the face of any curb. On existing streets where on-street bike lanes are being added and available right-of-way or improvements space is restricted, the width of the bicycle lane may be reduced to at least 4 feet wide, exclusive of the parking lane, or 12 feet from the face of any curb.

5.13 ACCESSIBLE PEDESTRIAN DESIGN

Curb Ramps on sidewalks shall be designed to comply with *Public Rights-of-Way Accessibility Guidelines* including detectable warnings. Where feasible separate ramps shall be provided for each crossing direction. Where site constraints prohibit separate ramps, a single multidirectional ramp may be used. Refer to *CDOT M & S Standard Plans* for ramp details. The standard detectable warning shall be cast iron, natural finish plates or approved equal.

5.13.1 ADA Accessibility Requirements, Standards, and Guidelines

The ADAAG and the PROWAG are not requirements of the ADA but serve as the standards and guidelines by which compliance of the law is measured. Generally, the ADA law requires:

1. New construction to be accessible
2. Alterations to existing facilities that are within the scope of a project to provide accessibility to the maximum extent feasible
3. Existing facilities that have not been altered shall not deny access to persons with disabilities

All new construction projects where a pedestrian demand is exhibited shall incorporate appropriate pedestrian facilities that are accessible to persons with disabilities. New construction projects have the ability to mitigate constraints through good planning and design practices. Project budget or limited scopes are not an acceptable reason to fail to provide compliant accessible facilities during new construction.

5.13.2 Technical Requirements for Accessible Design

The pedestrian access route (PAR) is a continuous and unobstructed path of travel provided for pedestrians with disabilities within or coinciding with a pedestrian circulation path.

The continuous width of the PAR shall be 5 feet minimum, exclusive of the curb. Where a pedestrian access route makes a 90-degree turn, it should be widened to 5 feet to accommodate the continuous passage of a wheelchair (i.e. pedestrian design vehicle). If the clear width of the PAR is less than 5 feet, passing spaces shall be provided at a maximum of 200-foot intervals. If passing spaces are provided, they shall be 5 feet by 5 feet minimum. The clear width of a pedestrian refuge island shall be 5 feet minimum.

Pedestrian facilities shall have a maximum running slope of 5%. If the grade of the roadway is steeper than 5%, then running slopes are permitted to match the grade of the roadway.

Pinch points should generally be avoided. Pinch points within the PAR shall not be less than 34 inches in width and not exceed 24 inches in the direction of pedestrian travel.

5.13.3 Curb Ramp Types

See the Street Standard Details for approved curb ramp types.

5.13.4 Curb Ramp Technical Requirements

5.13.4.1 Ramps

Curb ramps shall have a maximum running slope of 8.33%. The running slope of a curb ramp is measured in the center of the ramp run in the direction of pedestrian travel. If the surrounding terrain requires a ramp to chase grade, the ramp is required to be no longer than 15 feet, regardless of the resulting slope.

5.13.4.2 Landings and Turning Spaces

Landings and turning spaces allow users to maneuver on and off the curb ramp and are required at the top or bottom of a curb ramp. Turning spaces are required at the top of a perpendicular curb ramp and at the bottom of a parallel curb ramp. The maximum running slope and cross slope of landings and turning spaces shall be 2.0%. At mid-block crossings or locations without yield or stop control, the cross slope of the turning space can equal the street or highway grade. Turning spaces shall be 4 feet by 4 feet minimum. If the turning space is constrained by a vertical element on one or more sides, provide 5 feet in the direction of the street crossing.

When the profile of the roadway being crossed has an excessive slope, the curb ramp cross slope should be transitioned slowly to the turning space. The transition shall be spread evenly over the length of the curb ramp. See Curb Ramp Standard Details.

5.13.4.3 Cross Slopes

Cross slopes of all pedestrian facilities shall be a minimum of 1% and shall not exceed 2%.

5.13.5 Detectable Warning Surfaces

Detectable warning surfaces shall be made of untreated steel plates. Brick pavers are not permitted for detectable warnings. See CDOT M-Standards for Curb Ramps for detectable warning requirements.

5.13.6 Pedestrian Crossings at Controlled Intersections

Refer to Section 5.10 for Pedestrian Crossings at uncontrolled or mid-block crossings.

5.13.6.1 Signalized Intersection Crossing Controls

If an intersection under signal control has sidewalks, then marked crosswalks should be provided. In urbanized areas pedestrian signals are recommended at all intersections where sidewalks are provided on the approaches to a signalized intersection. STOP lines shall be placed a minimum of 4 feet in advance of the crosswalks. Consideration may be given to providing advance right turn STOP lines to improve the visibility of pedestrians coming from the motorist's left.

Pedestrian push buttons shall be accessible to pedestrians via an accessible pedestrian route in compliance with the ADA.

The draft PROWAG requires that whenever pedestrian signals are installed, accessible pedestrian push buttons be installed. Push buttons shall be connected to a fully-accessible pedestrian signal that complies with the *2009 MUTCD with amendments*, with the ability to enable or disable accessible features. The Town Engineer will decide on which functions to activate at each accessible pedestrian crossing on a case-by-case basis.

At intersections with high volumes of pedestrians, consideration should be given to restricting the right turn on red movement.

5.13.6.2 Stop and Yield Crossing Controls

At a minimum, marked crosswalks should be provided wherever a sidewalk crosses a street under stop or yield control. STOP or YIELD lines shall be placed a minimum of 4 feet in advance of the crosswalks.

5.13.6.3 Roundabout Crossing Controls

Requirements for roundabout crossings shall reference the latest version of *NCHRP Report 672 – Roundabouts: An Informational Guide* and the PROWAG.

5.13.7 ADA Curb Ramp Variance Process

It can be impractical to make facilities fully compliant with the standards due to existing site constraints. Improvements at locations can be deemed “Technically Infeasible” when sound engineering judgement is exercised. When full compliance is deemed technically infeasible, facilities being altered should be made accessible to the maximum extent practicable. If a site cannot meet accessibility standards, the proper documentation procedures should be followed.

Examples of site constraints that may make it technically infeasible to make a facility fully compliant include:

1. Adjacent development or buildings that would need to be moved or altered to make a facility fully compliant.
2. Required improvements that would alter the status of a Historic property.
3. Drainage that could not be maintained if an area is made fully accessible.
4. Underlying terrain that would require significant expansion of the project scope to achieve full compliance. An example would be altering a roadway profile to make the cross slope of a crosswalk fully compliant.

Project scope, not cost, should determine when existing constraints make an item technically infeasible.

To submit a curb ramp variance, the Town's Variance Request Form must be completed and signed by a licensed professional engineer documenting why the curb ramp was deemed technically infeasible and every effort was made to design the curb ramp to meet ADA compliance. The request will be reviewed by the Town Engineer, and once approved, will be filed with the Town in the instance that an ADA complaint is received by the Town.

5.14 PEDESTRIAN CROSSING CRITERIA FOR UNCONTROLLED OR MID-BLOCK CROSSINGS

The purpose of Section 5.14 is to serve as a policy to determine where uncontrolled pedestrian crossings should be located, and how to improve existing uncontrolled pedestrian street crossings within the Town.

5.14.1 Definitions

Uncontrolled pedestrian crossings are defined as:

1. Legal crossings that are located at an intersection without a traffic signal
2. Legal crossings without STOP or YIELD signs.

Mid-block crossings are defined as crossings that do not occur at an intersection and are marked to indicate that the location is a legal crossing.

Crossings can be marked with traffic control markings or unmarked with no traffic control markings present.

5.14.2 References

The newest versions of the following references shall be used for guidance in determining location, design elements, and requirements:

1. *The Manual on Uniform Traffic Control Devices 2009 Edition* including Revisions 1 and 2.
2. *Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations (FHWA, 2018)*.
3. *NCHRP Research Report 841 Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments (2017)*.
4. *Evaluation of R1-6 Gateway Treatment Alternatives for Pedestrian Crossings: Follow-Up Report (Roadway Safety Institute, 2017)*.
5. *TCRP Report 112 / NCHRP Report 562 Improving Pedestrian Safety at Unsignalized Crossings (2006)*.
6. *CDOT Roadway Design Guide, Chapter 14 (2018)*
7. *CDOT Standard Plan S-614-14 for Rectangular Rapid Flashing Beacon requirements (hard-wired only)*

References listed above can be utilized in instances where this document does not specifically include requirements or guidance on a particular topic.

5.14.3 Pedestrian Traffic Analysis and Recommendations

An engineering study should be performed at the discretion of the Town Engineer before a crosswalk is installed at a location away from a traffic signal or an approach controlled by a STOP or YIELD sign. If a pedestrian crossing is part of a development application, then a traffic study may also be required as described in Chapter 4 and the traffic studies may be combined. The engineering study shall be stamped by a professional engineer. The following steps are required as part of the Pedestrian Traffic Analysis:

1. Complete the worksheet shown in Table 5.12. If worksheet result is yes, proceed with developing the Pedestrian Traffic Analysis. If the worksheet result is no, no additional analysis is required.
2. Include number of lanes, presence of a median, distance from adjacent signalized intersections, average daily traffic (ADT), posted or statutory speed limit (85th-percentile or mean speed), crash history, geometry of the location, possible consolidation of multiple crossing points, availability of street lighting, and any other factors deemed appropriate by engineering judgement.
3. Provide pedestrian volumes and delays (see Section 5.10.3.1)
4. Crossing treatment recommendations based on criteria and sound engineering judgement (see Section 5.10.3.2)
5. Conclusion of results.

5.14.3.1 Pedestrian Volumes and Delays

Pedestrian volumes and delays will typically involve AM, mid-day, and PM peak hours. Locations near schools may only require two hours of data collection (AM and PM peak hours corresponding to school opening and closing times). All pedestrian volumes should include and differentiate between pedestrians and bicyclists and should note separately the number of young, elderly, and/or disabled

pedestrians. For locations where school crossing traffic is anticipated, the volume of student pedestrians (school age pedestrians on their way to/from school) should also be separately noted.

Whenever possible, pedestrian and bicycle volumes should be collected in the appropriate season when volumes may be close to or at their peak. Counts should be scheduled at a time when nearby businesses are open. If school traffic is an issue, the counts should be scheduled on school days when classes are in session. Given the potential fluctuation in pedestrian traffic from day to day, it may be necessary to collect up to three days of data to determine if an enhanced pedestrian crossing treatment is warranted as follows:

1. Collect pedestrian data on day one. If the minimum pedestrian volume threshold (20 pedestrians per hour accounting for a 1.33 multiplier used if vulnerable populations are present) is exceeded, no further pedestrian data collection is needed. If the threshold has not been exceeded, but at least 50% of the minimum pedestrian volume was observed, proceed to a second day of data collection.
2. Collect pedestrian data on day two. If the minimum pedestrian volume threshold is exceeded, no further pedestrian data collection is needed. If the threshold has not been met but again the volume is at least 50% of the minimum threshold, proceed to a third day of data collection.
3. Collect pedestrian data on day three. If the minimum pedestrian volume still has not been met, then no marked pedestrian crossing treatment is warranted by pedestrian crossing volume.

Pedestrian delays should be measured using procedures from the latest version of the Highway Capacity Manual.

5.14.3.2 *Crossing Treatment Criteria*

The following criteria shall be used in determining if crossing treatments are to be considered and shall be used to complete the worksheet shown in Table 5.12. If a crossing treatment should be considered, Section 5.10.5 shall be used to determine what type(s) of treatment is/are appropriate.

5.14.3.2.1 Criterion A

When vehicle volume is less than 5,000 vehicles per day or the average vehicle speed does not exceed 10 mph over the posted speed, crosswalk enhancements will be considered when there is a crossing pedestrian volume of at least 20 pedestrians per hour. When vehicle volume is greater than or equal to 5,000 vehicles per day or the average vehicle speed is 10 mph greater than the posted speed limit, crosswalk enhancements will be considered when there is a crossing pedestrian volume of at least 10 pedestrians per hour. A multiplication factor of 1.33 can be applied to the hour pedestrian volume if the volume consists of vulnerable populations (children, elderly, persons with disabilities, etc.). See lines (1) through (3) of Table 5.12.

5.14.3.2.2 Criterion B

Crosswalks enhancements will be considered when they could directly service or are adjacent to an existing shared-use path or trail, park, school, hospital, senior center, recreation center, library, or other facility with sensitive populations as determined by the Town Engineer. The minimum hourly pedestrian volume criterion may be waived if this criterion is satisfied. See line (4) of Table 5.12.

5.14.3.2.3 Criterion C

Crosswalk enhancements will be considered in locations where there are greater than 1 non-motorized (vehicle to pedestrian or vehicle to bicycle) crashes within the last 3 years. The minimum hourly pedestrian volume criterion may be waived if this criterion is satisfied. See line (5) of Table 5.12.

5.14.3.2.4 Criterion D

If criterion A, B, or C is met, the location must then also meet the following criteria:

1. The minimum stopping sight distance is available and free from obstructions. The minimum stopping sight distance shall be calculated using intersection sight distance per Section 5.6.1.5.
2. The crossing should match the grade of the existing roadway. More detail regarding maximum roadway grade can be found in Section 5.4.3.2.
3. The distance to the nearest existing marked or controlled crosswalk is at least 300 feet. If an existing marked or controlled crosswalk is within 300 feet, care should be given to direct pedestrian traffic to said crosswalk.
4. The existing roadway shall have a maximum slope of 6% in the downhill direction for a minimum distance of 200 feet. If the slope exceeds 6%, a crossing will not be allowed or the road must be re-graded to reduce the slope.

See lines (6) through (9) of Table 5.12.

5.14.4 Crossing Enhancement Eligibility Worksheet

The following table shall be used to determine if an uncontrolled or mid-block crossing is eligible for enhancement. A blank version of this worksheet can be found in Appendix E to assist with documentation of location decisions at the discretion of the Town Engineer.

Table 5.12 Crossing Enhancement Eligibility Worksheet

Criterion	Line	Criteria	Value	Eligibility Requirement
A	(1)	Average daily vehicle traffic	#	See (5)
	(2)	Mean vehicle speed differential from posted speed limit	#	See (5)
	(3)	Number of pedestrians per hour	#	See (5)
	(4)	Does the location serve a vulnerable population (children, elderly, persons with disabilities, etc.)?	Yes/No	See (5)
	(5)	Adjusted number of pedestrians per hour	#	If (4) is Yes, then value = (3)*1.33, otherwise value = (3) Eligibility Requirement: When (1) < 5,000 or (2) < 10, then ≥ 20 When (1) ≥ 5,000 or (2) ≥ 10, then ≥ 10
B	(6)	Does the location directly serve or is adjacent to one of the following: Existing shared-use path or trail; park; school; hospital; senior center; recreation center; library?	Yes/No	If Yes, then (5) eligibility requirement is waived
C	(7)	Number of non-motorized crashes in the last three years	#	If ≥ 6, then (5) eligibility requirement is waived
D	(8)	Is the minimum stopping sight distance available (see Section 5.6.1.5)?	Yes/No	Eligibility Requirement: Yes

	(9)	Will the crossing match the existing roadway grade or less?	Yes/No	<i>Eligibility Requirement: Yes, cannot be greater</i>
	(10)	Distance to nearest existing marked or controlled crossing (feet)	#	<i>Eligibility Requirement $\geq 300'$</i>
	(11)	Is the maximum grade of the roadway 6% or less in the downhill direction for a minimum 200' distance?	Yes/No	<i>Eligibility Requirement: Yes, or the road can be re-graded to meet</i>
	(12)	Eligible for Treatment?	Yes/No	<i>Yes = Criterion A, B, or C is met and Criterion D is met</i>

If eligible for treatment, see Section 5.10.5 for applicable crosswalk enhancements.

5.14.5 Pedestrian Crossing Enhancements

Once a determination has been made that a pedestrian crossing enhancement is recommended at a particular location, several design treatments can be considered.

Roadway traffic calming treatments should be considered in conjunction with pedestrian crossing enhancements as a means to enhance the effectiveness of one another. See Section [5.6](#) for more information on traffic calming treatments.

5.14.5.1 Pavement Markings and Conventional Signs

NCHRP Research Report 841 Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments (2017) states, "Recent research has found no safety benefit associated with various types of crosswalk markings, and the inappropriate use of marked crosswalks alone (without other substantial safety measures) can increase crash risk for pedestrians." This shall be considered when choosing to implement crosswalk markings at uncontrolled intersections or mid-block locations.

5.14.5.1.1 Standard Continental Crosswalk Markings

Standard continental crosswalk markings are pavement markings rectangular in shape. They shall be a minimum of 6 feet long and 1 to 2 feet wide. The alignment of the markings shall connect the curb ramps and be oriented so that they are parallel with the direction of travel. Markings shall be recessed into the pavement placed so that they avoid the anticipated vehicle wheel path to improve longevity of the markings. They can be spaced 1 to 5 feet apart. Crosswalk markings are to be used in conjunction with appropriate signing as defined in this section, because research shows that markings alone do not improve pedestrian crash rates. Decorative crosswalk markings are not recommended. Crosswalk markings shall be made retroreflective with glass beads or other approved methods. See Chapter 9 for construction requirements.

5.14.5.1.2 High Visibility Markings

High Visibility Markings are wider pavement markings that can be applied in the area of a crossing if the area is unlit and peak pedestrian traffic volumes occur during unlit times.

5.14.5.1.3 Advanced Yield or Stop Markings and Signs

Advanced yield or stop markings and signs may be used in conjunction with a crosswalk marking on major collector roadways with speeds of 40 mph and where placement of advanced markings and signs does not conflict with other intersections or traffic control. Refer to Section 3B.16 of the MUTCD for further standards and guidance.

5.14.5.1.4 Pedestrian Sign Assembly

The following list includes pedestrian signing options that should be utilized in combination with pedestrian markings listed in section

1. Pedestrian Crossing Sign Assembly (W11-2 with W16-7P) - shall be used in combination with crosswalk marking treatment. Sign structure shall be mounted at the roadside in accordance with MUTCD 2C.50.
2. Yield/Stop Here for Pedestrians Signs (R1-5) - may be used in conjunction with a crosswalk marking, advanced yield or stop markings, and a typical pedestrian crossing sign assembly on roadways with multiple lanes. Refer to Section 2B.11 of the MUTCD for further standards and guidance.
3. In-Street Pedestrian Crossing Signs (R1-6) - may be used when pedestrian crossing volumes are greater or equal to 20 pedestrians per hour OR when the mean vehicle speed at the crossing location is 5 mph greater than the posted speed limit. This treatment shall be used in conjunction with a crosswalk marking, a pedestrian crossing sign assembly, and a roadway centerline marking.

5.14.5.2 Physical Geometric Treatments

The following physical roadway geometric treatments can be considered to provide additional crossing safety and visibility as approved by the Town Engineer. Refer to the Town of Breckenridge's *Traffic Calming Policy* for additional treatment information regarding coordination and design considerations.

5.14.5.2.1 Refuge Islands

Refuge islands provide a space in the center of the traveled way for pedestrians to rest as they wait to cross each direction of vehicular travel independently. Refuge islands should be considered at pedestrian crossing locations on roads where one or both directions of travel are high volume, and see the most benefit with four or more lanes of traffic and speeds of 35 mph or greater. They can be paired with additional crossing enhancements provided in this section. Refuge islands shall be a minimum 10 feet wide from back of curb to back of curb. They shall be designed to allow for positive drainage and for adequate snow removal around the island and be ADA compliant. If the installation of a refuge island requires a shift in the traveled way, appropriate lane transition rates shall apply for the redirection of traffic around the island. Delineation markers may be required for snow removal activities.

5.14.5.2.2 Curb Extensions (Bulb-Outs)

Curb extensions extend the pedestrian sidewalk and curb out into the shoulder or parking lane of the roadway to reduce the crossing distance. This reduces the amount of time that pedestrians need to cross the traveled way, and provide additional space for curb ramps. They also can assist in reducing speeds of vehicular traffic. Curb extensions should allow for a minimum 11-foot travel lane. Curb extensions shall be designed to allow for positive drainage and for adequate snow removal around the extension. Delineation markers may be required for snow removal activities.

5.14.5.2.3 Raised Crosswalks

Raised crosswalks are ramped speed tables placed at mid-block crossing locations that assist with driver visibility of pedestrian crossings. They also provide traffic calming benefits. Raised crosswalks shall be flush with the sidewalk it is connecting on either side of the crossing, and shall be a minimum of 10 feet wide. They can be considered on minor collector and local roadways with a speed of 30 mph or less. Raised crosswalks shall generally be 6" tall, wings shall be 8% max, cross slopes shall be 2% maximum and meet ADA requirements, and storm sewer inlets shall be installed on the uphill side of the crosswalk. Raised crosswalks shall be designed to allow for positive drainage, and noise

considerations should be made prior to proposing a location. Delineation markers may be required for snow removal activities.

5.14.5.3 Rectangular Rapid Flashing Beacon (RRFB)

RRFBs should be used sparingly and are typically only installed when other crossing enhancements have proven ineffective. An RRFB may be installed when all of the following criteria are met:

1. Marking and signing enhancements in Section 5.10.5.1 have been implemented but a perceived or actual pedestrian/vehicle conflict issue still persists
2. Pedestrian crossing volumes are between 60 and 160 pedestrians per hour
3. Crosswalk length from curb to curb is greater than 32 feet.
4. Roadway speeds are between 30 mph and 45 mph, or mean vehicle speed at the crossing location is 5 mph greater than the posted speed limit.
5. Roadway volume is greater than 6,700 vehicles per day.

The RRFB treatment is a combination of signing, markings and pedestrian activated strobe and feedback devices at uncontrolled pedestrian crossings. Refer to CDOT Standard Plan S-614-14 for requirements. RRFBs shall be hard-wired. Solar is not permitted. Signing for the RRFB typically includes advance PEDESTRIAN WARNING signs (W11-2) with AHEAD supplemental plaques (W16-9p), and PEDESTRIAN WARNING signs (W11- 2) with down arrow supplemental plaques (W16-7p). Pavement markings include yield lines. The pedestrian activated treatments would be the W11-2 signs with built in rectangular strobe flashers. Additionally, pedestrian visible strobes and a recorded message inform pedestrians when the crossing is activated and instruct them to wait for motorists to yield. The R1-5 (YIELD HERE TO PED) shall be placed so that it does not restrict motorists' visibility of the RRFB at the crosswalk. For the placement of advance stop lines and advance warning signs, refer to the MUTCD. High visibility crosswalks are to be used with the RRFB crossing treatment. Timing of the flashing beacon should allow for pedestrians to scan for motorists, step from the side of the road and completely cross the street. Depending upon pedestrian volumes, 5 to 10 seconds should be provided for pedestrians to scan for gaps and enter the roadway. For areas with very high pedestrian volumes (more than 10 pedestrians crossing simultaneously), additional startup time should be provided. A minimum of 3.5 feet per second crossing speed should be assumed for pedestrians.

A median refuge area should be considered, refer to Section 5.10.5.2.1.

5.14.5.4 Pedestrian Hybrid Beacon

Pedestrian hybrid beacons are not generally recommended in the Town of Breckenridge. This treatment may be applied if all of the following criteria are met:

1. Warrants and guidance from Chapter 4F of the MUTCD deem a PHB may be appropriate, and
2. Written approval has been given by the Town Engineer.

5.14.5.5 Grade Separated Crossing

A grade separated crossing treatment is typically applied for roadways meeting one of the following requirements:

1. Posted speeds greater than 40 mph, crossing lengths greater than 48 feet, and average daily traffic volumes greater than 10,000 vehicles per day
2. When removing sight distance obstructions is not feasible
3. The majority of users are expected to be non-traditional pedestrians (skiers, snowboarders, bicyclists, skateboards, etc.)

4. The proposed crossing is within CDOT ROW and the pedestrian volume exceeds 60 pedestrians per hour
5. Pedestrian volumes exceed 200 pedestrians per hour.
6. An at-grade crossing is expected to cause traffic impediment along the roadway and lower the LOS of the roadway.

Within CDOT ROW, new crossings with pedestrian volumes exceeding 60 pedestrians per hour will require a grade separated crossing. If the pedestrian volume is less than 60 pedestrians per hour, the Town Engineer will review the proposed crossing and determine if an at-grade crossing will be allowed.

Prior to implementing a grade separated crossing, additional study should be performed to determine if other at-grade solutions may be preferable. Written approval from the Town Engineer is required for all grade separated crossings.

Grade separated crossings shall generally be designed for ADA compliance, include physical barriers to prevent at-grade crossing, light enhancements inside the crossing, and include pedestrian routes entering and exiting the crossing which are intuitive and natural routes for pedestrians resulting in high compliance of use.

5.15 TRANSIT FACILITIES

Streets shall be designed to accommodate transit facilities where transit routes are identified during the development process. Transit facilities, including transit stops, waiting areas, transit shelters, and other transit improvements are encouraged and may be required as determined by the Town Engineer. Transit stops shall be located to minimize impact on through traffic, provide efficient arrival and departure for the transit vehicle, and bear a logical relationship to the population served. New transit stops and facilities shall be connected to the adjacent developments via sidewalks and trails.

Where required by the Town Engineer, transit stops shall be located where direct pedestrian access is provided from the street and adjacent sidewalk or surrounding area to the stop. Transit stops shall include a paved waiting area with a direct connection to the adjacent sidewalk. As each site is unique, the waiting area dimensions shall be determined by the Town Engineer.

Bus pull outs shall be located on the downstream side of an intersection wherever possible designed to provide a 30-foot loading area per bus and a 3:1 exiting taper. The pavement in the bus pull out lane shall be designed per a pavement evaluation report to account for the expected bus traffic; minimum concrete thickness of 10 inches shall be provided. Bus pullouts shall be per the standard detail and shall be a minimum of 10 feet wide, 40- to 60-foot long tapers with a 50-foot minimum radius and 2% cross slope.

5.16 PAVEMENT DESIGN

This section provides the criteria used for the design of pavements and will ensure adequate strength and durability to carry the predicted traffic loads for the design life of each project. The street pavement design evaluation shall be established for each project in a geotechnical report following the latest *CDOT M-E Pavement Design Manual*. The pavement design will be based on a Design Equivalent Single Axle Loads (ESAL) which is determined on average daily traffic count (ADT), vehicle classification, traffic equivalence load factors, traffic growth rate, design period, and lane factor. Private streets and accesses may be asphalt, concrete, or other impervious surface approved by the Town Engineer. Sidewalks and bus pullouts shall be concrete.

5.16.1 Soils Testing for Pavement Design

To design pavements for approval and acceptance by the Town, sampling and testing must be performed under the direct supervision of a registered Professional Engineer to evaluate the soil

characteristics. Samples shall be taken at least 5 feet below proposed subgrade (10 feet on arterial roadways) at spacing of 250 feet or less, unless specified by a geotechnical engineer. Test holes shall properly evaluate all changes in soil character. Samples shall be taken at the minimum depth which will serve as subgrade for new street construction.

When joining to an existing paved street, cores of the existing pavement and base structure shall be made and analyzed to determine whether overlayment is feasible or reconstruction is necessary.

5.16.2 Flexible Pavement Design

Flexible pavements shall be designed, installed, constructed, maintained and repaired in accordance with these standards and with the latest editions of the *CDOT M-E Pavement Design Manual* and Standard Specifications for Road and Bridge Construction or the AASHTO Guide for the Design of Pavement Structures. In the event of discrepancies between these standards and the referenced publications, the more stringent shall take precedence.

A minimum of four inches of aggregate base course (ABC) shall be used as a base on roadways. If the design truck traffic is greater than 500 trucks per day, a minimum of six inches of ABC shall be used as a base. The minimum pavement thickness for all roadways shall be four inches. However, each roadway pavement section proposed in the Town shall be designed per a geotechnical report to determine actual recommended thickness and pavement mix. The minimum pavement thickness shall be per Table 5.13 below. These values only provide preliminary minimum values; the final pavement thickness shall be designed per the geotechnical report.

Table 5.13 Pavement Thickness Minimums

Street Type	Min. Asphalt Depth (Inches)	Min. Class 6 Aggregate Base Course Depth (Inches)
Private Roadway	4	4
Local	4	4
Minor Collector	5	6
Major Collector	6	6

The minimum lift thickness of flexible pavement shall be 1.5 inches and the maximum lift thickness shall be three inches.

5.16.3 Rigid Pavement Design

Rigid pavements shall be designed, installed, constructed, maintained and repaired in accordance with these standards and with the latest editions of the *CDOT M-E Pavement Design Manual* and Standard Specifications for Road and Bridge Construction or the AASHTO Guide for the Design of Pavement Structures. In the event of discrepancies between these standards and the referenced publications, the more stringent shall take precedence.

Rigid pavement shall have a minimum ABC thickness of six inches and a minimum concrete pavement thickness of seven inches.

5.17 Traffic Control Devices

Traffic control device designs shall be prepared by a Colorado licensed professional engineer experienced in traffic engineering. The designs shall be prepared in accordance with the latest version of the *Manual on Uniform Traffic Control Devices (MUTCD)*.

Striping plans are required for Collectors and Arterials, but may not be required for local subdivision streets. However, sign plans are required for all subdivisions. All signing and striping plans shall conform to the most current edition of the *MUTCD*. All traffic control devices shall be fabricated and installed in accordance with the *MUTCD*. Permanent signage and striping shall be complete and in place before any new roadway is opened to the public for use.

5.17.1 Street Name Signs

New streets in the Town of Breckenridge shall be named by the Town of Breckenridge in accordance with Town and Summit County naming procedures. The Town and County GIS Departments shall be used to ensure that each street name is unique and does not match or closely resemble another street name in the Town of Breckenridge or within Summit County.

Street name signs are required at the intersections of all public and private (serving four or more units) streets. Driveways serving three or less units may not install street name signs in the right of way.

Street name signs shall be fabricated to match existing Town of Breckenridge street signs. Color, size, font, and dimensions of the signs shall match existing Town street signs. The Town of Breckenridge Streets Department shall be consulted for street sign specifications.

5.17.2 Stop Signs

Stop signs or other traffic control devices shall be installed at the intersections of all public and private streets (access serving four or more units) and shall meet *MUTCD* requirements. Stop signs are not required at driveways serving three or less units.

5.17.3 Private Signage

No private signage shall be permitted within the ROW. No private signage shall be permitted on private property which attempts to direct traffic or parking. Business name signs and address signs may be installed outside of the ROW per requirements in the Town Code.

5.17.4 Signage Requests

Requests for additional signage for traffic calming, speed limit signs, children playing signs, parking signs, and other signage will be considered based on *MUTCD* standards, proximity to other signage, and local conditions. However, additional signage can create "signage clutter", a term for a condition when there is too much competing signage along a street causing driver confusion, reduced effectiveness of signage, distraction, and decreased aesthetics of a street. The Town of Breckenridge approves signage at that minimum level required to provide for safe and efficient travel of vehicles of pedestrians.

~~5.19.18~~ STREET LIGHTING

The purpose of streetlight installations shall be to illuminate the public traveled ways to a level that provides for the safe passage of public traffic, both vehicle and pedestrian. Arterial and Collector streets shall require street lighting at intersections. Pedestrian lighting will be required near all sidewalks, pedestrian routes & facilities, crosswalks, and transit facilities. All fixtures, poles, and designs will be reviewed and approved by the Engineering Division and the power provider.

~~5.19.1-15.18.1.1~~ Equipment Type and Location

~~The Town's standard Newport fixture, Providence Fixture, or Promenade Fixture shall be installed depending on the location within the Town. Typically, Newport fixtures are installed in the historic district, Providence fixtures are installed outside the historic district, and Promenade fixtures are~~

~~installed at critical intersections along SH 9. The Town Engineer will determine the appropriate light fixture depending on the location of the development. Typical spacing of light poles is 75 feet along pedestrian routes. Light pole spacing may be reduced to 110 feet along local road sidewalks. In residential areas, along a portion of road without a sidewalk, street light spacing may be further reduced to 300 feet. Typical pole height is 9 feet tall along pedestrian routes and 12 feet tall at intersection and crosswalks. The photometric analysis shall be completed to determine exact spacing, location, and pole height at all crosswalks and intersections. The type of area should also be considered when determining the equipment type and location. The Town staff can provide additional guidance on the type of illumination equipment that is required depending on the location of the project. Standard details for foundations, poles, fixtures, and luminaires are included in the standard details attached to Chapter 9 of these Standards.~~

The Town's standard Providence Fixture or Promenade Fixture shall be installed depending on the location within the Town. The Providence Fixture is the typical fixture installed in the Town, while the Promenade fixture is typically reserved for SH 9 and critical intersections or crosswalks. The Welsbach fixture (also called a Newport fixture) is installed in various locations within the Historic District of Breckenridge. No new Welsbach (Newport) fixtures will be installed unless a variance is granted by the Town Engineer. The Town Engineer will determine the appropriate light fixture depending on the location of the development. Standard details for foundations, poles, fixtures, and luminaires are included in the standard details attached to Chapter 9 of these Standards.

All new fixtures shall be dark sky compliant and shall have the capability to be automatically dimmable. All new street lights shall meet the following requirements:

1. Fixtures shall be certified dark sky compliant by the International Dark-Sky Association.
2. Fixtures shall be automatically dimmable. Fixtures in residential areas shall be programmed to dim at 10 pm and commercial areas shall be programmed to dim at 2:30 am. Fixtures at intersections and crosswalks shall have the capability to dim, but shall be programmed to remain and the same lumens throughout the night (no dimming).
3. New streets and development shall be designed to have a maximum 50,000 lumens/acre in commercially zoned areas and a maximum of 25,000 lumens/acre for residentially zoned areas. Area with traffic safety concerns, major collector roads, roundabouts, high pedestrian areas, crosswalks, and other areas of safety concern as determined by the Town Engineer shall be exempted from the maximum lumen requirements.
4. Light pole spacing shall be 75 feet along pedestrian routes. Light pole spacing may be reduced to 110 feet on roads classified as Local. On residential local roads without a sidewalk, street light spacing may be reduced to 300 feet. Light pole spacing may be modified for safety concerns or guidance from a photometric analysis.
5. Pole height shall be 9 feet tall along pedestrian routes and 12 feet tall at intersections and crosswalks. Pole height may be further increased for safety concerns with a photometric analysis.
6. Lights shall meet all requirements of Title 9, Chapter 12 (Exterior Lighting Regulations) and all other dark sky compliance regulations.
7. Photometric analysis (if determined necessary by Town Engineer).
8. Additional requirements as determined by the Town Engineer due to vehicle or pedestrian traffic, safety concerns, intersections, or other reasons.

~~5.19.1.25.18.1.2~~ -Positioning at Intersections

In general, the nighttime visibility of a pedestrian or hazardous object within an intersection is enhanced by increased contrast between the object and the surrounding street area. Street lights at intersections are required to be placed on the upstream side of the intersecting street, as viewed by a motorist approaching the intersection in the lane directly beneath the luminaries. The positioning of light standards at intersecting streets shall be up to two street lights per corner of intersection, depending on street geometry and crosswalk location.

5.19.1.35.18.1.3 *Roundabout Lighting*

Lighting columns should be arranged around the perimeter of the roundabout in a simple ring, with the lights equidistant from the center and from each other. Lighting should extend at least 197 feet back along each approach road. Mounting height should be uniform throughout the intersection and not less than on any approach road. The minimum illuminance required should not be less than the highest level of lighting for any of the approach roads. Lights near roundabouts shall not be located closer than 6 feet from the face of curb and shall not be located in the center of median islands.

5.19.1.45.18.1.4 *Light Pole Offset Distances*

Distance behind back of walk for local streets shall be at least 3 feet and must be within easements or right-of-way on Local residential streets. For Collector and Arterial streets, the light must be offset at least 3 feet from the back of curb and provide a clearance space between the light pole and edge of walk that equals or exceeds the required sidewalk width.

5.19.1.55.18.1.5 *Underground Service*

Street lighting shall be installed with underground electric service on all newly developed dedicated public streets in the Town. The Developer is responsible for coordinating with the appropriate utility company all aspects of design and installation. Junction boxes and other structures shall not be installed in sidewalks, curbs, or curb ramps.

5.19.25.18.2 **Pedestrian Lighting**

Install street lighting behind sidewalks where sidewalks attached to the curb are used. For sidewalks detached from the curb, install street lighting with a minimum of 3 feet clearance from back of curb to roadway side of support pole and 3 feet clear from all walks. All bridge underpasses, where vehicles, pedestrians, bicyclists, or equestrians may be present, shall require lighting.

Lighting for trails should be evaluated based on safety and the type of trail. Lighting will generally be required for primary trails at primary trailheads, underpasses, mid-block crossings. Where sidewalks and trails are located near or adjacent to streets, lighting shall be coordinated with street lighting requirements.

5.19.35.18.3 **Dark Sky Ordinance**

The Town has adopted an exterior lighting policy generally adhering to a Dark Sky Ordinance. See *Exterior Lighting Regulations* in Title 9, Chapter 12 of the Town Code.

5.19.45.18.4 **Residential Areas**

Street lights shall be shielded with house side shields or other measures to minimize light shining on residential areas.

5.205.19 **PRIVATE FACILITIES**

Private streets, alleys, and accesses are typically utilized by an individual, group of individuals, or private business to access private property. It is the responsibility of the private landowner to maintain the private facility.

5.20.15.19.1 Private Streets

A private street is an access serving ~~five~~four or more units or lots. Private streets are discouraged because they create a cost burden to residents. Private streets shall meet the same design standards as public streets. Private streets are not owned, maintained, or plowed by the Town. They are the sole responsibility of the property owner. A private street requires the approval of a variance request form by the Town Engineer.

5.20.25.19.2 Private Snow Melt Systems

~~Driveway-Private~~ heated pavement systems, also called snowmelt systems, shall terminate at the property line with no components located in the right-of-way. See section 9-1-19-33A and 33R of the Town Code for additional regulations. The following requirements shall be met for snowmelt systems:

1. Infrastructure permit shall be submitted for any private snowmelt system (even if located entirely on private land).
2. The snowmelt system shall stop 5 feet from the edge of a public roadway or 1 foot from the back of public sidewalk.
3. Drainage from the snowmelt system shall be captured on the premises and shall not drain across public pedestrian facilities or roadways. The drainage shall be designed to infiltrate or runoff without freezing. Examples include heated trench drains and inlets to storm pipes and drywells. Drywells shall be designed appropriately to infiltrate all runoff. Drainage shall not drain across public pedestrian facilities or roadways.

If the Town Engineer allows the snow melt system to encroach into the right-of-way, the following conditions shall be met in addition to the conditions above:

1. A separate mechanical zone shall be dedicated for the portion of the snowmelt system within the right-of-way
- ~~2. The snowmelt system shall stop 5 feet from the edge of roadway or at the back of sidewalk~~
- ~~3. Drainage from the snowmelt system shall be captured and shall not drain across pedestrian facilities or roadways~~
- ~~4.2.~~Expansion joint material shall be installed at the edge of heated concrete
- ~~5.3.~~A revocable encroachment license agreement, acceptable in form and substance to the Town Attorney for the components of the system extending into the ROW, must be approved by the Town and executed prior to the issuance of building permit
- ~~6.4.~~Other requirements as determined by the Town Engineer to reduce the impacts of the snow/melted interface

5.215.20 UTILITIES

Utilities in ROW shall be located to minimize roadway disturbance. Utility lines shall be located to minimize the need for future adjustment and shall consider future extensions of the street system. Utility structures above grade shall be placed in easements outside of the ROW, or as close to the edge of the Right of Way as possible, and at least 6 feet from the edge of roadway and 3 feet from the edge of sidewalk. Utilities shall be buried a minimum of 2 feet below finished grade. Utility rings and covers within pavement areas shall be 0.25 to 0.50 inches below top of pavement. Manholes, valves, junction boxes, and other structures shall not be located in curbs or sidewalks.

Utilities shall typically be installed in the roadway shoulder to avoid pavement removal. If the utility must be placed beneath pavement, the utility should be installed at the center or at the edge of travel lanes. Utilities shall not be placed beneath wheel paths of roads. Utilities shall not be located in drainage swales. Utilities shall be installed to meet all applicable standards and requirements for bury

depths, offsets, crossings, separation, and insulation. Utility crossings shall be perpendicular to street and pavements cuts shall be perpendicular to roadway. Pavement patches shall extend 1' minimum beyond trench and edge of patch shall not be located within wheel paths. See Chapter 3 of these standards for additional trenching and patching details.

All utilities (including storm sewer) shall be electronically locatable for the entire length of the utility. All wires and cables shall be buried in rigid conduits and backfilled with warning tape placed 1 foot above the conduits. Utilities and utility structures shall be located outside of ROW and within utility easements where feasible.

5.225.21 DESIGN CRITERIA TABLE BY STREET CLASSIFICATION

Table 5.14 Design Criteria by Street Classification

Street Classification						
	Major Collector					
	Minor Collector					
				Local		
Posted Speed	40 mph	35 mph	30 mph	25 mph	20 mph	15 mph
Design Speed	40 mph	35 mph	30 mph	25 mph	20 mph	15 mph
Min. Horizontal Curve Radius (normal crown)	770'	510'	350'	200'	110'	50'
Min. Tangent Between Curves	150'	150'	100'	50'	20'	20'
Max. Super Elevation	6%	6%	6%	N/A	N/A	N/A
Cross-slope	2%	2%	2%	2%	2%	2%
Minimum Stopping Sight Distance	305'	250'	200'	155'	115'	80'
Min. Grade	1%	1%	1%	1%	1%	1%
Max. Grade	6%	6%	6%	6%	6%	6%
Min. K-Crest	44	29	19	12	7	3
Min. K-Sag	64	49	37	26	17	10

CHAPTER 6 STORMWATER STANDARDS

TABLE OF CONTENTS

6.1	PURPOSE	1
6.2	OTHER STANDARDS	1
6.2	SUBMITTALS	1
6.3	RAINFALL.....	1
6.3.1	Rainfall Intensity	1
6.3.2	Rainfall Distribution.....	2
6.3.3	Design Storms	2
6.4	RUNOFF	2
6.4.1	Approved Hydrologic Methods.....	3
6.4.2	Subwatershed Sizing	3
6.4.3	Rational Method	3
6.4.3.1	Runoff Coefficient	3
6.4.3.2	Time of Concentration	4
6.4.3.3	Limitations and Considerations.....	6
6.4.4	SCS Method	6
6.4.4.1	SCS Method - Rainfall	6
6.4.4.2	SCS Method – Curve Number	6
6.4.4.3	SCS Method – Time of Concentration	8
6.4.4.3.1	Sheet Flow	8
6.4.4.3.2	Shallow Concentrated Flow	8
6.4.4.3.3	Open Channel Flow	9
6.4.5	Hydrograph Development and Routing Models	10
6.4.5.1	HEC-HMS.....	10
6.4.5.2	EPA SWMM.....	10
6.4.5.3	CUHP	11
6.4.6	FEMA Flows	11
6.5	OPEN CHANNELS	11
6.5.1	Open Channel Hydraulics.....	11
6.5.1.1	Uniform Flow	11
6.5.1.2	Critical Flow	13
6.5.1.3	Gradually Varied Flow	14
6.5.1.4	Rapidly Varied Flow.....	14

6.5.2	Open Channel Design	15
6.5.2.1	Channel Selection Factors.....	15
6.5.2.2	General Design Guidelines.....	15
6.5.2.3	High Gradient Channels	16
6.5.2.4	Ecological Channel Design Guidelines	17
6.5.2.5	Revegetation	18
6.5.3	Roadside Ditch Design	18
6.6	STREETS AND ROADSIDE CONVEYANCE.....	20
6.6.1	Allowable Flow Depth and Spread.....	21
6.6.2	Minimum and Maximum Grades.....	22
6.6.3	Cross Street Flow	22
6.6.4	Calculations	22
6.6.4.1	Streets with Curb and Gutter	22
6.6.4.2	Streets with Roadside Ditches.....	22
6.7	STORM DRAIN SYSTEMS	23
6.7.1	Storm Drain Design Criteria.....	23
6.7.1.1	Construction Materials	23
6.7.1.2	Pipe Size	23
6.7.1.3	Horizontal and Vertical Alignment.....	24
6.7.1.4	Utility Crossings	24
6.7.1.5	Inlets and Manholes.....	25
6.7.1.6	Capacity and Velocity	25
6.7.2	Storm Drain Hydraulics.....	26
6.7.2.1	Manual Calculations	26
6.7.2.2	Computer Model Calculations.....	27
6.7.2.2.1	Rational Method	27
6.7.2.2.2	Bend and Lateral Loss Coefficients	27
6.7.3	Inlet Hydraulics	27
6.7.3.1	Introduction.....	28
6.7.3.2	Inlet Capacity.....	28
6.7.3.3	Continuous Grade Condition	28
6.7.3.4	Sump Condition	28
6.7.3.5	Inlet Spacing.....	28
6.7.3.6	Inlet Grates	29
6.7.4	Design of a Storm Drain System	29
6.7.4.1	Preliminary Design.....	29

6.7.4.2	Final Design.....	30
6.8	CULVERTS AND BRIDGES.....	30
6.8.1	Culvert Design Standards.....	30
6.8.1.1	Materials and Structural Design.....	31
6.8.1.2	Minimum Size	31
6.8.1.3	Allowable Headwater	31
6.8.1.4	Roadway Overtopping	32
6.8.1.5	Velocity and Outlet Protection	32
6.8.1.6	Headwalls, Wingwalls, and End Sections	33
6.8.1.7	Grates	33
6.8.1.8	Location and Alignment	33
6.8.2	Bridge Design Standards.....	33
6.8.2.1	Bridge Sizing	34
6.8.2.2	Hydraulic Analysis	34
6.8.2.3	Inlet and Outlet Configuration	34
6.8.2.4	Scour Analysis and Countermeasures.....	34
6.8.2.5	Structural Design	35
6.8.3	Culvert Hydraulics	35
6.8.3.1	Inlet Control Calculation.....	36
6.8.3.2	Outlet Control Calculation.....	36
6.8.3.3	Evaluation of Results	38
6.8.3.4	Outlet Velocity Calculation	39
6.8.3.5	Computer Applications.....	39
6.8.4	Design Examples.....	39
6.8.4.1	Crossing Culvert Analysis Example	39
6.8.4.2	Private Driveway Culvert Design Example	41
6.9	DETENTION.....	42
6.9.1	Applicability.....	42
6.9.2	Detention Facility Design.....	43
6.9.2.1	Historic Flow Rates.....	43
6.9.2.2	MHFD-Detention.....	44
6.9.4	Snow Storage in Detention Ponds.....	45
6.9.5	Maintenance	45
6.9.6	Detention and Water Rights.....	45
6.9.7	Jurisdictional Dams	46
6.10	PERMANENT WATER QUALITY	46

6.10.1 Planning Principles	46
6.10.2 Applicability	47
6.10.3 Treatment Facility Types	48
6.10.4 Design Criteria	48
6.10.4.1 Tributary Offsite Area	48
6.10.4.2 Right-of-Way Restrictions	48
6.10.4.3 WQCV Storage and Release	48
6.10.4.3.1 Effective Imperviousness	50
6.10.4.3.2 Design Volume and Bypass Capacity	50
6.10.4.3.3 Detention	51
6.10.4.4 Infiltration	51
6.10.4.5 Proprietary Structures	52
6.10.4.6 Treatment in Series	52
6.10.5 Designing for Inspection and Maintenance Requirements	53
6.10.5.1 Access	53
6.10.5.2 Forebays	54
6.10.5.3 Stockpile Areas	54
6.10.5.4 Extended Detention Basins	54
6.10.5.5 Infiltration Facilities	54
6.10.5.6 Proprietary Structures	54
6.10.5.7 Ownership and Maintenance Plan and Agreement	54
6.11 CONSTRUCTION STORMWATER MANAGEMENT	56
6.11.1 Applicable Codes and Permits	56
6.11.2 Applicability within the Town	56
6.11.3 Stormwater Management Plan Requirements	57
6.11.3.1 SWMP Report	57
6.11.3.2 SWMP Plans	58
6.11.3.3 SWMP Specifications	58
6.11.4 SWMP Submittal, Inspection, & Maintenance	58
6.11.4.1 SWMP Submittal Requirements	59
6.11.4.1.1 Initial SWMP Plan	59
6.11.4.1.2 Interim SWMP Plan	59
6.11.4.1.3 Final SWMP Plan	59
6.11.4.1.4 SWMP Details	60
6.11.4.2 SWMP and CSMP Inspection	60
6.11.4.3 SWMP Maintenance	60

6.11.4.4 SWMP Adequacy.....	60
6.11.5 Temporary BMPs.....	60
6.11.5.1 Vehicle Tracking	61
6.11.5.2 Sediment Basins.....	61
6.11.5.3 Check Dams	61
6.11.5.4 Materials Storage and Stockpiles	62
6.11.5.5 Temporary Stabilization and Winterization	62
6.11.5.6 Erosion Blanket.....	63
6.11.5.7 Control Measure Specifications and Details	63
6.11.6 Construction Site Inactivity	63
6.11.7 Final Stabilization	63

LIST OF TABLES

Table 6.1. Intensity-Duration-Frequency Data	2
Table 6.2. 6-Hour Rainfall Depths for SCS Type II Distribution	2
Table 6.3. Land Use Imperviousness	4
Table 6.4. Runoff Coefficient Equations	4
Table 6.5. NRCS Conveyance Factors, K	5
Table 6.6. Runoff Curve Numbers	7
Table 6.7. Runoff Curve Numbers for Arid and Semiarid Rangelands	8
Table 6.8. Manning's Roughness Coefficients for Channels	13
Table 6.9. Factors to Consider for Channel Design.....	15
Table 6.10. Ecological Channel Design Advantages and Disadvantages	17
Table 6.11. Allowable Velocity and Froude Number for Roadside Ditches	19
Table 6.12. Maximum Allowable Flow Depth and Encroachment.....	21
Table 6.13. Maximum Allowable Manhole Spacing	25
Table 6.14. Manhole Sizing	25
Table 6.15. Manning's Roughness Coefficients for Storm Drain Conduits	26
Table 6.16. Applicable Culvert Standards.....	31
Table 6.17. Allowable Headwater	32
Table 6.18. Bridge Scour Design Standards.....	35
Table 6.19. Inlet Control Nomograph Selection	36
Table 6.20. Culvert Entrance Loss Coefficients, K_e , for Outlet Control Calculations	37
Table 6.21. Outlet Control Nomograph Selection	38
Table 6.22. Drain Time Coefficients for WQCV Calculations.....	49
Table 6.23. Recommended Inspection and Maintenance Schedule.....	55

LIST OF FIGURES

Figure 6.1. Average Velocities for Shallow Concentrated Flow	9
Figure 6.2. Ditch Check Schematic.....	20
Figure 6.3. Reduction Factor for Gutter Flow.....	23
Figure 6.4. Private Driveway Culvert Example Ditch Geometry.....	41
Figure 6.5. Map of the Average Runoff Producing Storm's Depth	50

LIST OF ATTACHMENTS – APPENDIX D

CULVERT DESIGN FORM

CULVERT DESIGN FORM EXAMPLE

TREATMENT TRAIN EXAMPLE CALCULATION

FACT SHEET: SUBSURFACE INFILTRATION FACILITIES

6.1 PURPOSE

The purpose of this Chapter is to set forth design standards and criteria for storm drainage infrastructure so there is reasonable degree of assurance that the health, safety, welfare, and property of the Town and citizens may be safeguarded and protected through the proper control and drainage of stormwater, the water quality of the Blue River and its tributaries will be protected, and there will be a certain uniformity in performance with respect to design and construction of drainage facilities.

Additionally, the Town of Breckenridge's mountain environment is known for steep grades, wetland areas, perennial streams, reservoirs, and the Blue River. This unique environment and topography results in grading, slope stability, stormwater runoff contamination, and phosphorus contamination concerns. This chapter establishes standards to safeguard public health and safety, protect environmentally sensitive areas, and protect the water quality of the Blue River, its tributaries, and Dillon Reservoir.

The design Standards presented herein are intended to aid in the design of stormwater infrastructure and outline the minimum standards required.

6.2 OTHER STANDARDS

The Mile High Flood District (MHFD), formerly known as the Urban Drainage and Flood Control District (UDFCD), has developed detailed permanent water quality design guidance and criteria in Volume 3 of the *Urban Storm Drainage Criteria Manual* (USDCM). This document is referenced extensively in this section and provides extensive discussion on the topic of stormwater quality treatment. When used for design, the most recent version shall be referenced as the MHFD continually updates Volume 3 of the USDCM based on performance and maintainability of the treatment facilities discussed.

6.2 SUBMITTALS

An Infrastructure Permit is required for all construction projects involving storm drainage infrastructure. Requirements for an Infrastructure Permit are summarized in Chapter 2. Other submittals may be required in accordance with Chapter 2 or as determined by the Town Engineer.

6.3 RAINFALL

A rainfall analysis was completed for the Town of Breckenridge using the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 data. The equations and data in this section are based on this analysis. A detailed memo regarding the evaluation of NOAA Atlas 14 is available from the Town upon request.

6.3.1 Rainfall Intensity

Equation 6.1 shall be used to calculate rainfall intensity for a given time of concentration or to develop intensity-duration-frequency curves for runoff analysis using the Rational Method as discussed in Section 6.4.

$$I = P_1 \frac{40.81}{(t+7.63)^{0.881}} \quad (6.1)$$

Where:

I = rainfall intensity (in/hr)

P_1 = 1-hour rainfall depth (in), see Table 6.1

t = storm duration, time of concentration (min)

Rainfall intensities as a function of storm duration and recurrence interval are provided in Table 6.1. This table was developed using Equation 6.1. The values in Table 6.1 are subject to revision and users of these Standards are encouraged to check for updates.

Table 6.1. Intensity-Duration-Frequency Data

Return Period	P_1	Peak Rainfall Intensity for Storm Duration (in/hr)				
		5-min	10-min	15-min	30-min	60-min
2-year	0.546	2.39	1.78	1.43	0.91	0.54
5-year	0.749	3.27	2.44	1.96	1.25	0.75
10-year	0.939	4.10	3.06	2.45	1.57	0.94
25-year	1.23	5.37	4.01	3.21	2.05	1.23
50-year	1.49	6.51	4.85	3.89	2.49	1.48
100-year	1.76	7.69	5.73	4.60	2.94	1.75
500-year	2.5	10.92	8.14	6.53	4.17	2.49

6.3.2 Rainfall Distribution

The 6-hour rainfall depths provided in Table 6.2 shall be used to develop a 6-hour SCS Type II rainfall distribution for runoff analyses that use hydrographs as discussed in Sections 6.4.4 and 6.4.5.

Table 6.2. 6-Hour Rainfall Depths for SCS Type II Distribution

Return Period	6-hour Rainfall Depth (in)
2-year	0.859
5-year	1.070
10-year	1.28
25-year	1.61
50-year	1.89
100-year	2.21
500-year	3.07

6.3.3 Design Storms

The objectives of establishing the minor and major design storms are to minimize inconvenience, protect against recurring minor damage, reduce maintenance costs caused by the minor storm, and eliminate substantial property damage and loss of life caused by the major storm. The goal is a functional drainage system at a reasonable cost. The storm drainage system may include streets, curb and gutter, roadside ditches, inlets, storm sewers, open drainageways, culverts, and detention facilities. In the Town of Breckenridge, the minor storm is the 10-year event and the major storm is the 100-year event.

6.4 RUNOFF

The hydrologic analysis of a site shall be based on the proposed land use for that site, as opposed to existing conditions. Calculation of contributing runoff from offsite upstream areas shall be based on the existing land use and topography. Flows specified in the Flood Insurance Study, Town of

Breckenridge (2011) shall be incorporated in the analysis where applicable and with the approval of the Town Engineer.

6.4.1 Approved Hydrologic Methods

All hydrologic methods have limitations and should be used only for appropriate scenarios. Accepted hydrologic methods are the Rational Method, the Soil Conservation Service (SCS) Dimensionless Unit Hydrograph Method, and the SCS Runoff Method. The last two methods are referred to collectively herein as the SCS Method developed by the Natural Resource Conservation Service (NRCS). The Rational Method may be used for watersheds of 90 acres or less and when only peak flows, as opposed to a hydrograph, are required for design (e.g., pipes, culverts, inlets). The SCS Method may be used for watersheds of any size or when hydrograph routing is required for design (e.g., detention ponds and volume-based water quality facilities). Information on the computer models that may be used to develop and route hydrographs is included later in this section.

6.4.2 Subwatershed Sizing

Determination of peak runoff at any downstream design point is affected by the size, number, and characteristics of the upstream subwatersheds within the overall drainage basin. Typically, the more homogenous each of the subwatersheds is, the more accurate the calculated peak flow is when compared to analysis of a single, larger watershed. Recommended guidelines are:

1. For an overall watershed of up to 100 acres, the maximum subwatershed size should be approximately 20 acres. Delineation should be conducted so that imperviousness, slope, and land use are similar for each subwatershed.
2. For an overall watershed over 100 acres, increasingly larger subwatersheds may be used provided the land use and surface characteristics within each subwatershed are homogeneous. In addition, the subwatershed sizing should be consistent with the level of detail needed to determine peak flow rates at various design points within the larger watershed.

6.4.3 Rational Method

The Rational Method uses Equation 6.2 to determine a peak runoff rate based on drainage area, rainfall intensity, and imperviousness. Imperviousness is represented by a coefficient, C.

$$Q = CIA \quad (6.2)$$

Where:

Q = peak rate of runoff (cfs)

C = runoff coefficient

I = rainfall intensity (in/hr)

A = drainage area (acres)

The rainfall intensity is given by Equation 6.1 or Table 6.1 based on the design storm and storm duration, which is assumed to be equal to the total time of concentration to the design point being analyzed. Determining values for the runoff coefficient, C, is discussed in the section below.

6.4.3.1 Runoff Coefficient

The runoff coefficient is based on land cover and soil classification. Soils are classified by the NRCS as belonging to Hydrologic Soil Group A, B, C, or D. The Hydrologic Soil Group(s) present at a site can be found using the Web Soil Survey tool available via an internet search for *NRCS Web Soil Survey*. Types of land use and their typical corresponding imperviousness are summarized in Table 6.3. Composite imperviousness should be obtained for each subwatershed that is not completely homogenous. The runoff coefficient, C, can then be calculated using the equations in Table 6.4. The

coefficients are dependent on the Hydrologic Soil Group, composite imperviousness, and the return period of the design storm. The values below are approximations of average imperviousness for typical land uses. If a development's land use does not match a land use in the table below, or if the development's imperviousness does not match the values in the table below, imperviousness may be calculated for each subbasin within the site by dividing the total impervious area within the subbasin by the total subbasin area.

Table 6.3. Land Use Imperviousness

Land Use	Imperviousness (%, i_p)	Land Use	Imperviousness (%, i_p)
Urban:		Playgrounds	25
Downtown Area	95	Schools	55
Suburban Area	75	Parks, Cemeteries	10
Residential Single-family:		Paved Streets	100
2.5 acres or larger	15	Drive and Walks	90
0.75 - 2.5 acres	20	Roofs	90
0.25 - 0.75 acres	30	Lawns	2
0.25 acres or less	50	Undeveloped Areas:	
Apartments/Duplex/Townhomes	75	Historic Flow Analysis	2
Industrial:		Greenbelts, Agricultural	2
Light Areas	80	Off-site Flow Analysis (land use not defined)	45
Heavy Areas	90		

Table 6.4. Runoff Coefficient Equations

NRCS Soil Group	Storm Return Period			
	2-year	5-year	10-year	25-year
A	$C=0.84i_p^{1.302}$	$C=0.86i_p^{1.276}$	$C=0.87i_p^{1.232}$	$C=0.88i_p^{1.124}$
B	$C=0.84i_p^{1.169}$	$C=0.86i_p^{1.088}$	$C=0.81i_p+0.057$	$C=0.63i_p+0.249$
C/D	$C=0.83i_p^{1.122}$	$C=0.82i_p+0.035$	$C=0.74i_p+0.132$	$C=0.56i_p+0.319$
NRCS Soil Group	Storm Return Period			
	50-year	100-year	500-year	
A	$C=0.85i_p+0.025$	$C=0.78i_p+0.110$	$C=0.65i_p+0.254$	
B	$C=0.56i_p+0.328$	$C=0.47i_p+0.426$	$C=0.37i_p+0.536$	
C/D	$C=0.49i_p+0.393$	$C=0.41i_p+0.484$	$C=0.32i_p+0.588$	

6.4.3.2 Time of Concentration

The storm duration used in Equation 6.1 is the time required for runoff to flow from the most hydraulically distant point within the subwatershed to the design point of interest. This time is known as the time of concentration. Time of concentration is calculated by adding the flow times for each type of flow along most hydraulically distant flow path. Types of flow include sheet flow and shallow

concentrated, or channelized flow. Time of concentration for the Rational Method is calculated using Equations 6.3 through 6.5.

$$t_c = t_i + t_t \quad (6.3)$$

Where:

t_c = time of concentration (min), minimum is 5 min in urban areas, 10 min in rural areas

t_i = initial or overland sheet flow time (min)

t_t = travel time for shallow concentrated flow in a ditch, channel, gutter, pipe, etc. (min)

Initial or overland flow is the sheet flow that occurs at the beginning of the flow path characterized by a flow depth less than 0.1 feet. It can be calculated using Equation 6.4 for flow path lengths up to 500 feet in rural areas and 300 feet in urban areas. However, in highly urbanized areas, the overland flow path is typically shorter than 300 feet because of the presence of drainage systems that collect and convey runoff.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_0^{0.33}} \quad (6.4)$$

Where:

t_i = initial or overland sheet flow time (min)

C_5 = runoff coefficient for 5-year return period (see Table 6.4)

L_i = length of overland flow segment (ft)

S_0 = average slope along the overland flow path (ft/ft)

Travel time for shallow concentrated flow is calculated based on the hydraulic properties of the conveyance element. The channelized travel time, t_t , is estimated by dividing the length of conveyance by the velocity. Equation 6.5 can be used to determine travel time in conjunction with the conveyance factors in Table 6.5.

$$t_t = \frac{L_t}{60K\sqrt{S_0}} = \frac{L_t}{60V_t} \quad (6.5)$$

Where:

t_t = travel time for shallow concentrated flow in a ditch, channel, gutter, pipe, etc. (min)

L_t = shallow concentrated flow path length (ft)

S_0 = average slope of shallow concentrated flow path (ft/ft)

K = NRCS conveyance factor (see Table 6.5)

V_t = travel time velocity (ft/s) = $K\sqrt{S_0}$

For shallow concentrated flow in a pipe or well defined channel, Manning's Equation for open channel flow in Section 6.5 may be used to calculate velocity. The time of concentration, t_c , is then the sum of the initial flow time, t_i , and the travel time for shallow concentrated flow, t_t .

Table 6.5. NRCS Conveyance Factors, K

Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5

Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

Reference: NRCS (1986)

6.4.3.3 *Limitations and Considerations*

The minimum time of concentration in urban areas is 5 minutes. The minimum time of concentration in rural areas is 10 minutes. A common mistake in urban areas is to assume travel velocities that are too slow. Another is to not check the runoff peak resulting from only part of the design catchment. Sometimes a portion of the design catchment closer to the design point or a highly impervious area will produce a larger peak design flow than that computed for the entire catchment. This most often happens when the catchment is long and narrow, or when the upper portion is undeveloped while the lower portion is, or will be, fully developed.

6.4.4 SCS Method

For drainage areas larger than 90 acres, the SCS Method is one method that can be used to develop hydrographs. The procedures used in the SCS Method are described in Technical Release 20 (TR-20) and Technical Release 55 (TR-55) both prepared by the NRCS. Three parameters are needed to use the SCS Method: rainfall, curve number, and time of concentration. This section provides some general information needed to use the SCS Method in a hydrologic model. However, the reader should refer to TR-20 and TR-55 for more detail describing the SCS Method; the applicable hydrologic equations and theory; and all other background information.

6.4.4.1 *SCS Method - Rainfall*

The SCS Method includes four rainfall time distributions that are assigned geographically across the country. The SCS Type II storm distribution is applicable to the entire State of Colorado and therefore should be used when preparing hydrologic analysis for the Town. The rainfall distribution is based on a 24-hour duration.

The 24-hour distribution was developed to include the maximum intensities of all smaller duration storms; the 24-hour storm theoretically includes the 2-hour, 6-hour, etc. distributions within one longer distribution and can be used to estimate peak flows for all storm events. However, it will typically overestimate the volume of a storm event with a duration less than 24 hours. Therefore, the SCS also developed a 6-hour storm distribution, which was derived from the original 24-hour distribution. The 6-hour distribution can be used if the drainage area being modeled has a total time of concentration less than 6 hours. The total rainfall depths should be taken from NOAA Atlas 14 for the project design storm return period.

6.4.4.2 *SCS Method – Curve Number*

The SCS Method curve number (CN) is a variable used to predict infiltration and runoff based on land use and soil types. When using the SCS Method in a hydrologic model, the user will be required to input the percent imperviousness and CN for each watershed or subwatershed modeled. The CN is dependent on land cover and the NRCS Hydrologic Soil Group (A, B, C, or D). The modeled watershed or subwatersheds may be composed of multiple land uses and soil types. In these cases, a composite CN must be calculated as the representative CN for the area. Refer to Tables 6.6 and 6.7 for CN values for specific land uses and hydrologic soil groups.

The initial abstraction is another important parameter used in the CN analysis. It represents all the losses that occur prior to runoff including infiltration, interception, depression storage, and evaporation. The hydrologic model will calculate the default initial abstraction based on the selected CN. However,

in some unique cases it may be desirable to provide a user-defined initial abstraction based on the site conditions.

The table below provides runoff curve numbers for typical land uses based on average imperviousness. If a development's land use does not match a land use in the table below, or if the development's imperviousness does not match the values in the table below, curve numbers for each subbasin within the development may be calculated using TR-20 and TR-55.

Table 6.6. Runoff Curve Numbers

Land Use or Surface Characteristic	Average Imperviousness (percent)	Runoff Curve Number by Soil Type			
		A	B	C	D
Commercial/Mixed Use					
Downtown and Base Areas*	95	95	96	97	97
All Other Commercial Areas	75	83	89	92	94
Residential Single Family					
2.5 acres or larger lot size	12	46	65	77	82
0.75 – 2.5 acres lot size	20	51	68	79	84
0.25 – 0.75 acres lot size	30	74	83	88	91
0.25 acres or smaller lot size	45	66	78	85	88
Multifamily and Resort Residential	75	83	89	92	94
Industrial					
Light	80	86	91	93	94
Heavy	90	92	94	96	96
Public Facilities/Open Spaces					
Parks, cemeteries	10	45	63	75	81
Playgrounds	25	45	63	75	81
Schools	55	69	80	86	89
Lawns and golf courses	2	40	62	74	80
Undeveloped Areas					
Pre-development conditions	2	40	62	74	80
Greenbelts, agriculture	2	40	62	74	80
Off-site analysis, unknown land use	45	66	78	85	88
Outcrops	70	80	87	91	93
Streets/Roads & Surfacing					
Paved	100	98	98	98	98
Road base or recycled asphalt	80	86	91	93	94
Gravel (uniformly graded)	40	63	76	84	87
Drives/Walks	90	92	94	96	96
Roofs	90	92	94	96	96

Reference: Values are from a combination of UDFCD (2016) and USDA NRCS (2004)

Table 6.7. Runoff Curve Numbers for Arid and Semiarid Rangelands

Cover Type	Hydrologic Condition ¹	Runoff Curve Number for Soil Type			
		A ²	B	C	D
Herbaceous – mixture of grass, weeds and low-growing brush, with brush the minor element	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen – mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Coniferous, general; grass understory	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sage-grass – sage with an understory of grass	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55

1. Poor: <30% cover (litter, grass, and brush overstory); Fair: 30 to 70% cover; Good: >70% cover

2. Curve numbers for group A have not been developed for these types of cover

Reference: USDA NRCS (2004)

6.4.4.3 SCS Method – Time of Concentration

The time of concentration (T_c) is defined as the time it takes for water to travel from the most hydraulically distant point in the watershed to the point of interest. The SCS Method for calculating T_c is done by splitting the watershed into three distinct flow types: sheet flow, shallow concentrated flow, and open channel flow.

6.4.4.3.1 Sheet Flow

Sheet flow occurs in the upper part of the basin where there is not yet a defined channel. The assumption is that the depth of flow is very shallow, less than 0.1 feet, and that the total flow length is less than 300 feet. The equation for sheet flow is as follows:

$$T_t = \frac{0.007(nL)^{0.8}}{(s^{0.4})(P_2^{0.5})} \quad (6.6)$$

Where:

T_t = travel time (hr)

n = Manning's n roughness coefficient (refer to TR-55 for example values)

L = flow length (ft)

P_2 = 2-year, 24-hour rainfall (in)

s = slope of hydraulic grade line (land slope, ft/ft)

6.4.4.3.2 Shallow Concentrated Flow

Travel time for shallow concentrated flow is estimated by multiplying the average velocity by the total length of flow. Average velocity is found using the Figure 6.1 below.

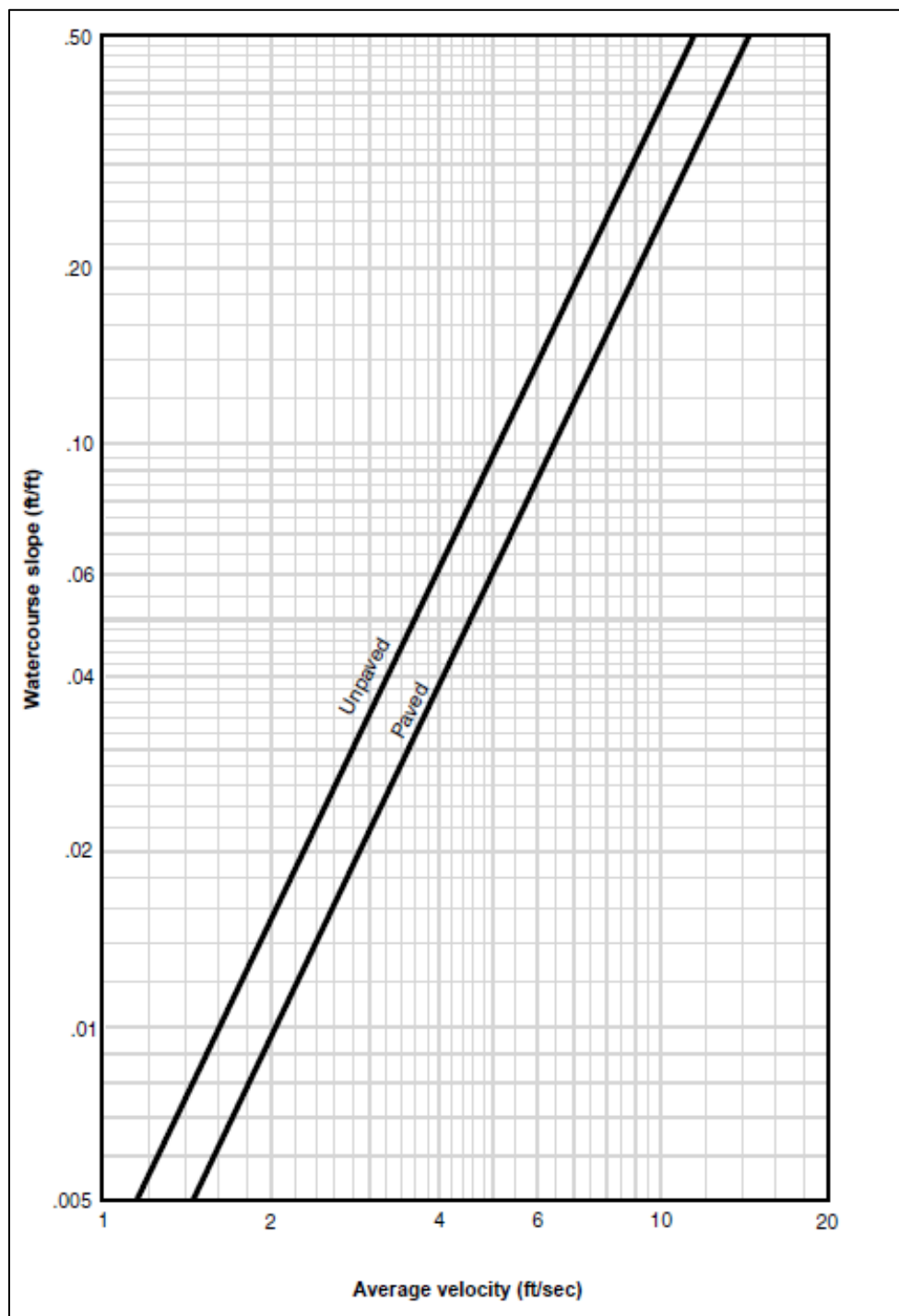


Figure 6.1. Average Velocities for Shallow Concentrated Flow

Reference: TR-55

6.4.4.3.3 Open Channel Flow

Open channel flow begins where there is a visible channel conveying storm water. Average velocity in the channel is estimated assuming the bank full flow. Velocity at bank full flow is calculated using Manning's equation or other available hydraulic modeling for the stream.

The total T_c is calculated as the sum of the three flows: sheet flow, shallow concentrated flow, and open channel flow. Some hydrologic models represent T_c as the lag time for the watershed. Lag time is defined as follows:

$$\text{Lag Time} = 0.6 * T_c \quad (6.7)$$

Where:

T_c = time of concentration (hr)

6.4.5 Hydrograph Development and Routing Models

Runoff hydrographs can be developed using CUHP, SWMM, or HEC-HMS modeling software. CUHP, which stands for Colorado Urban Hydrograph Program, was developed by the Mile High Flood District for use within SWMM. SWMM, which stands for Stormwater Management Model, was developed by the United States Environmental Protection Agency (EPA). SWMM can route hydrographs developed internally or those developed with CUHP. HMS, which stands for Hydrologic Modeling System, was developed by the United States Army Corps of Engineers' Hydrologic Engineering Center (HEC). HEC-HMS can also route the hydrographs it develops.

SWMM and HEC-HMS can evaluate runoff through larger or less homogenous basins or through complex drainage systems by routing flows through these elements. Other routing programs may be used if they are approved by the Town Engineer. The SCS Method should be used within HEC-HMS to generate runoff hydrographs. The EPA developed its own runoff method inherent to the SWMM software program. The SCS Type II storm distribution and NOAA Atlas 14 rainfall depths should be used to develop the hyetograph for input into the model. Other methodology may be used if it is better suited to site characteristics. A narrative describing the selected hydrologic methodology and the reasons for its selection should be included with the Drainage Report.

Basins should be divided into smaller and more homogeneous subwatersheds. The runoff hydrographs from upper subwatersheds are then routed through and combined with hydrographs from the lower subwatersheds, channels, detention basins, or other elements to develop a runoff hydrograph for the entire watershed.

The sizing of the detention storage may be based upon hydrograph storage routing techniques rather than direct calculation of volume and discharge requirements. A HEC or EPA SWMM model shall be used when reservoir routing of hydrographs is conducted, such as for the design of a detention pond. A HEC or SWMM model shall be used when channel routing of hydrographs is required.

6.4.5.1 HEC-HMS

HEC-HMS simulates the complete hydrologic process of a watershed system. The software includes traditional hydrologic analyses including infiltration, unit hydrographs, and hydraulic routing including through detention facilities. HEC-HMS also provides analysis tools for snowmelt. It should be noted that when using the SCS Type II storm distribution, the model is assuming that the storm distribution is for a 24-hour storm. If a 6-hour storm is desired, then the hyetograph must be input as a user-defined table.

6.4.5.2 EPA SWMM

SWMM is a rainfall-runoff model that analyzes a collection of subwatersheds that receive a rainfall hyetograph and generates runoff hydrographs at design points. SWMM can route runoff hydrographs through a system of pipes, channels, basins, and storage elements such as detention ponds; track the quantity of runoff generated at each design point; and track the flow rate and depth of water in each element over a specified simulation time. EPA SWMM is typically used for larger watersheds; for

designing detention basins and water quality facilities; and for modeling large storm sewer systems. Runoff hydrographs can be developed internally or within CUHP.

6.4.5.3 CUHP

CUHP is a rainfall-runoff model that analyzes a collection of subwatersheds that receive a rainfall hyetograph and generates runoff hydrographs and total runoff volumes at design points. The runoff hydrographs are then routed by SWMM through a system of pipes, channels, basins, and storage elements such as detention ponds to determine peak flows and volumes.

6.4.6 FEMA Flows

FEMA has established regulatory 100-year peak flow rates for some of the larger streams within the Town. Where these flow rates have been established, the Town Engineer should be consulted to determine the validity of these flow rates as it is not uncommon for them to be outdated. In some instances, a new hydrologic study may be required to evaluate current peak 100-year flow rates along FEMA-regulated streams. This study would then be submitted to FEMA for review and approval to revise the regulatory flow rates. The 2018 Breckenridge Flood Damage Prevention Ordinance presents the Town's requirements for work near FEMA floodplains and shall be consulted prior to design of any work near a FEMA floodplain.

6.5 OPEN CHANNELS

Open channel flow occurs when water has its surface exposed to the atmosphere. Open channels can be natural waterways, canals, ditches, swales, culverts, flumes, and gravity pipes that are not flowing full. Once water fully fills a closed conduit, flow in that conduit becomes pressure flow. This section discusses types of open channel flow and gives general design guidance for open channels including roadside ditches. Any work in natural channels may be subject to FEMA floodplain regulations. Chapter 2 (Section 2.4) discusses the permits that will be required for work in open channels as well as the applicability of the 2018 Breckenridge Flood Damage Prevention Ordinance to work in open channels.

For a more thorough discussion of open channel design principles, the user is encouraged to review the most recent version of the Urban Storm Drainage Criteria Manual (USDCM) by the Mile High Flood District (MHFD).

6.5.1 Open Channel Hydraulics

The hydraulics of an open channel can be complex, ranging from steady state uniform flow to unsteady, rapidly varied flow. Most drainage design involves uniform, gradually varied, or rapidly varied flow states. Steady uniform flow occurs when the depth of flow remains constant. The calculations for both uniform and gradually varied flow are relatively simple and assume parallel streamlines. In contrast, rapidly varied flow calculations, for hydraulic elements like hydraulic jumps and flow over spillways, have solutions that are generally empirical in nature. This section presents basic equations and computational procedures for uniform, critical, gradually varied, and rapidly varied flow for hydraulic jumps and weirs.

6.5.1.1 Uniform Flow

Open channel flow is considered uniform if the depth of flow is the same at every section of the channel. For a given channel geometry, roughness, discharge, and slope, there is only one possible depth for maintaining uniform flow. This is called the normal depth. For a prismatic channel cross section, the water surface will be parallel to the channel bottom during uniform flow. Uniform flow rarely occurs in nature and is difficult to achieve, even in a laboratory. However, channels are designed by assuming uniform flow as an approximation that is adequate for planning purposes.

Calculations for normal flow depth shall be based on Manning's equation shown as Equation 6.8. A spreadsheet can be developed for this equation as an effective tool for quick analysis.

$$Q = \frac{1.49}{n} A^{5/3} P^{-2/3} \sqrt{S} = \frac{1.49}{n} A R^{2/3} \sqrt{S} \quad (6.8)$$

Where:

- Q = flow rate (ft³/s)
- n = Manning's roughness coefficient (see Table 6.8)
- A = area (ft²)
- R = A/P = hydraulic radius (ft)
- P = wetted perimeter (ft)
- S = Channel or pipe slope (ft/ft)

Open channel flow velocity can be more easily calculated by rearranging Equation 6.8 to yield Equation 6.9. Equation 6.9 may be used to calculate travel time for the Rational Method. It may also be used to design channel revetment.

$$V = \frac{1.49 R^{2/3} S^{1/2}}{n} \quad (6.9)$$

Where:

- V = average velocity (fps)

For prismatic channels with uniform flow, the slope of the energy grade line (EGL), hydraulic grade line (HGL), and bottom of channel are assumed to be equal. Table 6.8 provides recommended Manning roughness coefficients for various channel linings and conditions. As channel roughness increases, a given flow rate will have a greater depth and slower velocity. Decreased roughness results in shallower depth and faster velocity. Selection of roughness coefficients for both the main channel and the overbanks is a critical part of the design and evaluation of an open channel, but it is also based on engineering judgement. Two engineers may look at the same natural channel and assign different Manning's n values.

Manning's n values may be selected to be slightly conservative for the variable being calculated. For example, when calculating a channel velocity, a slightly lower Manning's n value will result in a slightly higher calculated velocity, ensuring that channel revetment is adequately sized. When calculating channel capacity, a slightly higher Manning's n value will result in a slightly larger channel cross section, offering a factor of safety for channel sizing. Another factor to consider might be the anticipated long-term condition of the channel, as Manning's n values are prone to increasing if the channel is not properly maintained. Ultimately the Manning's n value selected by the design engineer must be defensible given the values presented in Table 6.8.

Table 6.8. Manning's Roughness Coefficients for Channels

Type of Channel & Description	Manning's n	Type of Channel & Description	Manning's n
Excavated or Dredged		Lined or Built-Up Channels	
Earth, straight & uniform		Riprap	
Clean, recently completed	.018	Riprap	Eq. 6.12
Clean, after weathering	.022	Concrete	
Gravel, uniform section, clean	.025	Trowel Finish	.013
With short grass, few weeds	.027	Float Finish	.015
Earth, winding & sluggish		Gunite, good section	.019
No vegetation	.025	Gunite, wavy section	.022
Grass, some weeds	.030	Concrete Bottom	
Dense weeds in deep channels	.035	Dressed stone in mortar	.017
Earth bottom & rubble sides	.030	Random stone in mortar	.020
Stony bottom & weedy banks	.035	Dry rubble or riprap	.030
Cobble bottom & clean sides	.40	Asphalt	
Dragline-excavated or dredged		Smooth	.013
No vegetation	.035	Rough	.023
Light brush on banks	.040	Gravel bottom with sides of	
Rock cuts		Formed concrete	.020
Smooth & uniform	.035	Random stone in mortar	.013
Jagged & irregular	.040	Dry rubble or riprap	.016
Channels not maintained, weeds & brush		Grassed	
Dense weeds	.080	Short grass prairie	0.15
Clean bottom, brush on sides	.050	Dense grasses	0.24
Natural Channels		Range (natural)	0.13
Natural channels, good condition	0.025	Wooded	
Natural channels, stones & weeds	0.035	Light underbrush	0.4
Natural channels, poor condition	0.06	Dense underbrush	0.8

References: Chow, V.T., Open Channel Hydraulics (1959), NRCS (1986)

For riprap lined channels, Equation 6.10 shall be used to calculate Manning's n value.

$$n = 0.0395D_{50}^{1/6} \quad (6.10)$$

Where:

 D_{50} = mean riprap stone size (ft)**6.5.1.2 Critical Flow**

Critical flow in an open channel is characterized by the following conditions:

1. The specific energy is at a minimum for a given discharge.
2. The discharge is at a maximum for a given specific energy.
3. The specific force is at a minimum for a given discharge.
4. The velocity head is equal to half the hydraulic depth in a channel with a minimal slope.
5. The Froude Number (Fr) is equal to 1.0.

When critical flow exists for uniform flow, the channel slope is at the critical slope. A slope flatter than critical will cause subcritical flow and result in a Froude number smaller than 1.0. A slope steeper than critical will cause supercritical flow and result in a Froude number larger than 1.0. When flow is at or near critical, it is unstable because minor changes in specific energy, such as from channel debris, will cause a major change in depth. Equation 6.11 should be used to calculate the Froude Number for all open channel designs.

$$Fr = \frac{v}{\sqrt{gD_h}} \quad (6.11)$$

Where:

Fr = Froude number (dimensionless)

v = velocity (ft/s)

g = gravitational acceleration (32.2 ft/s²)

D_h = hydraulic depth, A/T (ft)

A = channel flow area (ft²)

T = top width of flow area (ft)

6.5.1.3 Gradually Varied Flow

Gradually varied flow is most often seen as backwater created by culverts, inlets, and channel constrictions. For these conditions, flow depth will be greater than normal depth in the channel and the water surface profile must be computed using a backwater technique—either the direct step or the standard step method. The direct step method is best suited to the analysis of simple prismatic channels, whereas the standard step method is best suited for irregular or nonuniform cross-sections.

Hydrologic Engineering Center's River Analysis System (HEC-RAS), developed by the U.S. Army Corps of Engineers, is recommended for calculating water surface profiles in the Town of Breckenridge. If a designer would like to compute water surface profiles by hand, the methodology for using both the direct-step and standard-step methods can be found in the HEC-RAS Hydraulic Reference Manual (Brunner, 2016), as well as in Open Channel Hydraulics (Chow, 1959).

6.5.1.4 Rapidly Varied Flow

Rapidly varied flow has a very pronounced curvature of the streamlines. The change in curvature may be so abrupt that the flow profile is virtually broken, resulting in high turbulence. Common instances of rapidly varied flow include weir flow, orifice flow, and hydraulic jumps. Only hydraulic jumps will be discussed in this section. In the Town, weir and orifice flow are used almost exclusively for detention pond outlets and will be discussed in Section 6.9.

Hydraulic jumps may occur at grade control structures, inside storm drains or culverts, and at the outlet of a spillway and can be very erosive and affect hydraulic capacity. For grassed channels, the forces from a hydraulic jump must be controlled to prevent serious damage. Drops or other grade control structures can be used to direct the jump to an area specifically designed to resist the forces that come with it.

Jump locations within storm drain systems can be approximated by intersecting the energy grade line of the supercritical and subcritical flow reaches. There is little threat of damage to storm drains, but pipe capacity may be impacted. The effect on pipe capacity can be determined by evaluating the energy grade line and accounting for the energy lost by the jump. In general, for Froude Numbers less than 2.0, energy loss is less than 10%. For long concrete boxes, the concerns of the jump are the same as for storm drains. However, the jump can be adequately defined for box conduits and for spillways using the jump characteristics of rectangular sections. These Standards do not include a

detailed evaluation of hydraulic jumps, but the USDCM has procedures that can be used. Calculations must be included with the required submittals in accordance with Chapter 2.

6.5.2 Open Channel Design

The design standards for all open channels in the Town, except for roadside ditches addressed in Section 6.5.3, are those in the most recent edition of the USDCM. The design standards in the USDCM include channel centerline alignment and cross section layout, hydraulic analysis, and using rocks and boulders for protection from erosion. The design process for an open channel can be somewhat circular because of a wide range of options available for materials, typical cross section, channel slope, and the frequency and height of drop structures.

6.5.2.1 Channel Selection Factors

Each type of channel must be evaluated for hydraulic, structural, environmental, sociological, maintenance, economic, and regulatory factors. Table 6.9 summarizes the multi-disciplinary factors that should be used when selecting the channel that is most suitable for a specific site.

Table 6.9. Factors to Consider for Channel Design

Hydraulic	Structural	Environmental	Sociological	Maintenance	Regulatory
Topography	Cost	Habitat	Pedestrian	Lifespan	Federal
Capacity	Shear Stress	Water Quality	Recreation	Accessibility	State
Slope	Momentum	Traffic Patterns	Demographics	Repair	Local
Offsite Drainage	Seepage & Uplift	Aesthetics	Social Patterns	Reconstruction	Right-of-Way
Basin Sediment Yield	Material Availability	Wetland Mitigation		Maintenance Activities	
	Haul Off Site	Green Area Need			

6.5.2.2 General Design Guidelines

Except for roadside ditches and the additional criteria in these Standards, all open channel improvements shall be designed in accordance with the latest versions of the Open Channels, Hydraulic Structures, and Stream Access and Recreational Channels chapters of the USDCM.

All open channels within the Town shall be designed to convey both the minor and major design storms in a subcritical flow condition with a Froude number of less than 0.80. The major storm shall not result in a flow depth greater than 4.0 feet at any point along the channel reach. All open channels shall also be designed with public safety in mind and adequate maintenance access shall be provided.

Natural channels and grass-lined channels are preferred, and concrete-lined and riprap-lined channels are discouraged. Channel improvements that drastically change the look, shape, lining, alignment, or flow characteristics of the existing channel should be avoided. Improvements to natural channels should strive to maintain the capacity and alignment of the existing channel. In the event an entirely new channel is required, such as through a new development, it should closely mimic natural channels in the surrounding area with the same capacity.

The design components that have the greatest potential effect on the performance and cost of the improvements should be evaluated early on to guide the design process. High cost items include riprap channel linings and boulder drop structures, and the engineer should strive to design open channels to minimize the need for and use of these elements. Consideration should also be given to long term maintenance and repair costs.

6.5.2.3 High Gradient Channels

In mountainous areas, natural channels can have steep grades with cobble or rock along their bottoms. While uniform flow calculations with standard channel roughness values generally predict supercritical flow, field observations show that these channels are often protected by natural armoring. Field investigations have resulted in procedures for estimating hydraulic roughness for these streams that result in lower calculated velocities than those obtained with the Manning's equation using a uniform roughness coefficient. The designer is encouraged to review Determination of Roughness Coefficients for Streams in Colorado by Robert D. Jarrett in cooperation with the Colorado Water Conservation Board.

Equation 6.12 may be used as an aid in predicting the roughness coefficient of a high-gradient channel provided the following conditions are met.

1. The channel must be a natural channel that has a relatively stable bank material and a cobble or boulder bed material.
2. The channel friction slope must be between 0.01 and 0.04 feet per foot and the hydraulic radius must be between 0.5 and 7 feet.
3. The channel must not be affected by backwater.

$$n = 0.39S_f^{0.38}R^{-0.16} \quad (6.12)$$

Where:

n = Manning's roughness coefficient

S_f = channel friction slopes (ft/ft)

R = hydraulic radius, A/P (ft)

Additionally, while mountainous channels may have high average grades, they have often achieved this by cutting very steep drops interspersed along what are otherwise flatter reaches. The analysis of a natural mountain stream requires a careful topographical investigation. The hydraulic model must recognize that friction slope, hydraulic radius, and n value may change frequently along the length of the channel and take this into account by dividing the channel into reach lengths of reasonably uniform discharge, depth, slope, and channel and floodplain geometry. Determination of Roughness Coefficients for Streams in Colorado gives an in-depth discussion of suggested reach lengths and subdivision of cross sections to be used in the hydraulic model.

Natural channels have typically reached a reasonable state of equilibrium based on the amount of peak runoff they are accustomed to receiving. Although a new development may not encroach on the floodplain of a natural channel, it is also critically important that it does not increase the peak runoff the channel receives. This could easily cause erosion of the channel and require costly remediation.

If site conditions suggest use of Equation 6.12 might be appropriate, the designer shall consult with the Town to confirm its applicability and discuss any additional specific site concerns regarding the stability of the natural channel. Development shall be planned around natural channels so they remain in place in their natural alignment. If a Developer believes there is a benefit to realigning a natural channel, the proposed modifications shall be submitted to the Town Engineer for review. If the average slope of an existing natural channel through a development is greater than 1.0%, the existing natural channel should not be reconfigured either in horizontal or vertical alignment to suit development unless a geotechnical investigation identifies that the channel is unstable in its current condition. Rather, development should be planned to accommodate the location of the natural channel and its existing floodplain.

6.5.2.4 Ecological Channel Design Guidelines

The USDCM puts a considerable amount of emphasis on preserving and restoring natural stream corridors. The Town of Breckenridge strongly supports using ecological concepts to preserve and restore local channels. Ecological channel design includes bioengineering practices that utilize vegetation in a combination with natural structural measures to stabilize and protect stream banks while providing habitat.

Ecological channel design can have numerous public and environmental benefits when applied in an appropriate location, but care should be taken in selecting the location and completing design calculations to ensure an ecological channel design will hold up under the stream forces it is intended to withstand. Numerous types of bioengineering components can be used. Table 6.10 lists some of the potential advantages and disadvantages of an ecological channel design, as opposed to more traditional riprap and concrete design concepts. The potential for every channel restoration project to include ecological components shall be examined and discussed with the Town.

Table 6.10. Ecological Channel Design Advantages and Disadvantages

Advantages	Disadvantages
Environmental clearances (may facilitate permits)	Potentially more expensive
Aesthetically pleasing	Specialized vegetation
Fish passage	Additional maintenance required
Habitat for fish, birds, and macroinvertebrates	Susceptible to failure during larger storms
Open space creation and preservation	May require a larger footprint
Water temperature moderation	Specific hydrologic conditions required
Water quality enhancement	

Ecological channel design may be applied when the overall channel design is firmly rooted in engineering principles and when the following conditions are met:

1. Hydrologic conditions are favorable for establishment and successful growth of vegetation.
2. Designs are conservative in nature, and bioengineered features are used to provide redundancy.
3. Maintenance responsibilities are clearly defined.
4. Adequate structural elements are provided for stable conveyance of the major storm runoff.
5. Species are selected based on individual site characteristics.

It is important to note that bioengineered elements are commonly designed to withstand flows from more frequently occurring storms. Design events are typically between the 1.5-year to 10-year storm, with the 100-year storm occasionally being a consideration. While designing for a larger event is prudent, stability during such events may often be achieved by traditional engineering techniques because bioengineered elements may not remain stable above a certain threshold. If stability is critical at a given location, such as at bridge piers, bioengineering measures may not be enough without the addition of traditional engineering techniques. Bioengineering techniques can be incorporated into almost all traditional engineering projects, often to great ecological benefit. The design approach must balance ecological function with the need for channel stability when selecting a design discharge. Both the Town and the design engineer should discuss and agree upon the various ecological and hydraulic criteria the design will meet.

The key elements to consider in an ecological channel design include hydrology, hydraulics, geomorphology, physiochemistry, and biology. Each of the following elements should be addressed when designing the channel:

1. Future hydrologic changes associated with urbanization
2. Channel stability
3. Hydrology to support vegetation
4. Supplemental structural measures

The USDCM should be reviewed as part of the design process because it offers valuable guidance on typical minimum standards. The Natural Channel Design Review Checklist published by the US Fish and Wildlife Service should also be reviewed to ensure that all appropriate parameters have been considered.

No specific criteria or design guidance is included in these Standards because each site is unique and will require a solution based on the characteristics of and goals for each site. However, there are publications that offer guidance on ecological channel design, and these should be consulted to ensure the design will stand up to the chosen design hydraulic event. The Technical Supplements contained in *Stream Restoration Design* (National Engineering Handbook 654) (NRCS, 2007) offer extensive and detailed guidance on the physical design of ecological channels. Specifically, Technical Supplement 14, letters I through O, offer design guidance and equations for soil bioengineering, using large woody material for habitat and bank protection, vegetated rock walls, fish passage, and fish lunkers, among many other components.

Monitoring and maintenance should be performed throughout the life of the ecological channel design. The following list consists of four periods when a bioengineered structure is most at risk:

1. Immediately after construction
2. During the driest time of the year
3. During high magnitude discharge events
4. When a shift in plant community occurs away from plants chosen for biostabilization.

6.5.2.5 Revegetation

To achieve the highest likelihood of establishment of the specified vegetation, a 3-year maintenance plan from a certified landscaping company that understands native vegetation is required. The Town shall be consulted to provide a site-specific seed mix for each project. Plantings need to be completed in the fall or late winter to provide the best odds of establishment. Depending on the site, irrigation may also be required. Other techniques to improve the odds of successful vegetation establishment are in Chapter 7.

6.5.3 Roadside Ditch Design

Much like the design of any open channel, design of roadside ditches is a balance of several design components, including velocity, capacity, available right-of-way, slope, and cross-sectional geometry. Chapter 5 discusses several constraints and factors to consider when laying out a roadside ditch. The capacity requirements of a roadside ditch are based on the roadway encroachment criteria discussed in Section 6.6.

This section discusses permissible velocities and Froude numbers for a roadside ditch. Roadside ditch hydraulic calculations will be completed using Manning's equation. The Manning's roughness coefficients for calculating velocity, Froude number, shear stress, and capacity included in Table 6.8 will be used for all roadside ditch calculations. The designer should note that if a ditch is expected to be vegetated there is a much higher potential for erosion until revegetation is complete. The use of erosion control measures such as turf reinforcing mat prior to revegetation will minimize this potential.

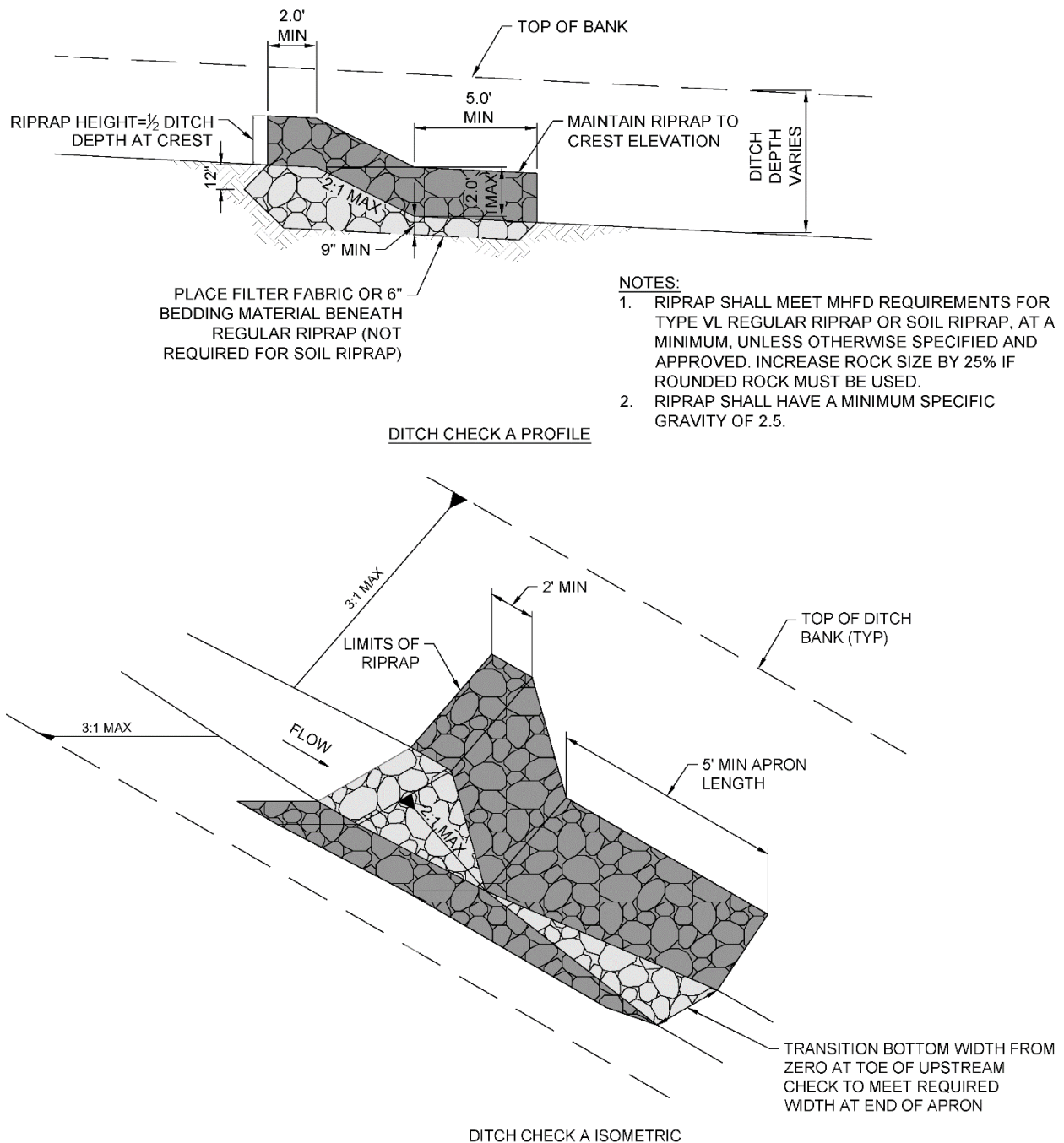
Roadside ditch flow with design depths less than or equal to 1.0 feet have no Froude number or velocity limitations. For ditch flow depths greater than 1.0 feet, velocity shall not exceed 7.0 feet per second, and the Froude number shall not exceed 0.8. These criteria are shown in Table 6.11.

Table 6.11. Allowable Velocity and Froude Number for Roadside Ditches

Design Component	Maximum Allowable Values	
	Flow Depth $\leq$ 1.0 feet	Flow Depth $>$ 1.0 feet
Velocity	No maximum	7 ft/s
Froude Number	No maximum	0.8

It is preferable that roadside ditches have side slopes no steeper than 3H:1V. If right-of-way is constrained, the ditch slope may be steepened to 2H:1V. Slopes steeper than 3H:1V shall be stabilized with erosion netting or stabilized with a method approved by the Town Engineer. Where right-of-way allows, roadside ditches will have a flat bottom at least two feet wide, but ditches may be V-shaped if right-of-way is constrained, with approval of the Town Engineer. Roadside ditches should ideally be designed as grass-lined channels without the need for riprap revetment. If riprap revetment is required, buried soil riprap shall be used in accordance with the design guidance in the USDCM and the ditch shall be revegetated.

Where roadway slopes are too steep to accommodate a ditch design that will meet velocity or Froude number criteria, a flattened ditch slope may be used with ditch checks placed at intervals to make up for grade discrepancies. An example of a ditch check is shown in Figure 6.2. In no case shall a roadside ditch have a slope steeper than 4%, regardless of whether allowable velocity and Froude number values are met.

Figure 6.2. Ditch Check Schematic

6.6 STREETS AND ROADSIDE CONVEYANCE

The primary function of public streets is the movement of traffic. The use of streets as part of the drainage system must be limited to prevent interference with traffic. Streets also typically convey runoff collected on the street surface as well as from some limited portion of the surrounding area. Streets must be capable of conveying that runoff to either a storm drain or open channel system. The drainage system in many parts of the Town is an open channel system with roadside ditches, which are discussed in Section 6.5. In dense and newly developed areas, an enclosed storm drain system is more appropriate, as discussed in Section 6.7.

This section presents the limitations on stormwater in public streets regardless of the type of roadside conveyance used. Limitations are established with roadway function and public safety in mind and are presented in terms of ponding depths at the curb face, the depth of flow permitted at the roadway crown, and the width of roadway that must remain clear during a storm event. Criteria vary based on the design storm and the roadway classification. When runoff in the street exceeds the allowable limits, a storm drain system, an open channel, or a combination of both is required to convey the excess flow. In all cases, the most stringent criteria will apply.

6.6.1 Allowable Flow Depth and Spread

Each street or roadway in the Town of Breckenridge is classified based on its role in connecting and providing access within and between various land uses. These classifications are available from the Town. The extent to which runoff from the minor or major design storm may encroach onto a roadway is based on that roadway's classification. Limiting the encroachment of stormwater onto a roadway section is the primary criteria by which public safety is maintained during a storm event.

Although many roads will utilize a roadside ditch to convey stormwater along the road, some will have a curb and gutter section. Using a curb and gutter or roadside ditch to convey flow along a street does not affect encroachment criteria because safety concerns remain the same for all types of roadways. The allowable encroachment onto the roadway for each roadway classification is presented in Table 6.12. These criteria may include the width of the roadway that must remain free of water or the allowable depth of flow at certain points along the roadway cross section. Curb overtopping criteria applies only to streets with a curb and gutter section.

In no case shall any roadway improvement, reconstruction, or expansion cause more flow encroachment on a parcel or structure outside the public right-of-way than currently exists. These criteria apply to roads with roadside ditches, curb and gutter sections, and culvert crossings. They do not apply to bridge crossings. Criteria for bridges are included separately in Section 6.8. Street inundation during both the minor and major storms must be analyzed for compliance with the criteria in this section.

Table 6.12. Maximum Allowable Flow Depth and Encroachment

Roadway Classification	Minor Storm Encroachment	Major Storm Encroachment
Arterial	10 feet clear each way; No curb overtopping; No encroachment on adjacent property	15 feet clear in center; Ponding below finished floor of all occupied structures
Major Collector	10 feet clear in center; No curb overtopping; No encroachment on adjacent property	Allowable depth at crown = 3 inches; Ponding below finished floor of all occupied structures
Minor Collector	10 feet clear in center; No curb overtopping; No encroachment on adjacent property	Allowable depth at crown = 6 inches; Ponding below finished floor of all occupied structures
Local	Flow may spread to crown; No curb overtopping; No encroachment on adjacent property	Allowable depth at crown = 9 inches; Ponding below finished floor of all occupied structures

Where roadside ditches are used to convey flow, they shall have sufficient capacity to meet the maximum encroachment and flow depth criteria in Table 6.12. Ditch geometry requirements are in Section 6.5 Open Channels.

6.6.2 Minimum and Maximum Grades

The minimum concrete or paved gutter grade shall be 0.5%. The minimum open channel grade shall be 1.0%. Maximum grades in roadside ditches shall meet criteria in Section 6.5 Open Channels.

6.6.3 Cross Street Flow

For all roadway classifications, flow in cross pans shall not exceed the limits set forth in Table 6.12.

6.6.4 Calculations

For roadway drainage, the minor and major storm must be evaluated separately for each side of the street using a Manning's n value of 0.016 for the gutter and street flow areas and a Manning's n value of 0.025 for sidewalk and grass areas, if needed. When a roadside ditch is used, a Manning's n value must be assigned based on the ditch lining.

6.6.4.1 Streets with Curb and Gutter

Design calculations can be performed manually, but this section assumes UD-Inlet will be used to calculate street capacity for those streets with curb and gutter. The USDCM provides additional details on the equations and methodologies that have been incorporated into the UD-Inlet spreadsheet, and guidance in the most recent version of the USDCM can be used for manual design. Note that as the MHFD updates their design spreadsheets they may change the prefix from UD to MHFD. The most recent version of UD-Inlet or MHFD-Inlet should be used.

A reduction factor from Figure 6.3 must also be applied to streets with curb and gutter, which will reduce effective street capacity. The reduction factor accounts for the increased effect on capacity that items like debris and parked cars can have at steeper roadway slopes. UD-Inlet includes these reduction factors automatically.

Street capacity calculations for the minor and major event shall be based on the following procedure:

1. Calculate the theoretical street capacity based on the allowable spread in Table 6.12.
2. Calculate the theoretical street capacity based on the allowable depth in Table 6.12.
3. Apply the appropriate reduction factor from Figure 6.3 to the theoretical flow rate based on allowable depth.
4. The lesser value from steps 1 and 3 is the allowable street capacity.
5. An inlet should be added whenever the runoff reaching the street exceeds the allowable street capacity for the major or minor event.

6.6.4.2 Streets with Roadside Ditches

Design calculations for streets with roadside ditches can be completed with a spreadsheet using Manning's equation in accordance with the design procedures in Section 6.5 Open Channels. The flow areas for the roadway and ditch must be separated so the appropriate Manning's n values can be used for each.

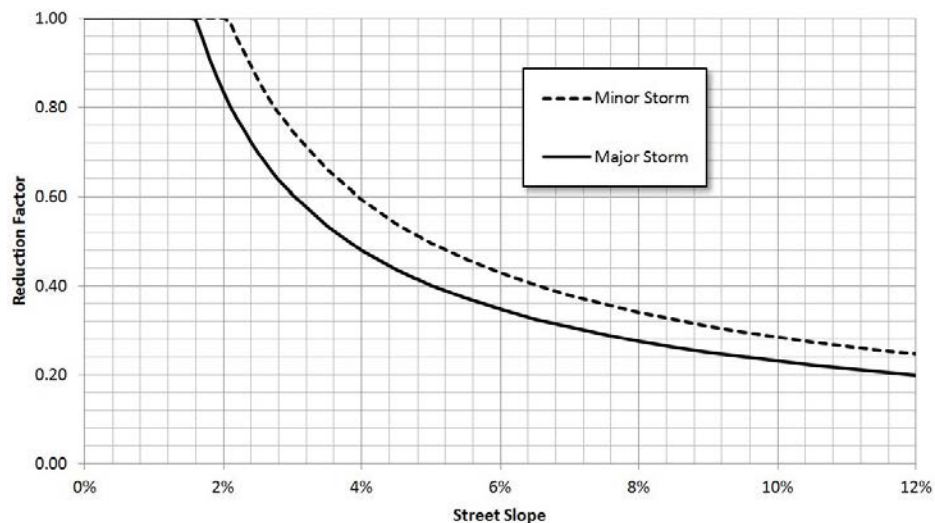


Figure 6.3. Reduction Factor for Gutter Flow
(UDFCD, 2018)

6.7 STORM DRAIN SYSTEMS

The criteria presented in this section shall be used to design and evaluate storm drain systems in the Town. A storm drain system refers to the system of inlets, pipes, manholes or junctions, outlets, and other appurtenant structures that are designed to collect and convey the initial or minor storm runoff. The storm drain system is a part of the local drainage system, which may also include curb and gutter, streets, roadside ditches, swales, and channels. This section presents both technical criteria and the general procedures for design and evaluation of pipes and inlets. Allowable roadway encroachment is in Section 6.6.

6.7.1 Storm Drain Design Criteria

A storm drain system is required when the allowable street capacity is exceeded during the minor storm event, or as required to eliminate the need for cross pans, or to prevent ponding/icing issues on roads. All criteria and guidelines below apply to the minor storm event unless site conditions offer no viable overflow option for the major storm event. Storm drain systems shall also be required where sump conditions exist and on major collectors and arterials to eliminate cross pans and ponding and icing near intersections.

6.7.1.1 Construction Materials

Pipe materials suitable for storm drains include reinforced concrete and high density polyethylene (HDPE). If the Town Engineer has reason to believe that pipe corrosion may be a problem, the Town Engineer may require a soils report to evaluate the corrosive potential of the soils and groundwater to be determined in the Geotechnical Report.

All pipe joint fillers, sealing compounds, gaskets, and the installation thereof, shall be in accordance with CDOT specifications. Rubber gaskets shall be used at pipe joints where the HGL is five feet higher or more than the pipe crown.

6.7.1.2 Pipe Size

The minimum allowable pipe diameter for storm drains shall be 18 inches for trunk lines and 15 inches for laterals. The minimum inside diameter of all pipes shall be no less than 14 inches for elliptical and arch pipe. In areas where debris, sediment deposition, adjacent wildfire burn area, or freezing are potential problems, the Town Engineer may require larger pipes. There is no maximum pipe size;

however, using multiple smaller barrels in lieu of very large pipes may be physically or economically advisable under some circumstances. For pipes below 5' diameter, a single barrel pipe is preferred over multiple smaller barrel pipes.

6.7.1.3 *Horizontal and Vertical Alignment*

Storm drains shall be designed and installed with sufficient cover to support an HS-20-44 loading in accordance with the pipe manufacturer's recommendations. Minimum and maximum cover are determined by the size, material, and class of pipe, as well as by the characteristics of the cover material and the expected surface loading. The designer should consult appropriate data sources to determine these values, but the minimum cover in all instances shall be greater than 24 inches of cover.

To prevent freezing issues, the following cover requirements shall be met as well, where feasible. In areas that are regularly plowed, storm sewers shall have a minimum cover of 5 feet. In areas not typically plowed, storm sewers shall have a minimum cover of 4 feet. Less cover may be allowed if winter flows are diverted and an alternate means of flow disposal is provided, such as a dry-well. If utility conflicts or grade restrictions do not allow the minimum values above, additional measures may be required to prevent freezing, including insulation around pipes, slotted pipes, deep inlets that are perforated or bottomless, and other measures as determined by the Town Engineer.

The following resources should be consulted to assist the designer in determining cover requirements:

1. Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, Section 700 (Materials Details)
2. Concrete Pipe Design Manual (ACPA)
3. Handbook of Steel Drainage and Highway Construction Products (AISI)
4. Pipe Manufacturer Specifications
5. Other applicable references

Trench installations, including bedding, shall be in accordance with the most recent edition of the CDOT M&S Standard Plans. In manholes and junction boxes, the lowest inlet pipe invert elevation must be at least 0.2 feet higher than the outlet pipe invert elevation. In cases where inlet pipes are smaller than outlet pipes, the top of the inlet pipes shall be at least 0.2 feet higher than the top of the outlet pipes.

6.7.1.4 *Utility Crossings*

The Town's required minimum clearance between storm drains and other utilities is 12 inches, regardless of whether the crossing utility is above or below the storm drain. If either the storm drain or crossing utility is encased, the minimum clearance may be reduced to 6 inches. In all cases, backfill material, compaction, and additional protection shall be designed and provided to prohibit settling or failure of either the storm drain or crossing utility.

When storm drains cross above or within 18 inches below water mains, the storm crossing shall be constructed of a 20-foot section of pipe centered on the water main alignment, and the bounding joints shall be encased. Storm drain joints shall also be encased at all locations less than 10 feet horizontally from a water main. Encasement shall be a reinforced concrete collar, 6 inches thick, extended to 12 inches on either side of the joint. The minimum reinforcement shall be a minimum of four continuous #4 bars, equally spaced around the pipe, and tied with #3 bars around the pipe at 8 inches on center.

All work shall be in accordance with these Standards, the Town's Standard Drawings, CDOT M&S Standard Plans, or other approved details, and the design must be approved by both the Town and

the utility owner. Utility owners may have more stringent requirements and local utilities shall be consulted to ensure these requirements are met.

6.7.1.5 Inlets and Manholes

The standard inlets permitted in the Town are a CDOT Type 13 combination inlet, a CDOT Type 13 valley inlet, and a CDOT Type C grated inlet. Type 13 combination inlets may also be called a Type 16 inlet. Type 13 combination inlets shall be used with a 6-inch vertical curb and gutter section and installed with a localized depression at least 2 inches below the gutter flowline elevation. Type 13 combination inlets shall be located, at a minimum, just upstream of curb ramps, and never in the ramp itself. Type C inlets shall be used in roadside ditches and installed in accordance with the CDOT standard plans, including creating a sump condition where one does not naturally exist. Type C inlets are not traffic rated and shall not be placed in roadways. Type C inlets may not be placed in sidewalks or other pedestrian routes. Other types of inlets, including those made of PVC, HDPE, or other materials are only allowed in landscaped areas outside of roadway and sidewalk clear zones.

Table 6.13 provides the maximum allowable manhole or junction box spacing for storm drains. Manholes are also required where there is a change in pipe size, vertical or horizontal alignment, elevation, or slope, and where there is a junction of two or more pipes or laterals. All manholes and junction boxes must provide access to the storm drain system for maintenance and inspection. All manhole and junction box inverts shall be formed with a minimum of a half bench to provide more hydraulically efficient flow through the manhole.

Table 6.13. Maximum Allowable Manhole Spacing

Vertical Pipe Dimension	Maximum Manhole or Junction Spacing
15 to $\leq$ 36 inches	400 feet
> 36 to $\leq$ 60 inches	500 feet
> 60 inches	750 feet

The required diameter of the manhole barrel is dependent upon the size of the largest pipe connecting to it. Minimum manhole sizes are in Table 6.14 and assume the storm drain alignment passes straight through the manhole with no incoming lateral lines. If a storm drain system changes alignment or must accommodate incoming lateral lines at a manhole, the manhole may need to be larger.

Table 6.14. Manhole Sizing

Maximum Pipe Dimension	Minimum Manhole Size
$\leq$ 24 inches	4-foot diameter
> 24 to $\leq$ 42 inches	5-foot diameter
> 42 inches	6-foot diameter or box base

6.7.1.6 Capacity and Velocity

Minimum velocities are required in storm drains to reduce sedimentation and promote positive drainage through the pipe at all flow depths. Public and private storm drains shall have a minimum flow velocity of 3 feet per second when normal flow in the pipe is at 0.25D and never be constructed at less than 0.40% slope. Public and private storm drains shall have a maximum flow velocity of 16 feet per second for all storm events, although care should be taken with velocities this high as there is a higher risk for hydraulic jumps and extreme head loss through junctions.

The storm drain system shall be designed to convey the minor storm without resulting in pressure flow, and the energy grade line (EGL) for the minor storm shall be at or below finished grade at all manholes, inlets, or other junctions. Pressure flow during the major storm is discouraged, but if it does occur, it must not create a surcharged condition at any inlet. Where the 100-year hydraulic grade line (HGL) is above any manhole rim, or if any manhole or inlet is in a floodplain, all manhole and inlet covers must be bolted down.

The EGL and HGL for both the minor and major storm events shall be calculated and plotted for all storm drain systems. Hydraulic losses will include friction, expansion, contraction, and junction losses at a minimum. The methods for estimating these losses are presented in the following sections. Manning's *n* values for capacity and velocity calculations for storm drains shall be the values in Table 6.15. The design of storm drain outlets into open channels, including revetment shall meet the requirements of Section 6.8 for culvert outlets.

Table 6.15. Manning's Roughness Coefficients for Storm Drain Conduits

Pipe Interior	Manning's <i>n</i>
RCP (newer)	0.013
RCP (older)	0.015
RCP (preliminary design)	0.015
Smooth Plastic (HDPE)	0.011

When a planned storm drain system connects directly into the Town's existing storm drain system, an analysis must be provided showing the additional flow from the proposed project does not result in the capacity of the existing storm drain system being exceeded. The requirement for detention in Section 6.9 is intended to facilitate meeting this requirement.

6.7.2 Storm Drain Hydraulics

This section presents the general aspects of hydraulic design and evaluation of storm drains. Hydraulic design calculations can be performed manually with a spreadsheet or by using a computer model. Both methods are briefly discussed below. The user is assumed to possess a basic working knowledge of storm drain hydraulics and is encouraged to review technical literature available on the subject as needed.

6.7.2.1 Manual Calculations

Manual storm drain hydraulic calculations shall be performed in accordance with the HEC-22 (Brown et al., 2013) or the latest version of the USDCM. HEC-22 includes a discussion of both open channel and pressure flow and includes a design example.

Two of the critical design elements of a storm drain system are the HGL and the EGL. The HGL is a line that represents the water surface elevation along an open channel, including open channel flow within a pipe. In pressure flow, the HGL is the level to which water would rise in a vertical tube at any point along the pipe. The EGL is an imaginary line that represents the total energy at any point in the system. Total energy includes elevation head, velocity head, and pressure head and is the HGL plus the velocity head ($V^2/2g$). The total energy at any location equals the energy at any downstream location plus the losses that occur between the two locations.

Losses are typically classified as either friction or form losses. Friction losses occur as water flows along the length of a pipe. Form losses occur at the exit from the system and at junction structures within the system. Because the Town does not allow transitions or bends outside of manholes, form

losses will be restricted to exit losses when flow leaves the system, and structure losses, such as through inlets or manholes. These are referred to by HEC-22 as inlet and access hole losses.

6.7.2.2 Computer Model Calculations

Computer models are often used to calculate the HGL and EGL of storm drain systems. The benefits of using a computer model include consistency, speed, and the ability to check the validity of the model with relative ease. One disadvantage of computer modeling is that errors can occur and be hidden when the model user is inexperienced. Three common programs used throughout Colorado include those listed below. Additional software may be used as approved by the Town provided it utilizes industry standard calculation methods:

1. UD-Sewer 2009, a simple and free program developed by the MHFD that is easy to learn. Note that while UD-Sewer is still provided on the MHFD website and may still be used for new projects, the MHFD no longer supports this program.
2. Storm and Sanitary Analysis, a more complex design tool which runs within the AutoCAD Civil 3D design software package by Autodesk.
3. StormCAD, a more complex design tool which runs within the MicroStation design software package by Bentley Systems or within AutoCAD.

This section provides specific guidance for UD-Sewer 2009. The program uses Manning's equation to analyze and size storm sewer systems. The program can also use the Rational Method to calculate runoff, perform HGL and EGL calculations, and provide plots of the storm drain, ground line, HGL, and EGL. The user's manual is embedded in the software, which can be obtained from the MHFD website (<https://mhfd.org/resources/software>) or via an internet search for "MHFD UD-Sewer."

6.7.2.2.1 Rational Method

UD-Sewer 2009 uses the Rational Method to calculate runoff based on input parameters provided by the user. The user can override Rational Method calculations by manually entering known flows that have been calculated separately; however, values must be entered for Rational Method parameters or the program will give an error.

6.7.2.2.2 Bend and Lateral Loss Coefficients

UD-Sewer 2009 requires bend and lateral loss coefficients for each storm drain segment within a model. Bend and lateral losses both occur at a manhole or inlet junction. Bend losses are the result of the angle between the incoming storm drain and the exiting trunk line at a junction. Lateral losses are the result of turbulence or eddies that occur from lateral flows joining a trunk line. These coefficients are calculated by the program based on user inputs that define the geometry of the system.

To calculate the bend loss coefficient, the user must select the shape of the manhole invert and enter the angle between the incoming and downstream pipe segments. To calculate the lateral loss coefficient, the user must enter the angle between the incoming lateral and downstream trunk line. When entering the angle, the user must select main line or lateral line. Lateral loss is only applied to the main lines of a storm sewer system in UD-Sewer 2009. For all lateral lines, the user should select lateral line and the program will default to zero. If more than one lateral enters a manhole, the user must exercise judgment to determine the appropriate loss coefficient. .

6.7.3 Inlet Hydraulics

This section presents the general procedures for sizing and spacing inlets for a storm drain system. Design calculations can be done manually, but this section focuses on the use of UD-Inlet to calculate street and inlet capacity. The USDCM provides additional details on the equations and methodologies that have been incorporated into the UD-Inlet spreadsheet, and guidance in the most recent version

of the USDCM shall be used for manual design. Note that as the MHFD updates their design spreadsheets they may change the prefix from UD to MHFD. The most recent version of UD-Inlet or MHFD-Inlet should be used.

6.7.3.1 Introduction

Inlets on a continuous grade result in uncaptured flow bypassing the inlet and continuing to the next inlet in the system. Sump inlets are located at low points in the roadway vertical alignment which are known as sags or sumps; there is no way for excess water to bypass a sump curb inlet. A sump condition can occur at a change in street grade from positive to negative or at an intersection due to the crown of the cross street.

6.7.3.2 Inlet Capacity

Inlet capacity may be calculated using the UD-Inlet spreadsheet developed by the MHFD. UD-Inlet is an Excel-based program that calculates both street and inlet capacities based on several parameters entered by the user. In general, the procedure consists of defining the amount and depth of flow in the gutter and determining the theoretical flow interception by the inlet. The calculations within the spreadsheet program are based on physical research completed at Colorado State University. The most recent version of UD-Inlet can be obtained via an internet search for "UD-Inlet MHFD" or from the MHFD website (<https://mhfd.org/resources/software>).

Information required by the UD-Inlet spreadsheet includes design flow; height of curb; distance from curb face to street crown; gutter width; street cross and longitudinal slopes; gutter cross slope; Manning's n for the street; maximum allowable spread from gutter flow line; maximum allowable depth at gutter flow line; and allowable flow depth at the street crown. Additionally, if flow is allowed behind the curb, the allowable spread width, side slope, and Manning's n behind the curb must be entered. The spreadsheet can use the Rational Method to calculate a design flow at the inlet or will accept a flow entered by the user. If the inlet receives bypass from an upstream inlet, the bypass flow can be entered or referenced from another UD-Inlet worksheet. Default clogging factors included in the UD-Inlet spreadsheet shall be used to account for potential debris clogging, pavement overlaying, and varying design assumptions.

6.7.3.3 Continuous Grade Condition

The capacity of an inlet on grade is dependent on street slope, depth of flow in the gutter, height and length of curb opening, street cross slope, and the amount of local inlet depression. Cost effective inlet design allows for some bypass. The amount of bypass or carryover flow must be included in the drainage facility evaluation as well as in the design of the inlet.

6.7.3.4 Sump Condition

Due to frequent freezing conditions and the associated hazards, sump conditions will only be allowed where no practical alternatives for grading and drainage exist. Where a sump condition is unavoidable, sump inlets shall be sized to have twice the capacity as otherwise required by these Standards to decrease the likelihood of ice buildup preventing the inlet from functioning.

6.7.3.5 Inlet Spacing

The optimum spacing of storm inlets is dependent upon several factors, including traffic requirements, contributing land use, street slope, allowable street capacity, and distance to the nearest outfall system. The suggested sizing and spacing of the inlets is based on an ideal interception rate of 70% to 80%. This spacing has been found to be more efficient than a spacing that will accomplish a 100% interception rate; although, the downstream-most inlet will still need to be designed to intercept 100% of the flow.

Inlet spacing is typically an iterative process, and the designer may have to move inlet locations multiple times before determining the appropriate spacing to meet design criteria and maintain efficiency. After initial inlet locations are determined, the designer should recalculate the peak flow to each inlet and check that the allowable street capacity has not been exceeded at any location. If the actual flow is less than the allowable street capacity, inlets may be spaced further apart to prevent overdesign of a system. Locating inlets is a balance between meeting criteria and efficient design. It is not usually possible to have optimum inlet spacing throughout an entire storm drain system. The inlets must be spaced so that no portion of a roadway exceeds the spread criteria of this chapter.

6.7.3.6 *Inlet Grates*

All grates used on storm inlets in the Town will be bicycle-safe grates in accordance with the most recent version of the AASHTO Guide for the Development of Bicycle Facilities. Grates shall be Type L vane grates or approved equal style meeting AASHTO bicycle and ADA requirements. Grates shall be cast iron and rated to withstand HS-20-44 loading.

6.7.4 **Design of a Storm Drain System**

This section presents the general procedure used to design a storm drain system from preliminary through final design. A typical local drainage system consists of flow in the storm drain and allowable flow in the gutter and street. These flows are ultimately discharged to a larger drainage system or an open channel with capacity for a much larger event.

6.7.4.1 *Preliminary Design*

The preliminary design of the storm drain system begins after a preliminary development plan has been prepared that delineates the general development areas, major drainage paths, and drainage outfall locations. Allocation of space for drainage facilities and considerations shall be incorporated into the preliminary development plan. The drainage engineer must have input into the development plan to ensure proper drainage planning.

1. The first step in any drainage project is the collection of basic data. Information typically required includes:
 - a. Topographic maps of the development and drainage basins that show existing and proposed roadways, existing and proposed land uses, major drainage features such as creeks and streams, development area, and property boundaries
 - b. Typical street cross sections
 - c. Preliminary grading information, such as contours, profiles, and control elevations
 - d. Soils information
 - e. Existing and proposed utilities
 - f. Existing irrigation and raw water facilities and requirements for maintaining facilities
 - g. Rainfall information
2. Perform the hydrologic evaluation of the basin(s) for both the minor and major storms, typically using the Rational Method. Divide each basin into smaller subbasins and calculate the peak design flow for each hydrologic point of interest or potential inlet location. The degree of basin subdivision will depend on the detail of information available and the experience of the licensed professional drainage engineer.
3. Complete preliminary sizing for the minor storm. Beginning at the upper end of the basin, calculate the flow in the street until the allowable capacity of the street as calculated in Section 6.6 matches the design runoff. The storm drain system will typically start at this point. Removal of all street flow by inlets is not required, except at sump locations, and is typically not

economical. The sum of the flow in the storm drain and the street must be less than or equal to allowable capacity.

4. Assign a diameter, pipe material, and slope for preliminary sizing. Manning's *n* values should be those in Table 6.15. A profile may be required to check for utility conflicts or to confirm compatibility with the receiving drainage system. The preliminary vertical alignment should not be steeper than the proposed street grade. The designer should also be aware of existing utility locations, especially when crossing water and sanitary main and service lines.
5. After sizing the system for the minor storm, route the major storm through the system and evaluate the results. The combined total of the allowable street capacity and the storm drain capacity during the major storm should equal or exceed the 100-year runoff. A plan and profile of the pipes and minor and major storm EGL and HGL is required. If the combined allowable capacity is less than the design flow, some or all the following actions may be taken:
 - a. Increase storm drain sizes and/or the number and size of inlets
 - b. Increase street grade within acceptable limits or revise street cross-sectional geometry to allow additional capacity
 - c. Provide additional onsite detention within the development to decrease peak flow.
6. Evaluate the preliminary design for costs and benefits. The impact of the system on downstream properties must be evaluated and mitigated as needed.

6.7.4.2 Final Design

Final design consists of final revisions to the storm drain system model and preparation of plans, profiles, and specifications for the storm drain system in enough detail for construction. Basic data, hydrologic analysis, and inlet sizing performed during preliminary design should be reviewed and verified. Drainage subbasin boundaries should be confirmed or revised as necessary, and design peak flows should be recalculated. The pipe and inlet sizes and locations are finalized while accounting for final street and storm drain grades, locations of existing and proposed utilities, and the design of the major drainage system. The EGL and HGL should be revised with updated energy losses at manholes and any other structures.

6.8 CULVERTS AND BRIDGES

Culverts and bridges convey surface water through or beneath an embankment such as a roadway, railroad, or canal. The size, alignment, and support structures of a culvert or bridge directly affect the capacity of the drainage system. An undersized culvert or bridge will force water out of the channel and cause flooding and damage. Culverts and bridges may significantly influence upstream and downstream flood risks, floodplain management, and public safety.

The criteria presented in this section shall be used to evaluate and design culverts and bridges in the Town, regardless of whether they are located within public right-of-way. The review of all submittals will be based on the criteria in this section. Stormwater crossings of CDOT roadways may have additional requirements.

6.8.1 Culvert Design Standards

Culverts shall be designed and constructed to the following standards. All proposed culverts, regardless of whether they are in public right-of-way, are subject to review and approval by the Town Engineer.

6.8.1.1 Materials and Structural Design

Allowable materials for culverts include HDPE and reinforced concrete. The culvert materials and joints shall meet the most recent versions of the standards listed in Table 6.16 for each type of culvert.

Each culvert installation shall be designed to maintain its full shape and function under an HS-20-44 loading in accordance with the design procedures in the latest edition of the AASHTO Standard Specifications for Highway Bridges, or appropriate ASTM standard, and with the pipe manufacturer's recommendations. For roadway crossing culverts, the minimum cover shall be 24 inches measured from the top of the pavement. For culverts crossing private driveways, the minimum cover shall be 8 inches. In all cases, minimum cover over roadway crossing culverts shall also include at least 6 inches of aggregate base course under the pavement. Total minimum cover may need to be increased for thicker pavement sections. In all cases, the minimum and maximum cover shall be in accordance with the manufacturer's recommendations. Trench installations shall be in accordance with the most recent edition of the CDOT M&S Standard Plans.

Table 6.16. Applicable Culvert Standards

Culvert Type	Standard
Reinforced Concrete Pipe—Round	ASTM C76 or AASHTO M 170
Reinforced Concrete Pipe—Elliptical	ASTM C507 or AASHTO M 207
Reinforced Concrete Pipe—Joints	ASTM C443 or AASHTO M 198
Reinforced Concrete Box Culvert—Joints	ASTM C1677
Reinforced Concrete Pipe—Arch	ASTM C506 or AASHTO M 206
Precast Concrete Box Culverts	ASTM C1433/C1577 or AASHTO M 259/M 273
Concrete for Cast-in-place culverts	CDOT 601
High Density Polyethylene Pipe (HDPE)	ASTM F2306
Gaskets for Joining Plastic Pipe (HDPE)	ASTM F477

6.8.1.2 Minimum Size

The minimum pipe diameter for culverts in the public right-of-way that are not driveway culverts shall be 18 inches. The minimum vertical pipe dimension shall be 18 inches where elliptical or arch pipe is used. Equivalent sizes for a 24-inch round pipe are a 29-inch by 18-inch arch and a 30-inch by 19-inch elliptical section.

Roadside ditch culverts crossing private driveways shall have a minimum diameter of 18 inches. Roadside ditches shall be re-graded if necessary to provide positive drainage below the culvert and prevent ponding or a sump condition near the culvert. The developer is responsible for re-grading and reconditioning existing swales to prevent ponding or a sump condition. If existing conditions prohibit the installation of an 18" culvert, the Town Engineer may grant a variance to allow a smaller culvert.

6.8.1.3 Allowable Headwater

Ponding above culvert entrances can cause property or roadway damage, culvert clogging, saturation of fills, detrimental upstream deposits of debris, an increase in floodplain elevation, or inundation of existing or future facilities. The maximum headwater for the 100-year design flow shall be 2.0 times the culvert diameter or culvert rise dimension for shapes other than round ($H_w/D \leq 2.0$) for culverts with a rise dimension less than or equal to 36 inches. For culverts with larger rise dimensions, the headwater to depth ratio for the 100-year design flow shall be less than 1.5. There is no maximum headwater value for the minor storm. Table 6.17 lists these criteria. The criteria in Table 6.17 are in

addition to roadway encroachment and overtopping criteria, and do not apply to detention, water quality, or sedimentation facility outlets.

Table 6.17. Allowable Headwater

Culvert Diameter or Rise	100-Year Maximum Headwater/Diameter (H_w/D)
≤ 36 inches	2.0
> 36 inches	1.5

6.8.1.4 Roadway Overtopping

No overtopping of any public roadway at a roadway culvert crossing is permitted during the minor storm. Roadway overtopping of up to 6 inches may occur at culvert crossings of local roads during the major storm. Overtopping at arterial, major collector, and minor collector roadways may not occur during the major storm. Overtopping of driveways at culverts in roadside ditches may not result in roadway encroachment that exceeds that specified in Section 6.6. These criteria should be considered as headwater limitations in addition to those in Table 6.17 above.

Additionally, culverts under arterial and major collector roadways, or those conveying flows from drainage areas larger than 0.50 square miles shall pass the 100-year storm assuming 20% of the inlet is plugged.

The depth of roadway overtopping is assumed to be the difference between the headwater elevation and the roadway crown elevation along the centerline of the culvert. Where overtopping is not permitted, but some amount of encroachment is permitted, the culvert headwater elevation can be set at the elevation corresponding to the limits of encroachment.

During roadway overtopping, the roadway crown is assumed to act as a broad-crested weir. A weir coefficient of 2.8 shall be assumed along with a weir length not to exceed 100 feet, regardless of roadway geometry. The designer should first calculate weir flow using the allowable overtopping depth for the major storm. The designer should then calculate flow through the culvert in accordance with these Standards, with culvert headwater set at the allowable overtopping elevation. If the calculated weir flow plus the flow through the culvert exceeds the design flow, the allowable overtopping condition has been met.

6.8.1.5 Velocity and Outlet Protection

A minimum flow velocity within the culvert of 3 feet per second is required to prevent sediment from accumulating in the culvert. The minimum flow velocity should be calculated using Manning's equation with a flow depth equal to 0.25 times the vertical dimension of the culvert. Manning's n values are presented in Table 6.15 above. Regardless of calculated flow velocity, the minimum slope of any culvert shall be 0.40%.

Culvert design must include revetment to protect the outlet from erosion if exit velocity exceeds 6 feet per second during the 100-year event as calculated in accordance with these Standards. The most common type of outlet protection is riprap, either as a riprap apron or as a low tailwater basin. Procedures for designing a riprap apron or low tailwater basin downstream of a culvert outlet, including for multiple conduit installations, can be found in the USDCM. Culverts should not be designed with 100-year outlet velocities greater than 16 feet per second.

An economical culvert design that meets allowable headwater requirements should not result in a Froude number larger than 2.5 when design velocities are kept below 16 feet per second. Culvert

slopes should be as flat as practicable to limit the amount of revetment required at the outlet. A riprap apron is typically used when the culvert discharges to a well-defined channel that can be expected to have a tailwater elevation equal to at least one-third of the height of the culvert. A low tailwater basin is typically used when the receiving channel may have little or no tailwater or where the receiving channel is not well defined.

6.8.1.6 Headwalls, Wingwalls, and End Sections

Except for private driveway culverts, all culverts in the public right-of-way shall be designed with headwalls and wingwalls or flared end sections at the inlet and outlet to minimize head loss. Stone headwalls and wingwalls are not allowed in roadside ditches. Private driveway culverts less than 36 inches in equivalent diameter may have projecting ends. Headwalls, wingwalls, and end sections shall be in accordance with the most recent edition of the CDOT M&S Standard Plans. Headwalls or end sections shall be located to provide a grade no steeper than 3H:1V between the back of the structure and the edge of the roadway shoulder or back of walk. Ditch and channel sections and profiles shall be transitioned at culvert inlets and outlets to allow for adequate cover over the culvert and to provide inlet and outlet conditions that will not cause erosion or sediment deposition.

6.8.1.7 Grates

Where a clear and present danger exists such as a siphon, a drop in elevation adjacent to a sidewalk or road, a long pipe with one or more manholes, or at pipes which are near playgrounds, parks and residential areas, a grate at the inlet and outlet of the culvert may be required. For most pipes through embankments and under streets, grates will not be required.

6.8.1.8 Location and Alignment

Culverts shall be located to completely drain all rainfall and snowmelt runoff where drainageways intersect a roadway or sidewalk. All areas that water could be impounded, or flow restricted, by the new embankment must be identified and considered for culvert locations. Culverts shall be aligned to give drainageways a linear entrance and exit. Abrupt changes in alignment at either end of a culvert may retard flow and make a larger structure necessary. If possible, a culvert shall have the same alignment as the channel it conveys. If this is not practical, and the water must be turned into a culvert, headwalls, wingwalls, and aprons shall be used as protection against scour and to provide a more hydraulically efficient inlet.

Where the natural channel alignment would result in a culvert alignment skewed more than 30 degrees from perpendicular to a roadway, modification may be necessary. Such modifications will change the natural stability of the channel, and an investigation into other options is recommended. Although economic factors are important, hydraulic effectiveness of the culvert must be given primary consideration.

Roadway alignment also affects culvert design. The vertical alignment of roadways may define the maximum culvert diameter that can be used. Low vertical clearance may require the use of elliptical or arched culverts or the use of multiple barrels.

6.8.2 Bridge Design Standards

Based on hydraulic capacity requirements, bridges may be required to cross major open channels. Sizing bridge openings is of great importance. Improperly designed bridges may cause excessive scour or deposition or may not be able to pass the design flow. Backwater caused by bridges can cause flooding of upstream property, overtopping of roadways, or costly maintenance. Bridge openings should have as little effect on the flow characteristics as is reasonable, consistent with good design and economics. The criteria in this section apply to bridges on public and private roads in the Town. The Town will review bridge designs based on the guidance in this section.

It is possible that a bridge designed to meet the criteria of these Standards may be on a roadway that becomes flooded during the storm event the bridge is designed to pass. New bridges shall be designed to these Standards regardless of adjacent roadway flooding because roadways that experience frequent flooding may be reconstructed at a higher elevation in the future to achieve an overall greater level of protection.

6.8.2.1 Bridge Sizing

The low chord of all bridges must provide a minimum freeboard. All bridges on arterial and major collector roadways, or above the Blue River or its major tributaries, shall have a low chord elevation set at least 3 feet above the HGL. All other bridges shall have a low chord elevation at least 1 foot above the HGL. Arch culverts, large diameter culverts, or other structures may be classified as a bridge and subject to freeboard requirements. Freeboard requirements apply to both vehicular bridges, pedestrian bridges, and any other structures spanning a floodway.

6.8.2.2 Hydraulic Analysis

Hydraulic analysis and design calculations for all bridges must be prepared and certified by a licensed Colorado Professional Engineer. The procedures for design as outlined in the Federal Highway Administration (FHWA) publication *Hydraulic Design of Safe Bridges* shall be used for the hydraulic analysis of the proposed design. HEC-RAS may be used to complete the hydraulic analysis of bridge openings provided the guidance in the publication is followed. All bridges are assumed to remain in place during all storm events and shall not be assumed to break away or otherwise be removed from any modeling scenario. Design flow rates shall be those specified by FEMA or as calculated in accordance with these Standards.

6.8.2.3 Inlet and Outlet Configuration

Where bridge abutments and foundations are located below the 100-year water surface elevation, concrete wingwalls shall be tied to the existing side slopes to prevent erosion behind the abutments and to provide slope stabilization from the top of the embankment to the toe of slope. Riprap protection on the inlet and outlet transition slopes shall be provided to prevent erosion caused by eddy currents.

6.8.2.4 Scour Analysis and Countermeasures

Velocity limitations through the bridge opening are intended to limit potential scour. Regardless of the results of the scour analysis, a maximum 100-year average channel velocity of 16 feet per second shall be allowed through a bridge opening. Whenever a new or replacement bridge is designed, it is critical that scour depths at piers and abutments be estimated. The scour estimate must consider subsurface data and a hydraulic analysis of the proposed design.

The FHWA has published a set of Hydraulic Engineering Circulars (HEC) to provide guidance for bridge scour and stream stability analysis. The set includes HEC-18, Evaluating Scour at Bridges, HEC-20, Stream Stability at Highway Structures, and HEC-23, Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance. Latest editions of each shall be used in concert with each other to evaluate stream stability, potential scour, and appropriate scour countermeasures. HEC-RAS may be used to provide the raw data required for the HEC-18 equations. HEC-RAS may also be used to evaluate scour, but the user must be experienced in the nuances HEC-RAS presents in evaluating scour and the potential errors that can occur. Using HEC-RAS default values will cause inaccurate results.

The potential for local scour (pier and abutment) and general scour (contraction, stream degradation, and pressure) should be evaluated using HEC-18 to determine the extent of the various types of scour as applicable to each site. HEC-20 should be consulted to determine the general stability of the stream and whether lateral channel movement should be anticipated. If there is potential for scour during the scour design storm shown in Table 6.18, countermeasures shall be designed in accordance with HEC-

23. In all cases, the length of bridge piles shall be such that the design structural load may be safely supported entirely below the probable scour depth.

Table 6.18. Bridge Scour Design Standards

Roadway Classification	Design Storm for Abutment, Pier Cap, and Retaining Wall Design	Design Storm for Foundation Design
Arterial	500-year	500-year
Major Collector	100-year	500-year
Minor Collector	100-year	500-year
Local	50-year	500-year

6.8.2.5 Structural Design

The type of bridge foundation and foundation elevations should be determined by the bridge structural design engineer. During the design of the bridge foundations, the design engineer shall consider the design loading, the findings of the geotechnical investigation, scour depth as calculated using the procedures in HEC-18, anticipated frost depth, pressure flow during the 100-year event, and any other factors the engineer considers appropriate in his or her professional judgement. If scour is anticipated, the engineer can either design scour countermeasures using the procedures in HEC-23 for the applicable design storm or locate the bridge foundations below the anticipated depth of scour by a distance that provides a sufficient factor of safety in his or her professional judgement. Scour countermeasures will be required if anticipated scour depth is more than 5 feet.

Structural, scour, and foundation design calculations must be accompanied by a certification statement that is signed and sealed by a professional engineer licensed in the State of Colorado and submitted to the Town for review. The certification statement shall read as follows.

I hereby affirm that the design calculations and plans for the bridge at [insert address] were prepared by me, or under my direct supervision, for the owners thereof, in accordance with the requirements of the International Building Code, the Breckenridge Town Code, the Breckenridge Town Standards, any approved variances and exceptions thereto, and my professional engineering judgment. I understand that the Town of Breckenridge does not and will not assume liability for facilities, structures, or improvements designed by others.

Registered Professional Engineer [Affix Seal]

State of Colorado No. _____

All assumptions made by the bridge design engineer shall be provided in the calculations. Furthermore, the design of bridges may be subject to review by a third party at the Town's discretion. When located within a FEMA floodplain, all bridges are subject to requirements of the National Flood Insurance Program (NFIP) and local floodplain management regulations.

The Town recognizes that in certain limited instances, it may be exceptionally difficult to conform to these Standards. In these instances, the applicant may submit a variance request in accordance with the requirements in Chapter 1. The request must be signed and sealed by a professional engineer licensed in the State of Colorado.

6.8.3 Culvert Hydraulics

Presented in this section are the general procedures that shall be used for hydraulic design and analysis of culverts. The user is assumed to possess a basic working knowledge of culvert hydraulics

and is encouraged to review the technical literature on the subject that is included in Hydraulic Design Series 5 (HDS-5), *Hydraulic Design of Highway Culverts*, published by the FHWA). The two primary types of culvert flow are inlet control and outlet control. Under inlet control, the cross-sectional area of the barrel, inlet geometry, and headwater are the factors that affect capacity. Outlet control involves the additional consideration of tailwater and the slope, roughness, and length of the culvert barrel. The Culvert Design Form, included as an attachment to this chapter, is a template for culvert hydraulic analysis that can be used with the information and equations below. All culvert designs shall include an analysis to determine whether inlet or outlet control conditions govern for both minor and major storm runoff.

6.8.3.1 Inlet Control Calculation

Under inlet control conditions, the slope of the culvert is steep enough that the culvert does not flow full. The control section of a culvert operating under inlet control is located just inside the entrance. Inlets may be either unsubmerged or submerged. In an unsubmerged condition, the headwater is high enough to submerge the top of the culvert and the culvert slope is supercritical. In a submerged condition, the headwater submerges the top of the culvert, but the pipe does not flow full. In this situation, the culvert inlet acts like an orifice.

In the submerged inlet condition, the equation governing the culvert capacity is the orifice flow equation. However, because of the uncertainty in estimating the orifice coefficient for a submerged culvert inlet, it is recommended that the inlet control nomographs published in HDS-5 be used to determine headwater for submerged inlets operating under inlet control. Nomographs may be found online in the second edition of HDS-5, publication number FHWA-NHI-01-020. Later editions do not have as many nomographs. Table 6.19 provides the appropriate inlet control nomograph to use for various types of culverts and end treatments. The FHWA has not published inlet control nomographs for plastic pipe. In their absence, the nomographs for concrete may be used for round HDPE with a smooth interior wall.

Table 6.19. Inlet Control Nomograph Selection

Material	Cross Section	End Treatment	Chart
Concrete/HDPE	Circular	None (Projecting), Headwall	1B
Concrete/HDPE	Circular	Flared end section	55B
Concrete	Horizontal Elliptical	Headwall or Projecting (use scale 1 for end section)	29B
Concrete	Rectangular	Wingwalls, angle and headwall bevel varies	8B-13B

6.8.3.2 Outlet Control Calculation

Outlet control occurs when the culvert barrel is not capable of conveying as much flow as the inlet opening will accept. Either subcritical or pressure flow exists in the culvert barrel under these conditions. Outlet control will govern if the headwater is deep enough, the culvert slope is sufficiently flat, or the culvert is sufficiently long.

Outlet control generally exists under two conditions. The first, and less common, occurs when headwater is not high enough to submerge the top of the culvert and the culvert slope is subcritical. The more common outlet control condition exists when the culvert is flowing full. A culvert with a submerged inlet and an unsubmerged outlet may also operate under outlet control, especially if it has a long barrel length or a flat enough slope. Culverts under outlet control may flow full or partly full, depending on various combinations of hydraulic factors.

Culvert capacity under outlet control is calculated using Bernoulli's equation. An energy balance is determined between the headwater at the culvert inlet and at the culvert outlet and includes inlet losses, friction losses, and velocity head. The general equation is expressed as:

$$H = h_e + h_f + h_v \quad (6.13)$$

Where:

H = total energy head (headwater elevation minus tailwater elevation) (ft)

h_e = entrance head loss (ft), $K_e V^2 / 2g$

h_f = friction losses (ft)

h_v = velocity head (ft), $V^2 / 2g$

K_e = entrance loss coefficient per Table 6.20

Friction loss is the energy required to overcome the culvert barrel roughness and is calculated by the following equation.

$$h_f = (29n^2 L / R^{1.33}) (V^2 / 2g) \quad (6.14)$$

Where:

n = Manning's coefficient per Table 6.15

V = velocity of flow (ft/s)

L = length of culvert (ft)

g = gravitational acceleration, 32.2 ft/s²

R = hydraulic radius (ft)

Table 6.20. Culvert Entrance Loss Coefficients, K_e , for Outlet Control Calculations

Structure and Entrance Type	K_e	Structure and Entrance Type	K_e
<u>RCP</u>		<u>RCB</u>	
Headwall, socket end of pipe	0.2	<u>Wingwalls at 30° to 75° to barrel</u>	
Headwall, square edge	0.5	Square edge at crown	0.4
Projecting from fill, socket end	0.2	Rounded or beveled top edge	0.2
Projecting from fill, square cut end	0.5	<u>Wingwalls at 10° to 25° to barrel</u>	
Mitered to conform to fill slope	0.7	Square edge at crown	0.5
Side- or slope-tapered inlet	0.2	<u>Wingwalls parallel (side extensions)</u>	
Beveled edges, 33.7° or 45° bevels	0.2	Square edge at crown	0.7
Rounded (radius = $D/12$)	0.2	Side- or slope-tapered inlet	0.2
End section that conforms to fill slope ⁽¹⁾	0.5	<u>No wingwalls</u>	
<u>HDPE</u> ⁽²⁾		Square edge on 3 sides	0.5
Projecting from fill	0.9	Rounded or beveled on 3 sides	0.2

⁽¹⁾ End sections that conform to fill slope are the sections commonly available from manufacturers. From limited hydraulic tests, they are equivalent in operation to a headwall in both inlet and outlet control. Some end sections, which incorporate a closed taper in their design, have a superior hydraulic performance. These latter sections can be designed by using the information given for the beveled inlet.

⁽²⁾ Conditions not listed specifically for HDPE with a smooth interior wall have the same coefficient as RCP. The "projecting from fill" value given for HDPE is an approximation based on published values for CMP.

Combining the equations yields the following equation, which can be used to calculate culvert capacity directly only when the tailwater is at or above the crown of the culvert outlet.

$$H = (K_e + 1 + 29n^2L/R^{1.33})(V^2/2g) \quad (6.15)$$

When the tailwater is below the culvert outlet crown, the tailwater depth used for calculations shall be the larger of the tailwater anticipated in the downstream channel at the culvert outlet and the average of the critical depth in the culvert and the culvert diameter, $(D+d_c)/2$. The FHWA has determined the average of the critical depth and the culvert diameter to be an adequate approximation for tailwater depth for culverts that flow partially full. Critical depth calculation is a direct process for a box culvert but an iterative one for a circular pipe that is easily accomplished with a spreadsheet. Critical depth occurs when the Froude number is equal to 1.0. The flow area and top width will be those that occur at critical depth in the pipe. Many online tutorials are available.

$$Fr = \frac{v}{\sqrt{gD_h}} \quad (6.16)$$

Where:

Fr = Froude number (dimensionless)

v = velocity (ft/s)

D_h = hydraulic depth (ft), A/T

A = flow area (ft²)

T = top width of flow area (ft)

g = gravitational acceleration, 32.2 ft/s²

In addition to equation 6.15, outlet control nomographs published by the FHWA in HDS-5 can also be used to calculate the required headwater under outlet control conditions where the outlet is submerged. Outlet control nomographs can be found online in the second edition of HDS-5, publication number FHWA-NHI-01-020. Later editions do not have as many nomographs. Table 6.21 provides the appropriate outlet control nomograph to use for various types of culverts. The FHWA has not published outlet control nomographs for plastic pipe. In their absence, the nomographs for concrete may be used for round HDPE with a smooth interior wall. End treatments do not affect outlet control.

Table 6.21. Outlet Control Nomograph Selection

Material	Cross Section	Chart
Concrete/HDPE	Circular	5B
Concrete	Rectangular	15B
Concrete	Horizontal Elliptical	33B

Culvert capacity shall be computed using the Culvert Design Form, included as an attachment to this chapter. Two example calculations for culvert sizing are at the end of this section. The first is for a roadway crossing culvert and the second is for a driveway culvert in a roadside ditch. HDS-5 offers extensive guidance on the design of culverts that are under roadways and that may be used in conjunction with the requirements of these Standards.

6.8.3.3 Evaluation of Results

If the culvert selected will not fit the site, return to the design process, and select another culvert. Repeat the design process until an acceptable culvert configuration is determined. Compare the headwater elevations calculated for inlet and outlet control. The higher of the two is the controlling

headwater elevation. The culvert can be expected to operate with that higher headwater for at least part of the time.

If outlet control governs and the headwater depth is less than $1.2D$, it is possible that the barrel flows partly full through its entire length. In this case, caution should be used in applying the approximate method of setting the downstream elevation based on the greater of tailwater or $(d_c + D)/2$. If an accurate headwater is necessary, backwater calculations should be used to check the result from the approximate method. If the headwater depth falls below $0.75D$, backwater calculations are required.

6.8.3.4 Outlet Velocity Calculation

The outlet velocity may be calculated as follows:

1. If the controlling headwater is based on inlet control, determine the normal depth and velocity in the culvert barrel. The velocity at normal depth is assumed to be the outlet velocity.
2. If the controlling headwater is based on outlet control, determine the area of flow at the outlet based on the barrel geometry and the following:
 - a. Critical depth if the tailwater is below critical depth.
 - b. Tailwater depth if the tailwater is between critical depth and the top of the barrel.
 - c. Height of the barrel if the tailwater is above the top of the barrel.

6.8.3.5 Computer Applications

While it is possible to use the procedures and nomographs for analyzing culvert hydraulics, it is more common to design culverts using computer applications. Among the applications approved for use by the Town is the FHWA's HY-8 Culvert Analysis Program and the Mile High Flood District's MHFD-Culvert spreadsheet, both of which may be used to calculate roadway overtopping, inlet and exit velocity, and hydraulic grade line.

6.8.4 Design Examples

Two design examples are included in this section. The first example is the analysis of an existing roadway cross culvert using the Culvert Design Form. Calculations from this design example are shown in the Culvert Design Form Example, included as an attachment to this chapter. The second example is the design of a private driveway culvert in a roadside ditch.

6.8.4.1 Crossing Culvert Analysis Example

The procedure to evaluate culverts is based on the procedures presented in HDS-5. The methodology consists of evaluating the culvert headwater requirements for both inlet and outlet control. The type of flow control that results in a larger required headwater is the governing flow condition.

An example calculation for rating an existing culvert is presented in the Culvert Design Form Example, included as an attachment to this chapter. The culvert is a 48-inch RCP. The length is 150 feet. The upstream invert elevation is 8540.0, and the downstream invert elevation is 8535.5. The slope is 0.030. The low point of the embankment over the culvert has an elevation of 8551.90. The n value is 0.015, in accordance with Table 6.15 for older concrete pipes. The culvert has flared end sections on each end. All depths are in feet unless noted otherwise.

The tailwater rating values are provided for this example and shown in Column 5. If the tailwater condition is unknown, it must be computed using the normal depth (subcritical or critical only) of a trapezoidal channel approximating the existing drainageway. A HEC-RAS model of the site could also be used to determine the tailwater rating curve.

The entrance loss coefficient, K_e , is determined from Table 6.20 as 0.5 for an end section that conforms to fill slope, which is the category used to represent a common flared end section. The full flow and the velocity are calculated from these values for comparison. The rating then proceeds in the following sequence:

1. The culvert design process begins with selecting a range of discharges or headwater depths and then using an inlet control nomograph to determine the corresponding flow values. This example begins with a range of headwater depths that are entered in Column 3. Headwater to pipe diameter ratios (H_w/D) are calculated and entered in Column 2. If the culvert is not circular, the culvert height is used for the calculation. Note that for design of new culverts, the Town has restrictions on the headwater-to-depth ratio in Table 6.17.
2. For each H_w/D ratio, inlet capacity is read from the appropriate inlet control nomograph (Chart 55B for this example because of the flared end sections) and entered in Column 1. Scale (1) for concrete should be used on Chart 55B to determine discharges, which then completes the inlet control rating.
3. For outlet control, the Q values that have been entered in Column 1 are used to determine the head values (H) in Column 4 from the appropriate outlet control nomograph, Chart 5B in this case. Note that flared end sections do not affect outlet control calculations. The first line drawn in Chart 5B is between the pipe diameter and the pipe length. The second line connects the Q value and passes through the turning line where the first line crossed it to determine H .
4. The known tailwater depths (T_w) for normal flow in the downstream channel are then entered into Column 5 for each Q value in Column 1. The depths have been provided in this example but must be calculated if they are not available using the normal depth of a trapezoidal channel approximating the existing drainageway downstream of the culvert. If the tailwater depth is less than the diameter of the culvert, Columns 6 and 7 must be calculated per Step 5, and the larger of the tailwater depth and the value of Column 7 shall be used as h_o . If the tailwater depth is greater than the diameter of the culvert, the tailwater values in Column 5 are entered into Column 8 as the values for h_o , and Step 6 should begin (Step 5 being skipped).
5. Approximate tailwater depths are calculated when tailwater depths in the downstream channel are less than the diameter of the culvert. The critical depth, d_c , for each Q value in Column 1 is calculated and entered in Column 6. For a circular pipe, the Froude number calculation is completed iteratively using a spreadsheet until the Froude number is 1. Alternately, Chart 4B from HDS-5 can be used to determine d_c for the pipe size and Q value. The average of the critical depth and the culvert diameter is calculated and entered in Column 7 as the approximate h_o value.
6. The headwater values (H_w) in Column 9 are calculated according to Equation 6.17:

$$H_w = H + h_o - LS_o \quad (6.17)$$

where H is from Column 4 and h_o is either the value from Column 8 where $T_w \geq D$ or the larger value of Column 5 and Column 7 where $T_w < D$. L is the length of the culvert barrel and S_o is its slope.

7. The final step is to compare the inlet and outlet control headwater requirements (Columns 3 and 9) and record the higher of the two values in Column 10. The type of flow control is recorded in Column 11. The upstream water surface elevation is then calculated by adding the controlling headwater (Column 10) to the upstream invert elevation. Add this value to Column 12. The culvert rating curve can then be plotted from the values in Columns 12 and 1.

Outlet velocity for designing downstream protection can be computed using $V = Q/A$. For full flow conditions, the culvert area is the full cross sectional area of the culvert. For partially full conditions, the culvert area is the area calculated at a depth of h_o . Channel protection shall be in accordance with

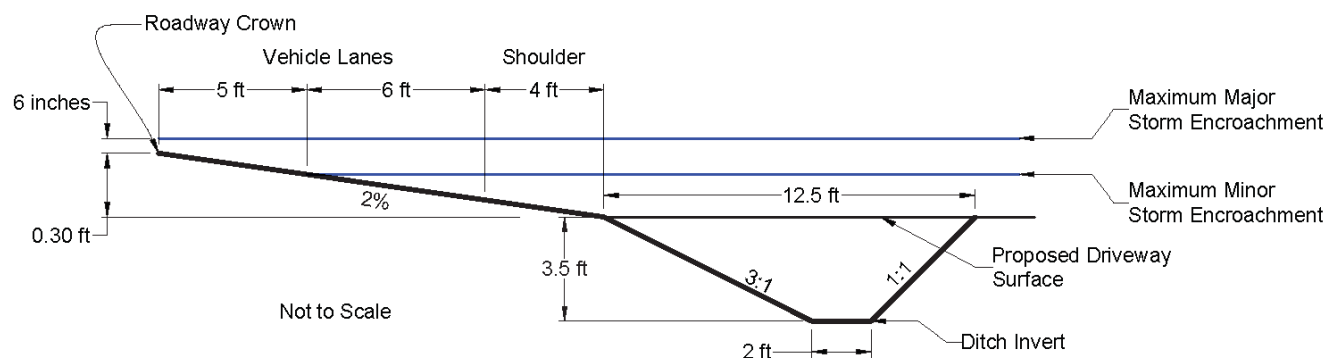
guidance in the USDCM. Velocity values are not shown in the Culvert Design Form but should be calculated for the 100-year event.

To size a culvert crossing, the same form can be used, with some variation in the basic data. First, a design Q is selected, and the maximum allowable headwater is determined. An inlet type is selected, and the invert elevations and culvert slope are estimated based on site constraints. A culvert type and size is then selected and rated for both inlet and outlet control. If the controlling headwater exceeds the maximum allowable headwater, the design data must be modified, and the procedure repeated, until the desired results are achieved.

6.8.4.2 Private Driveway Culvert Design Example

A driveway is planned to provide access to a new residence from a minor collector roadway with an existing roadside ditch. The minor collector has a transverse slope of 2%. The roadside ditch is trapezoidal with a 3:1 side slope down from the road, a 1:1 backslope, a 2-foot bottom width, and a 3.5-foot depth as shown in Figure 6.4.

Figure 6.4. Private Driveway Culvert Example Ditch Geometry



The driveway is assumed to have no slope over the ditch for calculation purposes. The calculated peak flow is 28 cfs for the major storm and 12 cfs for the minor storm. Floodwater encroachment onto the road must not exceed the limitations set forth in Table 6.12 of these Standards. Inlet control is assumed for this example; however, actual projects should use the Culvert Design Form to determine if culverts are under inlet or outlet control.

1. During the major storm, water on a minor collector may be 6 inches deep at the crown of the road. The depth of the water from the allowable water surface to the ditch invert is 4.3 feet. This value is assumed as the headwater depth.
2. For the major storm, calculate the discharge through an 18-inch HDPE ($D = 1.5$ feet) with projecting ends and a headwater depth of 4.3 feet using Chart 1B:

$$H_w/D = 4.3 \text{ ft}/1.5 \text{ ft} = 2.9$$

A H_w/D ratio of 2.9 on Scale 3 of Chart 1B for projecting culvert ends gives a discharge of 18.0 cfs for an 18-inch HDPE.

3. Calculate weir flow over the road and driveway during the major storm. Flow over the road and over the driveway are calculated independently. Because the road grade is sloped across the cross section, the average depth of flow over the road is used. Flow outside the top of the ditch side slope is assumed to be negligible for this example, but it may be considered if the designer feels it is appropriate. Assume a weir coefficient of 2.8.

$$Q_{\text{weir}} = Q_{\text{road}} + Q_{\text{drive}}$$

$$Q_{\text{weir}} = CLH^{3/2} + CLH^{3/2}$$

$$Q_{\text{weir}} = (2.8)(15)((0.85 + 0.50)/2)^{3/2} + (2.8)(12.5)(0.85)^{3/2}$$

$$Q_{\text{weir}} = 23.3 \text{ cfs} + 27.4 \text{ cfs} = 50.7 \text{ cfs}$$

Total flow over the road and driveway is 50.7 cfs.

4. The combined flow through the 18-inch HDPE and over the road/driveway is 68.7 cfs, which is significantly more than the major storm design flow of 28 cfs. Encroachment onto the minor collector will not exceed allowable and the chosen culvert is acceptable for the major storm. If the combined flow would have been less than the major storm flow, a larger culvert would be required, and Steps 2–3 would be repeated using a 24-inch HDPE. In this case, a shallower ditch or a smaller pipe may be considered.

Verify that the design meets the minor storm criteria. During the minor storm, flow may spread to within 5 feet of the crown of a minor collector to allow a single 10-foot lane to remain clear during the minor storm. Assuming encroachment extends only to within 5 feet of the roadway crown yields a headwater depth of 3.7 feet and a H_w/D ratio of 2.5.

5. Scale 3 of Chart 1B indicates a discharge of 16.0 cfs for an 18-inch HDPE with a H_w/D ratio of 2.5, which is greater than the 12 cfs peak flow during the minor storm. The design will meet the minor storm criteria.
6. Verify that the culvert has a minimum 8 inches of cover. The driveway surface is 3.5 feet or 42 inches above the ditch invert. The 18-inch HDPE has more than the minimum 8 inches of cover and meets all criteria for this location.

6.9 DETENTION

The imperviousness of any site typically increases when it is developed. Roof areas, sidewalks, and parking all contribute to site imperviousness. Rain falling on this added impervious area cannot infiltrate into the ground after development. The rainfall discharges from the site instead, impacting adjacent properties, storm drain capacity, and even the capacity of larger drainageways when development is considered in the aggregate. The purpose of detention facilities is to store the additional runoff volume associated with development and discharge it from the developed site at the rate experienced during pre-development conditions. Detention helps to minimize peak flows in urbanized areas. Detention can include individual site options such as small landscaped basins and larger regional options that serve multiple sites. Detention facilities can also be dual purpose when they are designed to meet water quality requirements as well as hydraulic detention requirements. This section presents the Town's criteria and guidance for designing detention ponds.

6.9.1 Applicability

Detention is required for all new development and redevelopment. Subdivided developments may use a single detention facility provided it captures runoff from the entire development. All detention facilities in the Town are subject to oversight by the Town. A maximum of 5% of the total development site may discharge directly from the site, without hydraulic detention, provided the peak site discharge does not exceed the peak historic discharge from the site.

Exemptions from the detention requirement may be granted if the project has either of the following characteristics, provided the additional undetained runoff will cause no adverse impacts to any downstream properties.

1. Impervious area is increased by no more than 0.10 acres or 4360 square feet.

2. Other situations as may be determined by the Town to be in the best interest of the Town.

Exemptions may also be provided for single family homes in subdivisions without regional detention provided low-impact development principles are included in the design to minimize the increase in runoff and not aggravate flooding or erosion problems. Low impact development principles include using pervious pavers or pavement for driveways and walkways, minimizing directly connected impervious areas, and routing drainage from impervious areas such as roofs and driveways through infiltrating swales or across vegetated pervious areas prior to discharging it from the site. Detailed guidance on low impact development can be found in Volume 3 of the USDCM.

Supporting analysis and certification by a professional engineer that exclusion from the detention requirement will not cause any adverse downstream impacts must be submitted to the Town Engineer for consideration if an exemption is requested. An exemption to provide detention issued by the Town does not eliminate potential liability to others.

Although development increasing impervious area by less than 0.10 acres is exempted from detention requirements, any new development or redevelopment is required to analyze and correct any inadequate drainage, including insufficient drainage away from buildings, runoff adversely affecting downstream properties, inadequately sized drywells, drainage exceeding existing storm drains, pipes, or other conveyance, or other drainage concerns identified by the Town Engineer.

6.9.2 Detention Facility Design

All detention facilities shall be designed as full-spectrum detention facilities. The Mile High Flood District has developed detailed design guidance for detention basins. The USDCM provides discussion on the applicability of detention; an explanation for why full-spectrum detention is the preferred approach; and calculations for sizing a detention facility and designing the outlet structure.

The most recent versions of the USDCM and the design tool MHFD-Detention.xlsm (formerly UD-Detention.xlsm) may be used for sizing and designing all detention facilities in the Town. Detention facilities in the Town may be extended detention basins, sand filters, and rain gardens. Constructed wetlands may also be used provided water rights are accommodated. The USDCM also includes weir and orifice equations for the design of detention basin outlets that may also be used for other applications within these Standards as needed. Guidance on the use of MHFD-Detention within the Town is included in this section.

6.9.2.1 Historic Flow Rates

The policy of the Town is to require detention storage of stormwater runoff to limit peak discharges from new development and redevelopment sites to historic rates. Detention facilities shall be designed to release stored runoff volumes at or below the calculated historic peak rate for the 2-, 5-, 10-, 25-, 50-, and 100-year storms.

For new development, historic peak runoff rates per acre shall be calculated in accordance with the procedures in these Standards using a site imperviousness of 2% to represent historic conditions in accordance with Table 6.3. For redeveloped areas, historic rates shall be those calculated for the condition immediately prior to redevelopment in accordance with these Standards unless other criteria are specified by the Town Engineer in writing. Calculated historic rates will vary based on the methodology chosen to calculate peak flow, whether it is the Rational Method, the SCS Method, or a computer model. Calculated historic rates for each storm event shall be presented as part of the drainage analysis in the Drainage Report.

Post-development peak runoff from a site may not be greater than pre-development runoff from a site for any storm event. Total site runoff is typically a combination of detention basin release and direct runoff from areas not draining to a detention facility, both of which must be considered. A maximum of

5% of the total site area may contribute direct runoff. Note that the allowable peak discharge from a detention facility will be less than the allowable peak runoff from the whole site unless the entire site drains to the detention facility.

For redevelopment sites, any existing detention facilities shall be factored into the runoff calculations and accounted for with the revised runoff characteristics to preserve the pre-development runoff rates as identified in any previous drainage studies. If a HEC model of the watershed exists, it can be used to generate historic runoff rates by changing the imperviousness of the watershed to historic conditions.

6.9.2.2 MHFD-Detention

The last three tabs in the MHFD-Detention spreadsheet contain helpful information on how to use the MHFD-Detention spreadsheet as a design tool. Users are highly encouraged to thoroughly review the information in these tabs, including the video provided before beginning design. For designing detention facilities within the Town, the following inputs shall be used in lieu of default values.

1. While most detention basins in the Town will include water quality treatment, the first drop down menu on the Basin worksheet below Watershed Information should be set to Flood Control Only if no water quality treatment is to be provided. If water quality treatment is to be provided within the detention facility, the user should select the type of facility being designed.
2. Location for 1-hr Rainfall Depths on the Basin worksheet shall be set to User input and the P_1 values from Table 6.1 of these Standards shall be entered into the appropriate, blue-shaded cells on the Basin worksheet.
3. In the three cells used to Define Zones and Basin Geometry in the Basin worksheet, the Zone 1 Volume shall be the WQCV if water quality treatment will be provided. If water quality will not be provided, the Zone 1 Volume shall be the 2-year event. In all cases, the Zone 2 Volume shall be set to EURV – Zone 1, and the Zone 3 Volume shall be set to 100-year minus Zones 1 & 2.
4. The remainder of the user inputs on the basin worksheet tab shall follow the recommended guidelines indicated as notes in each cell. Assuming the design of the facility was completed in accordance with guidelines in the USDCM, the design values for these inputs will be within the recommended ranges of values for each variable. Note that the Total Available Detention Depth should be set at the maximum allowable 100-year water surface, not at the downstream embankment crest, to allow for design freeboard.
5. On the Outlet Structure worksheet, an Outlet Type must be selected from the drop down menu at the top of the worksheet for each Zone. When water quality treatment is provided, the lowest outlet is typically an orifice plate, which is a plate with multiple smaller orifices cut into it. When water quality treatment is not provided, the lowest outlet may be a vertical orifice, which is also a plate, but with a single, larger hole cut into it. The options available in the drop down menu for Outlet Type will automatically only be those applicable to the design completed up to that point. The user should only enter additional design values into the User Input rows in the remainder of this worksheet that correspond to the Outlet Types selected at the top of the worksheet. For example, if there is no orifice plate, there is no need for the user to enter data describing an orifice plate. But each Outlet Type selected must have its design data entered for the worksheet to yield correct results.
6. Several rows of hydraulic results are presented at the bottom of the Outlet Structure worksheet. While several of the values are of interest, there are only a handful that are critical for detention facilities in the Town. If these criteria are not met, the design must be adjusted until they are.
 - a. Peak Outflow for each design storm may not exceed the historic rates calculated for the site.

- b. Time to Drain 97% of Inflow Volume must not exceed 72 hours after the end of a 5-year storm.
- c. Time to Drain 99% of Inflow Volume must not exceed 120 hours after the end of storms greater than the 5-year storm.
- d. Maximum Ponding Depth must be at or below the emergency spillway and at least 12 inches below the surrounding embankment.

6.9.4 Snow Storage in Detention Ponds

If it is intended that a detention pond will serve as a snow storage area, the calculation of the pond's required volume must be increased by 50% of the full design snow storage volume and the pond must provide permanent water quality treatment in the form of the water quality outlet.

6.9.5 Maintenance

The performance of detention facilities is extremely sensitive to a lack of maintenance, and all detention facilities must be designed to facilitate maintenance. Section 6.10 of these Standards includes design guidance related to maintenance. It is the responsibility of all private detention facility owners to regularly maintain their detention facilities, except as modified by a recorded agreement. Outlets, especially, must be regularly maintained to ensure the basins do not detain water longer than allowed by Colorado water law.

The Town may require an enforceable Ownership and Maintenance (O&M) Agreement to be in place for detention and water quality facilities before issuing any applicable local permits. The O&M Agreement must include the party responsible for maintaining the facility, inspection frequency, and proposed maintenance activities in an Operations and Maintenance Plan (O&M Plan). Should the responsible party fail to adequately maintain the detention facility, the Town shall have the right to enter the property for the purpose of maintenance. All such maintenance costs and associated legal fees will be assessed to the property owner. Guidance on maintenance frequency for various types of facilities is included in Section 6.10. Guidance on the development of the O&M Plan is included in Chapter 2.

6.9.6 Detention and Water Rights

Senate Bill 15-212 became effective on August 5, 2015, as Colorado Revised Statute (CRS) §37-92-602 (8), *Concerning a Determination that Water Detention Facilities Designed to Mitigate the Adverse Effects of Storm Water Runoff Do Not Materially Injure Water Rights*. This statute provides legal protection for any stormwater detention and infiltration facility in Colorado, provided the facility does not materially injure water rights and meets the following criteria.

1. It is owned or operated by a governmental entity or is subject to oversight by a governmental entity.
2. It continuously releases or infiltrates at least 97% of all the runoff from a rainfall event that is less than or equal to a 5-year storm within 72 hours after the end of the event.
3. It continuously releases or infiltrates as quickly as practicable, but in all cases releases or infiltrates at least 99% of the runoff within 120 hours after the end of events greater than a 5-year storm.
4. It operates passively and does not subject the stormwater runoff to any active treatment process such as coagulation, flocculation, and disinfection.

There are reporting requirements for any owner or operator of any detention facility constructed after August 5, 2015 that seeks protection under the new statute. A data sheet and online map-based compliance portal website has been developed that will allow owners and operators in the Town to

upload the required notification information. The notification requirement applies only to facilities constructed after August 5, 2015. Facilities in existence before August 5, 2015, are defined in the statute as materially noninjurious to water rights and do not require notification.

The compliance portal can be found online (<https://maperture.digitaldataservices.com/qvh/?viewer=cswdif>). A document containing frequently asked questions, links to a video tutorial, and the link to the compliance portal can be found online (<http://www.crgov.com/DocumentCenter/View/12225>) or via an internet search for “Colorado water rights compliance portal.” The owner or operator must report new detention via the portal, and the county must approve the portal entry once it is complete. The owner or operator shall inform the county once the portal documentation is ready for approval.

6.9.7 Jurisdictional Dams

Detention facilities with a downstream embankment height in excess of 10 feet, 100-year water surface area in excess of 20 acres, or 100-year volume in excess of 100 acre feet are considered jurisdictional dams and require approval by the State Engineer’s office.

6.10 PERMANENT WATER QUALITY

The naming convention for facilities that treat stormwater quality after construction has varied over time. These facilities have been called both best management practices (BMPs) and control measures by various entities. The Town’s term for these facilities is permanent stormwater treatment facilities. The term treatment facilities may also be used. This term distinguishes these facilities from those used during construction.

The goal of the requirements in this section is to keep the Town’s streams and drainageways healthy. This section presents runoff reduction and site planning principles, the applicability of the requirements for permanent water quality treatment, design requirements for permanent stormwater treatment facilities, and design requirements associated with maintenance.

6.10.1 Planning Principles

Increases in impervious area that typically come with development can negatively impact flow volumes, temperature, and stormwater quality. To minimize these impacts, site planning should consider how the site will be used as well as how stormwater runoff will be conveyed and treated. While no specific design criteria is associated with many of these guidelines, general site planning goals for every development include:

1. Considering stormwater quality needs early in the development process to better integrate stormwater treatment facilities into the site.
2. Minimizing impacts to the natural environment including water quality, air quality, wildlife habitat, vegetation, and natural landforms and protecting areas with high ecological value such as those with mature trees, stream corridors, wetlands, and soils with high infiltration rates.
3. Developing creative site layouts to reduce the extent of paved and other impervious areas.
4. Reducing runoff from the site and maximizing infiltration by minimizing directly connected or continuous impervious areas and slowing runoff through pervious and/or vegetated areas. Developing the layout of a site to reduce runoff will also reduce the required size of WQCV treatment facilities.
5. Centralizing water quality treatment for larger developments and integrating them with site operations to minimize land use, achieve greater economy of scale, and reduce the number of treatment facilities requiring maintenance.

6. Developing operational procedures to minimize the risk of spills and designing the site layout to prevent any spills from leaving sites with operations that include washing, fueling, manufacturing, materials storage, and vehicle maintenance, among others.
7. Using pervious drainage conveyances where appropriate, routing downspouts across pervious areas, and incorporating vegetated areas into locations that generate and convey runoff like parking lots and driveways. Grass buffers, grass swales, and bioretention can all be used.
8. Discharging site runoff across a vegetated area prior to discharge from the site. No impervious area should discharge directly into wetlands, the Blue River, or one of its tributaries.
9. Maintaining natural drainage patterns and implement sheet flow.
10. Selecting permanent stormwater treatment facilities based on expected pollutant type.
11. Providing areas for snow storage so that snow melt will not be a nuisance and will drain to a permanent water quality facility.

Chapter 1 of Volume 3 of the USDCM includes a section on ways to minimize the adverse impacts of development on water quality, including ideas to minimize site runoff. This document should be reviewed to gain a better understanding of planning principles as they relate to water quality. A discussion on how design of the site minimizes site runoff and the impacts to water quality shall be included in the permanent water quality portion of the Drainage Report.

6.10.2 Applicability

Permanent stormwater treatment facilities are required to be designed and installed for all new development and redevelopment sites that meet one of the following criteria:

1. Disturb at least one acre of land.
2. Disturb less than one acre but are part of a larger common development plan. In these cases, the individual development need not provide a permanent stormwater treatment facility, provided the larger common development provides a centralized facility that will provide treatment for all the sites within it.
3. Increase impervious area by more than 0.10 acres or 4360 square feet.
4. Include any of the following land uses: auto service station, auto repair, auto body work/paint, auto wash/polish, equipment repair, lumberyard, nursery, asphalt plant, concrete batch plant, industry, manufacturing, crushing gravel/rock, milling, mining, sawmill, silviculture, junkyard, sludge, sanitary landfill, truck terminals, impound yard, motor vehicles parking/storage, or storage of pesticides, herbicides, fertilizer, or other potentially hazardous materials.

New development is classified as any land disturbing activity or construction of any building or structure. Redevelopment is any creation, addition, or removal and replacement of any impervious area, or any building construction or land disturbing activity, on a site that is already substantially developed.

For sites that require permanent stormwater quality treatment, treatment must be provided for at least 80% of the added impervious area on the site. At least 80% of the disturbed site pervious area must also be treated unless justification is provided showing that runoff from these areas will not negatively impact water quality within the Town. An area larger than the minimum required may necessarily drain to the treatment facility, and this runoff must be accounted for in the design of the facility. Calculations documenting this has been achieved shall be included in the permanent water quality portion of the Drainage Report.

Although certain development that is exempted from permanent water quality requirements, any new development or redevelopment is may still be required by the Town to analyze and correct any

inadequate drainage, including insufficient drainage away from buildings, runoff adversely affecting downstream properties, inadequately sized drywells, drainage exceeding existing storm drains, pipes, or other conveyance, or other drainage concerns identified by the Town Engineer.

6.10.3 Treatment Facility Types

There are three basic methods by which stormwater quality can be treated in the Town.

1. Collecting and storing the water quality capture volume (WQCV) and releasing it slowly, thereby settling out pollutants in the stormwater instead of discharging them downstream,
2. Infiltrating the WQCV into the ground within a given time, and
3. Using a proprietary vault or structure that has been developed to treat stormwater quality.

Volume 3 of the USDCM provides graphics that offer some general guidance as to the treatment facilities that are typically used for sites having specific characteristics. Details for the design of each type of treatment facility, as well as design constraints, are in the next section.

6.10.4 Design Criteria

The Town's general criteria for permanent water quality treatment is 80% removal of the 60 micron particle from the WQCV of the area being treated or from the peak runoff rate from the 2-year return period storm over the area being treated, depending on the type of treatment facility being designed. For sites that require permanent stormwater quality treatment, treatment must be provided by one of the methods in Section 6.10.3. Meeting the criteria in this section for each type of treatment mechanism is assumed to result in this criteria being met. Supporting calculations must be included in the Drainage Report.

6.10.4.1 Tributary Offsite Area

When offsite area is tributary to a permanent stormwater treatment facility there are two options. The first option is to intercept the offsite flow and route it around or through the site in a separate conveyance system. The second option, if offsite flow cannot be separated, is to size the treatment facility for the entire tributary area. This could mean a much larger design volume or a larger peak runoff rate.

6.10.4.2 Right-of-Way Restrictions

Privately owned and maintained treatment facilities must be located outside the public right-of-way and offline from public stormwater conveyance systems. Easements are required for the area occupied by all facilities located outside the public right-of-way including for access.

6.10.4.3 WQCV Storage and Release

The WQCV is a volume of water designated for treatment that has been determined to provide the most water quality benefit for the cost to construct the improvements required to treat it. Volume 3 of the USDCM provides detailed discussion on the development of the WQCV. Capturing, storing, and slowly releasing the WQCV of a site will meet the Town's requirements for permanent water quality treatment by storing it long enough that pollutants settle out. WQCV treatment facilities acceptable for use in the Town include extended detention basins, sand filter basins, rain gardens, and infiltration galleries and trenches. Other types of facilities may be considered on a case-by-case basis.

The first step in designing a WQCV facility is calculating the WQCV. Two variables are required to calculate the WQCV. The first is the total imperviousness of the area draining to the treatment facility.

Recommended imperviousness values are in Section 7.5. The total imperviousness of a site can be determined by taking an area-weighted average of the different imperviousness values for the site. Total imperviousness can also be adjusted to an effective imperviousness if certain practices are implemented as part of the site design. Effective imperviousness applicability and calculations are discussed below the calculation for the WQCV.

The second variable is the design drain time of the treatment facility. Recommendations for design drain time for different types of WQCV treatment facilities can be found in Volume 3 of the USDCM. The most common WQCV facility is an extended detention basin, for which the recommended drain time is 40 hours. WQCV drain time coefficients are in Table 6.22 below. The general equation to calculate the WQCV in Breckenridge is expressed as:

$$WQCV = 0.84Aa(0.91I^3 - 1.19I^2 + 0.78I)/12 \quad (6.18)$$

Where:

WQCV = water quality capture volume (acre-feet)

a = WQCV drain time coefficient

I = imperviousness as a decimal percentage

A = area draining to the treatment facility in acres

Table 6.22. Drain Time Coefficients for WQCV Calculations

Drain Time	Coefficient, a
12 hours	0.8
24 hours	0.9
40 hours	1.0

The WQCV equation was initially developed based on rainfall data from the Denver metro area. However, the precipitation depth of the average runoff producing storm in Breckenridge is 0.36 while in Denver it is 0.43. The WQCV equation above includes a coefficient of 0.84 to adjust the equation for use in Breckenridge. A map showing the variance in the average runoff producing storm across Colorado is shown as Figure 6.5.

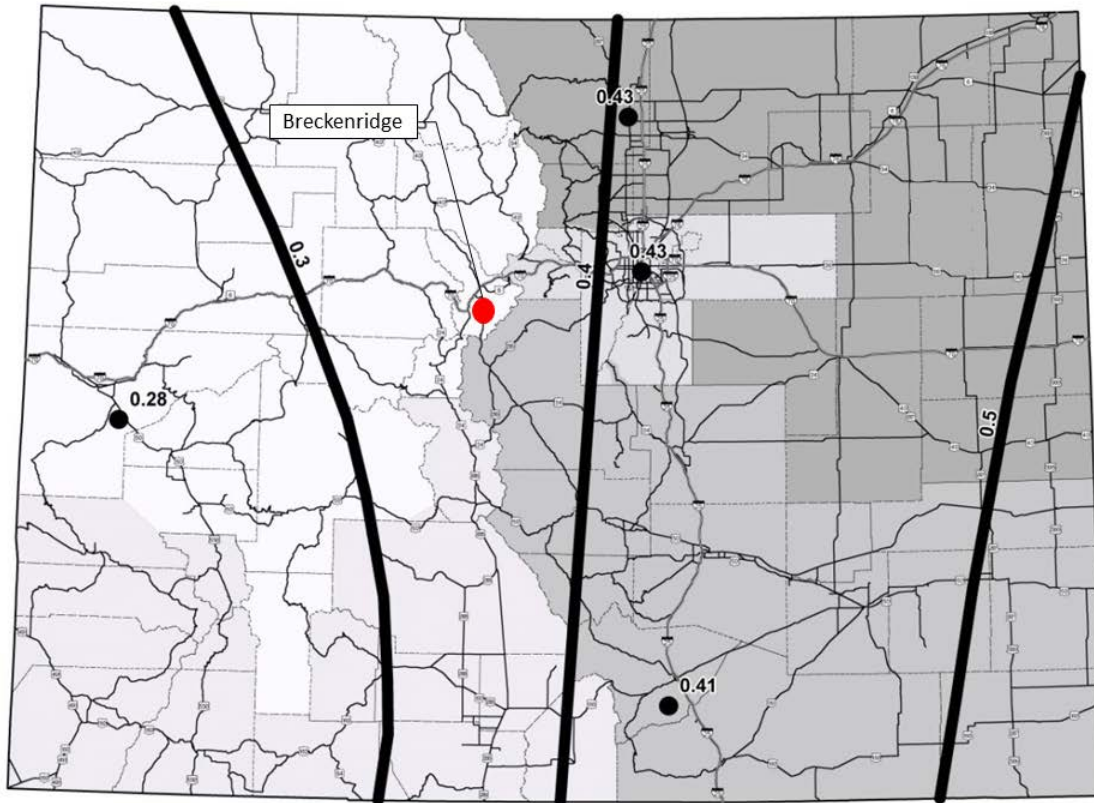


Figure 6.5. Map of the Average Runoff Producing Storm's Depth
(Modified from UDFCD, 2016)

Guidance on how to design extended detention basins, sand filter basins, and rain gardens to meet the WQCV standard are included in the Fact Sheets in Volume 3 of the USDCM. Sand filter basins are referred to as simply sand filters and rain gardens are referred to as bioretention.

6.10.4.3.1 Effective Imperviousness

The imperviousness value used in the WQCV calculation for sites that implement low impact development (LID) principles such as green infrastructure and MDCIA may be reduced to reflect the site's effective imperviousness. The effective imperviousness is dependent on the level of MDCIA implemented for high-level planning applications. Level 1 includes designing impervious surfaces to drain over a grass buffer or other pervious surface prior to reaching any stormwater conveyance system. Level 2 is an enhancement to Level 1 and includes eliminating curb and gutter or using slotted curbs; low-velocity pervious grass- or rock-lined swales instead of storm sewers, and pervious street shoulders. Guidance on calculating effective imperviousness for Level 1 and Level 2 MDCIA can be found in Volume 3 of the USDCM.

Where a detailed site plan has been developed and the square footage of directly connected impervious area, unconnected impervious area, receiving pervious area, and separate pervious area have all been defined, a more detailed effective imperviousness can be determined using the methods in Volume 3 of the USDCM.

6.10.4.3.2 Design Volume and Bypass Capacity

If it is intended that a WQCV treatment facility will serve as a snow storage area, the calculation of the required volume must be increased by 50% of the full design snow storage volume.

WQCV treatment facilities will likely receive more runoff than they were designed to treat during larger storm events. The design of any treatment facility designed to store and release the WQCV must include bypass capacity for the 100-year peak inflow rate into the facility. This is often provided in the form of an overflow weir set at the elevation of the design WQCV. Design guidance is provided in the Fact Sheets in Volume 3 of the USDCM.

6.10.4.3.3 Detention

When a site requires detention in addition to permanent water quality treatment, a single facility may be designed to serve both needs. Detention facilities that are also water quality treatment facilities have outlets to provide for both the stormwater quality treatment and detention release rates. For these facilities, the guidance in the USDCM for Excess Urban Runoff Volume (EURV) facilities shall be followed. Section 7.12 discusses detention further.

6.10.4.4 Infiltration

It is common within the Town of Breckenridge for the subgrade soils to have a high infiltration rate. Infiltration testing is required when infiltration facilities are planned. Infiltration rates must be established by a double ring infiltrometer test performed by a geotechnical engineer at each proposed infiltration site at the proposed elevation of the bottom of the filter material prior to beginning detailed design. Treatment facilities acceptable for use in the Town that can be designed to infiltrate the WQCV include sand filter basins, rain gardens, drywells, infiltration trenches, and infiltration galleries. Other types of facilities may be considered on a case-by-case basis. ~~Note that~~ However, if the same area is intended being used as that an infiltration treatment facility will ~~to~~ serve as a snow storage area, the calculation of the required volume must be increased by an additional 50% of the full design snow storage volume.

Infiltration facilities must have a high enough subsoil permeability to infiltrate the entire WQCV of the area draining to them within 6 hours without the use of underdrains. Infiltration facilities shall be designed to drain 150% of the WQCV (see attached fact sheet for more information) within 72 hours. Infiltration facilities are not allowed within 300 feet of any active waterway without appropriate pretreatment prior to infiltration (examples include sand filters, water quality vaults, detention basins, and rain gardens). Infiltration facilities located between 300 and 1000 feet from an active waterway must not drain the WQCV in less than 4 hours unless appropriate pretreatment is designed. If subgrade soils at these facilities result in infiltration of the WQCV in less than 4 hours, a sand layer must be designed to slow the infiltration of the WQCV to a minimum of 4 hours. There are no ~~additional~~ restrictions on infiltration facilities located more than 1000 feet from an active waterway.

Guidance on how to design sand filter basins and rain gardens to infiltrate the WQCV standard are included in the Fact Sheets in Volume 3 of the USDCM. Sand filter basins are referred to as simply sand filters, rain gardens are referred to as bioretention. Guidance on how to design drywells, ~~and~~ infiltration trenches and galleries ~~is-are~~ included in the Fact Sheets ~~included as~~ attachments to this chapter.

Permeable pavements may be considered with a legally binding maintenance agreement in place as alternative to conventional pavement in pedestrian areas and lower-speed vehicle areas. They will not be allowed for treatment of tributary areas with high sediment yields that could easily clog the system and they are not allowed in the public right-of-way. Permeable pavements will not be allowed on steep slopes or in areas receiving runoff from bare or nearly bare earth. Permeable pavements will be considered impervious materials for detention and water quality calculations and must be designed in accordance with manufacturer's recommendation.

See the subsurface infiltration facility fact sheet in Appendix D of these Standards for additional information and requirements for designing infiltration facilities.

6.10.4.5 Proprietary Structures

Proprietary structures are designed to treat a design flow rate instead of a design volume, and typically function by gravitational separation, vortex separation, filtration, or by screening and retaining pollutants within the structure. The use of proprietary facilities is acceptable but generally discouraged as more frequent maintenance is typically required to maintain adequate performance, proprietary structures often have high long-term costs, and they are often very large while treating only a small flow rate. Proprietary facilities that require removable or replacement cartridges and those that require confined space entry procedures or remote camera operation for routine inspections may be considered on a case-by-case basis.

The two most recognized national programs that test the TSS removal of proprietary structures are in Washington state and New Jersey. Proprietary structures acceptable for use in the Town are those that have been tested by one of these programs and have received one of the following:

1. General or Conditional Use Level Designation for the Pretreatment or Basic test protocols of the Washington State Department of Ecology (WSDOE) Test Assessment Protocol – Ecology (TAPE) for emerging stormwater treatment technologies
2. Certification by the New Jersey Department of Environmental Protection (NJDEP) with verification by the New Jersey Corporation for Advanced Technology (NJCAT) that the manufactured treatment device (MTD) is adequate for TSS removal.

The Town may consider allowing a proprietary structure that is not approved by WSDOE or NJCAT provided that, as part of the drainage report, a qualified professional engineer submits adequate documentation, as determined by the Town, of the manufacturer's test data showing similar performance to that required by either the WSDOE or the NJCAT. The level of scrutiny during review for approval of such devices may be significant.

Proprietary structures must be designed to provide water quality treatment for the 2-year peak design flow rate from the area they are treating. Bypass capacity must be included for the 100-year peak flow rate from this same area. If bypass capacity is not included within the structure, it must be provided before the structure in the form of a diversion for higher flows provided the first flush flows pass to the treatment facility.

6.10.4.6 Treatment in Series

Treatment in series is a very effective way to provide water quality treatment and is highly encouraged. Treatment in series, also referred to as a treatment train, involves passing stormwater from one treatment facility to the next, with each facility providing additional treatment. The facilities used in a treatment train are positioned so facilities that can handle a larger, coarser pollutant load are first, while those facilities that are more suited to a smaller, finer pollutant load are last. This allows for longer periods between required maintenance, especially for the facilities that provide more refined removal.

One option for calculating TSS removal rates is presented in the *Methodology for Analysis of Detention Basins for Control of Urban Runoff Quality* (EPA,1986). The development of this manual was supported by the EPA Nationwide Urban Runoff Program (NURP). While the entire document is worth reviewing, Chapter 4.2.1 of this document presents an analytical method under which TSS removal can be evaluated under the dynamic conditions expected in permanent stormwater treatment facilities. Removal due to sedimentation in a dynamic system is expressed by the equation below.

$$R = 1 - \left[1 + \frac{1}{n} * \frac{V_s}{Q/A} \right]^{-n} \quad (6.19)$$

Where:

R = fraction of solids removed

V_s = settling velocity of particles

Q/A = rate of applied flow divided by surface area

n = turbulence parameter

The turbulence factor offers a way to factor in poor performance caused by turbulence and short circuiting, with $n=1$ representing very poor performance and $n=5$ or more indicating very good performance. With n equal to infinity, removal efficiency is linked to detention time. This equation is useful in areas without enough relief to drain a pond that could hold the entire WQCV, or to design basins in series or those receiving inflow that may have already been partially treated by a different type of upstream treatment facility.

Particle settling velocity is calculated as the submerged weight of a particle minus the drag. This calculation requires the minimum particle size of interest be specified. It also requires the viscosity of water, which varies with temperature. To meet Town requirements, a spherical particle with a diameter of 60 microns may be used. A water temperature of 40 degrees Fahrenheit may be assumed, having a viscosity of 1.664×10^{-5} ft²/s.

Given the Town requirement for 80% removal of the 60 micron particle, an appropriate treatment train composed of any types of permanent treatment facilities discussed herein may be designed using the equation above. Grass buffers and grass swales are especially helpful at the upstream end of a treatment train. Each of the facilities in the treatment train must include physical components in accordance with these Standards and with the manufacturer's recommendations for permeable pavement, if applicable. A Treatment Train Example Calculation is included as an attachment to this chapter.

6.10.5 Designing for Inspection and Maintenance Requirements

Long-term maintenance requirements are a critical component of treatment facility selection and design because facilities that are not properly maintained do not function properly and/or do not treat stormwater runoff to the extent required by the Town. All new facilities shall be designed to facilitate maintenance operations.

Maintenance considerations that must be evaluated during the selection and design process include accessibility, required equipment, frequency of maintenance, special required training, the freeze/thaw nature of the Town's climate, and the need for replacement materials.

Property owners shall be responsible for the maintenance of stormwater detention and water quality facilities to ensure proper functioning. See Section 6.10.5.7 for additional maintenance requirements.

6.10.5.1 Access

An easement shall be provided to allow Town staff to access the facility if the responsible agency is negligent. Access roads shall be provided to all structures including forebays, outfalls, inlets, micropools, outlet structures, and proprietary facilities. Access roads must support an 80,000-pound vehicle load, be at least 10 feet wide, and have an inside turning radius of at least 25 feet. Access roads must pass close enough to each treatment facility component needing maintenance (forebays, micropools, subgrade vaults, etc.) that the equipment to be used will be able to reach the structure. For example, a backhoe with a reach of 25 feet must be able to pass within 25 feet of the structure without leaving the access road. The Town's vacuum truck has a reach of only 5 feet. If a vacuum truck is required for maintenance, the access road must pass within 5 feet of the facility being maintained. If the access road cannot pass close enough to the structure for the equipment to reach, a concrete access ramp or similar supportable material, such as a 6-inch layer of angular 4-inch-minus

riprap, shall be provided at a slope no steeper than 10:1. Concrete ramps shall be scored for wet weather traction.

6.10.5.2 Forebays

Accessible forebays shall be provided at all concentrated inflow points of extended detention basins and sand filter basins for removal of accumulated sediment and floatables. The forebay must be designed in accordance with the Fact Sheets in Volume 3 of the USDCM.

6.10.5.3 Stockpile Areas

Facilities should be designed with stockpile areas for temporary storage and drying of mucked out material. A stockpile area should be directly adjacent to each structure to be cleaned out. Stockpile areas shall be located outside the low flow area and should be as flat as possible. Total stockpile area shall be twice the square footage of all forebays and the micropool.

6.10.5.4 Extended Detention Basins

Extended detention basins shall include a micropool with a hard bottom against which to excavate that is accessible to a vacuum truck or backhoe. Extended detention basins shall include a trickle channel at least 48 inches wide with no cross slope. Trickle channels shall have a concrete bottom and sides at least 6 inches high to allow access for lightweight maintenance equipment if the trickle channel longitudinal slope is less than 5%. If there is a desire for a more aesthetically natural trickle channel, the Town Engineer shall be consulted to discuss and determine maintenance requirements and protocols.

6.10.5.5 Infiltration Facilities

Sand filter basins, rain gardens, drywells, and infiltration trenches have a short lifespan before needing replacement filter material. These facilities shall include pretreatment to remove trash and larger sediment. If located next to a roadway, infiltration facilities shall also include a barrier to prevent degradation of the roadway subgrade. Infiltration testing is required prior to facility design if an infiltration facility is planned. Infiltration testing shall also be conducted after construction and prior to acceptance to ensure the facility functions as intended.

During construction and maintenance operations, special care shall be taken to avoid compaction of subsurface soils that will reduce infiltration rates. If a full infiltration basin is not used, an underdrain system including a loading evaluation will be required and cleanouts must be provided every 300 feet.

Guidance on how to design drywells and infiltration trenches and galleries is included in the Fact Sheets included as attachments to this chapter.

6.10.5.6 Proprietary Structures

Proprietary structures must not require confined space entry procedures for maintenance. Careful design of access to vaults and use of a vacuum truck may eliminate confined space entry requirements.

6.10.5.7 Ownership and Maintenance Plan and Agreement

Treatment and detention facilities require regular inspection and maintenance, to be completed by the property owner. Table 6.23 lists the minimum required inspection and maintenance schedule and typical maintenance activities and operational protocols for various types of treatment and detention facilities. Based on site conditions, the design engineer may require additional maintenance measures, a more frequent schedule, or unique protocols for a site. Volume 3 of the USDCM should be consulted when determining the maintenance schedule, activities, and protocols to be included on the O&M Plan.

An Ownership and Maintenance (O&M) Plan must be developed, submitted, and approved as part of the Drainage Report and then also included as part of the Ownership and Maintenance (O&M) Agreement. An executed O&M Agreement may be required prior to facility approval and project close out. The Town will have the right to access the property to maintain the treatment or detention facility and invoice the owner for the cost of such work if the owner fails to maintain the facility. An example O&M Plan, including a template for the O&M Plan text, and an O&M Plan checklist are included as attachments to Chapter 2. Town staff is available for consultation during the treatment and/or detention facility selection and design process to ensure the design meets the requirements of these Standards. Minimum required components for maintenance are presented in Table 6.23 below.

Town staff will routinely inspect facilities or respond to complaints relating to facilities that may not be performing properly. Facility owners should expect notification of inspections and subsequent findings to be communicated by inspection personnel.

Table 6.23. Recommended Inspection and Maintenance Schedule

Extended Detention Basin	
Activity	Required Frequency
Inspection for debris at outlet, sediment in the forebay, and damage to structures or embankments; maintain or repair as necessary.	Twice annually
Remove sediment from forebay, trickle channel(s), and micropool; aeration of vegetated areas	Annually
Mowing	As needed to maintain 6" height and control weeds
Irrigation and application of fertilizer, herbicide, and pesticide	As needed to maintain vegetative health

Notes: Maintenance frequency is highly dependent on construction activity within the tributary area, associated erosion control measures, and the design of the facility. More frequent removal of accumulated sediment may be required, but detention basins are generally low maintenance facilities.

Sand Filter Basin, Rain Gardens, Dry Wells, and Infiltration Trenches and Galleries	
Activity	Required Frequency
Inspection to confirm infiltration rate after rainfall; maintain as necessary. Debris and litter removal.	Twice annually
Mowing, plant care, irrigation, and application of fertilizer, herbicide, and pesticide (for bioretention only)	As needed to maintain vegetative health
Mulch replacement (for rain gardens only)	As needed to maintain 3" depth
Inspection of underdrain	When ponding lasts longer than 24 hours
Sediment removal and replacement of media	When ponding lasts longer than 24 hours and underdrain is not clogged

Proprietary Structure	
Activity	Required Frequency
Inspection for debris that may cause bypass of design treatment flow rate; maintain as necessary.	Quarterly for first 2 years, as indicated based on first 2 years after that

Filter cartridge inspection; replace as necessary.	Twice annually
Debris removal, filter cartridge replacement, and vacuuming	As recommended by the manufacturer

6.11 CONSTRUCTION STORMWATER MANAGEMENT

Management of stormwater runoff from construction sites in the Town of Breckenridge contributes to our community goal of protecting and maintaining water quality within our local watercourses. A significant amount of sediment can be discharged with stormwater runoff from a construction site. This sediment has the potential to end up in receiving streams, lakes, and rivers, negatively impacting the riparian and aquatic habitat. Establishing a program to minimize untreated runoff from construction sites is essential to keeping streams and drainageways healthy and to minimizing impacts from pollutants and litter.

This section presents the Town's requirements regarding the control of stormwater runoff quality from construction sites, the applicability of the requirements, design guidance for selected BMPs, and references that provide additional information and details. The goal of the requirements in this section is to keep the Town's streams and drainageways healthy. Volume 3 of the USDCM includes a substantial amount of guidance on construction stormwater management and is referenced throughout this section.

The naming convention for facilities or practices that treat stormwater quality during construction has varied over time and between documents. These facilities and practices have been called best management practices (BMPs) in the past. While some more recent documents refer to them as control measures or temporary control measures, these Standards will continue to refer to them as BMPs.

6.11.1 Applicable Codes and Permits

The Town requires applicable construction activity to obtain at least one permit from the Town prior to beginning construction activity. See Chapter 2 for permit requirements. A Stormwater Management Plan (SWMP) or Construction Site Management Plan (CSMP) is required as part of these permits. CSMP requirements are in the Town Code.

Applicable construction projects must apply for a permit from the CDPHE to be covered by the CDPS General Permit for Stormwater Discharges Associated with Construction Activity (Permit No. COR400000). For activity involving dewatering operations, a Construction Dewatering Permit from the CDPHE is required. Information on these permits, and others that may be required during construction, can be found at the CDPHE's webpage for water quality construction permits.

CDOT Erosion Control and Stormwater Quality Field Guide will be used to ensure compliance designing, installing and maintaining BMPs through construction.

6.11.2 Applicability within the Town

The Town's requirements depend on the area disturbed by the project. Applicable projects must develop a Stormwater Management Plan (SWMP). Non-applicable projects, those disturbing less than one acre including any commercial, multi-family, or applicable single family/duplex development, must develop a Construction Site Management Plan (CSMP). CSMP requirements are in the Town Code

A SWMP consists of construction plans and details, specifications for BMPs, and a narrative report that collectively indicate how a construction site will implement structural, non-structural, and planning measures to reduce erosion at the source and prevent pollutants such as sediment and litter from leaving the site. Detailed SWMP requirements are included later in this section.

The Town also requires a Construction Site Management Plan (CSMP) for certain projects. For sites disturbing one acre or more, the CSMP applies only to traffic and site access control. For sites disturbing less than one acre, the CSMP applies to traffic, site access, and erosion and sediment control. Criteria in this section for the design of BMPs and for site inspections apply to sites that require a SWMP and those that require a CSMP.

6.11.3 Stormwater Management Plan Requirements

The intent of a Stormwater Management Plan (SWMP) for construction activities is to prevent pollution, contamination, or degradation of waters of the State and to prevent discharge of pollutants from a project site. Appropriate BMPs must be implemented prior to the start of construction activity, must control potential pollutants during each phase of construction, and must be maintained in operational condition through final stabilization. BMPs must be selected, designed, installed, implemented, and maintained to provide control of all potential pollutants including sediment, construction site waste, trash, discarded building materials, concrete truck washout water and materials, chemicals, sanitary waste, and contaminated soils in discharges from the site. The SWMP will include the following at a minimum:

6.11.3.1 SWMP Report

The SWMP Report is a narrative description and summary of the project site and proposed improvements, how construction activities will be conducted, and the erosion and sediment control practices, procedures, and physical BMPs that will be installed or implemented on site. Items to be included in the SWMP Report are:

1. Administrative Information: Include the project name, location, owner, operator, qualified stormwater manager that will conduct inspections, and the CDPHE certification number.
2. Existing Site Information: Include a description of the existing site, the existing site vegetation and percent density, and the name of the receiving water.
3. Proposed Improvements: Include a description of the proposed project, a description of construction activities, the total area of planned disturbance including access, staging, and storage areas, a sequence of major activities, an approximate construction schedule, and a description of how the project site will be phased.
4. Structural Control Measures: Include a description of the structural BMPs for each stage of construction. Each site must provide structural BMPs that:
 - a. Trap sediment before it leaves the site or enters the municipal storm sewer system or watercourse. These shall be installed prior to initiating earth disturbances. Examples include check dams, inlet protection, sediment basins, sediment control logs, and silt fence. Sediment basins are required for sites that have more than 3 acres of tributary area or are directly adjacent to a wetland or major tributary.
 - b. Capture and retain runoff from vehicle and equipment washing operations, such as cleaning of concrete trucks, chutes, and associated equipment. An example is the concrete washout. Equipment wash water may not be discharged to State waters or storm sewer systems.
 - c. Stop erosion at the source and minimize off-site vehicle tracking of sediment. These include BMPs that stabilize earth disturbances with vegetation or soil stabilization techniques after grading is substantially complete on any portion of the site or for any portion of the site that is inactive for a certain duration of time. Examples include surface roughening, mulching, vehicle tracking control, and installation of blankets, straw wattles, tackifiers, netting, and matting.
 - d. Provide bulk storage and prevent spills of petroleum products and other chemicals or fertilizers and contain storm runoff from construction wastes to a designated area, if

- applicable. These BMPs shall be able to contain all spills and prevent any spilled material from entering State waters. Secondary storage must be provided, and all bulk storage shall be located as far away from State waters as possible.
- e. Provide final stabilization of a site. These may include sod, seed, mulch, landscape plantings, decorative rock, or hard surfacing such as pavers, concrete, or asphalt. Seed mixes must be provided. An anticipated schedule must be provided. If a site is to be winterized, discuss temporary stabilization measures to be utilized. The Town may require a revegetation and stabilization bond for some projects.
5. Non-Structural Control Measures: Include a description of the non-structural BMPs that will be used throughout construction. This section of the report must include:
 - a. Discussion about how the following operations will be conducted: trash management; dust and particulate management; materials loading and unloading; vehicle and equipment maintenance and fueling; building materials, chemical, fertilizer, and stockpile storage; routine maintenance involving fertilizers, pesticides, detergents, petroleum products, and solvents; and concrete and batch plants.
 - b. A plan to remove from the site and dispose of all waste composed of building materials in licensed disposal facilities. No building material waste or unused building materials shall be buried, dumped, or discharged at the site.
 - c. A program and schedule for regular inspection and maintenance of BMPs.
 6. Include a description of how construction will be sequenced to reduce the duration any disturbed areas are exposed. Temporary disturbed areas and disturbed areas that will be permanently stabilized shall be exposed no longer than 30 days.
 7. Addition Potential Pollutants: Identify and address pollutant sources associated with any other areas or operations not included above where spills can occur. Identify other non-stormwater discharges not included above including construction dewatering not covered under the Construction Dewatering Discharges general permit and wash water that may contribute pollutants to Town waters.

6.11.3.2 SWMP Plans

The SWMP Plans are construction plans that locate and identify the number, extent, and installation details of the structural and nonstructural BMPs included and discussed in the SWMP Report. The SWMP plans must also include property boundaries, construction site boundaries, existing and proposed utilities, limits of cut and fill, stockpile areas, porta-let locations, arrows to depict the direction runoff will flow, and the locations of all receiving waters and drainages.

6.11.3.3 SWMP Specifications

BMP materials specifications and installation requirements may be provided with the BMPs installation details included with the SWMP Plans or as separate technical specifications in the project manual. Installation and implementation specifications must be provided for all structural BMPs in one of these two documents.

6.11.4 SWMP Submittal, Inspection, & Maintenance

For applicable sites, a SWMP must be submitted to the Town for review and approval prior to construction. Once the SWMP is approved and construction begins, regular inspection and maintenance of the BMPs will proceed throughout the duration of construction. The subsections below provide more detail on these requirements and processes.

6.11.4.1 SWMP Submittal Requirements

SWMP plans are construction plans that depict the type and location of structural and procedural BMPs that will be implemented on site during various stages of construction. SWMP plans must be submitted to the Town for review and approval. A SWMP shall be developed by a qualified stormwater professional.

Each SWMP must have separate sheets for the initial/interim and final phases of construction as well as detail sheets with a design and installation detail for each BMP specified in the SWMP. A legend shall be provided that includes all abbreviations used (e.g. CWA is used for concrete washout area) as well as all symbols, blocks, and line types that represent various BMPs. Each kind of symbol, block, or line type shall be labeled at least once on each sheet on which it is used. Text on all SWMP plan sheets, including the detail sheets, shall be legible when the SWMP plan set is printed on 11 x 17 paper, using at least a 9-point font. In the case of overlapping or adjacent project sites that are separately managed, the SWMP shall include at least one plan sheet that clearly shows the site area managed as part of the submitted permit. If more than one sheet is required for each phase of the SWMP plan set, the first sheet of the initial phase shall match the first sheet of the interim phase, and so forth. For project sites that are adjacent to or within construction activity that is not being performed by the same owner or operator, the SWMP shall delineate the exact project site boundaries that each owner or operator is responsible for.

6.11.4.1.1 Initial SWMP Plan

Initial SWMP plans include all BMPs that will be installed before construction begins. These shall include vehicle tracking at all exits from the site and enough stabilized staging area to accommodate the site's operations. Initial SWMP plans will also include any construction fence, inlet protection, curb socks, perimeter controls, or concrete washout areas that are required on site. Initial BMPs shall be identified on the initial SWMP plan by their two- or three-letter abbreviation and a quantity such as linear feet (LF) or square feet (SF), where applicable. The initial plan may be combined with the interim plan for small sites that do not have complex phasing. Sites disturbing 40 acres or more must have separate initial and interim SWMP plan sheets that detail the planned phasing of the site, and it is likely that more than one of each will be required to cover the larger area at a reasonable scale.

6.11.4.1.2 Interim SWMP Plan

Interim SWMP plans include all BMPs that will be installed as construction progresses. These include all BMPs such as temporary stream diversions, check dams, sediment basins, stockpile areas, sediment control logs on exposed slopes, and culvert outlet protection, among others. The interim SWMP plan should include all the BMPs shown on the initial SWMP plan, but they should have their dimensions removed for clarity. Like the initial SWMP plan, interim BMPs shall be identified on the interim SWMP plan by their two- or three-letter abbreviation and a quantity such as linear feet (LF) or square feet (SF), where applicable. Operators are encouraged to phase construction sites to minimize erosion. A complicated site may require more than one interim SWMP plan. The interim plan may be combined with the initial plan for small sites that do not have complex phasing. Sites disturbing 40 acres or more must have separate initial and interim SWMP plan sheets that detail the planned phasing of the site, and it is likely that more than one of each will be required to cover the larger area at a reasonable scale.

6.11.4.1.3 Final SWMP Plan

Final SWMP plans include final stabilization BMPs such as seeding, mulching, and erosion control blanket. For some sites, the landscape plan, if it is comprehensive and included in the construction plan set, may be used as the final SWMP plan, provided the required information is included. In other cases, a separate final SWMP plan will be required. The final SWMP plan should generally not include initial and interim BMPs and abbreviation labels. If an initial or interim BMP is to remain, it shall be

included on the final SWMP plan and noted to remain. Otherwise all initial and interim BMPs shall be assumed to be removed.

6.11.4.1.4 SWMP Details

Details for all BMPs specified shall be provided on SWMP plan detail sheets. Details shall be in accordance with CDOT or MHFD standard details.

6.11.4.2 SWMP and CSMP Inspection

Each SWMP permittee shall designate a qualified stormwater manager to inspect the BMPs on the construction site. Inspections should occur either weekly or every 14 days and after each runoff-producing storm event to confirm they are installed and functioning as intended, beginning with an inspection of the initial BMPs prior to any excavation and ending with final approval of the site by the Town. The stormwater manager shall be an individual knowledgeable in the principles and practices of erosion and sediment control and pollution prevention, and with the skills to assess: 1) conditions at construction sites that could impact stormwater quality and 2) the effectiveness of stormwater controls implemented to meet the requirements of this permit.

The stormwater manager should keep a record of all inspections including the date and time of the inspection, recent precipitation, required maintenance activities to be completed, and a summary of maintenance completed since the previous inspection. The stormwater manager shall update the SWMP (or CSMP) plans to reflect current conditions by showing changes made to the location and/or type of BMPs based on their performance and/or inspection reports throughout the duration of construction. An updated set of SWMP plans, including installation details, shall be on site during construction activities.

The Town will periodically inspect construction sites for conformance to the SWMP, to confirm installation, maintenance, and function of the BMPs are adequate, and to assure compliance with the Town's permit(s) and Town Code. Work that is not in compliance with the Town's Standards, the SWMP, the CSMP, or the Town Code is subject to enforcement action.

6.11.4.3 SWMP Maintenance

Maintenance of BMPs is typically ongoing for the duration of construction. The SWMP permittee shall schedule any required maintenance noted during regular inspections to be completed prior to the next inspection or reinspection. The SWMP must be updated as needed to reflect current site conditions and be maintained on site. Possible modifications may include replacing and adding BMPs and identifying additional pollution sources. Hand-written notations, initialed and dated, are adequate for most plan updates.

6.11.4.4 SWMP Adequacy

If BMPs installed on the site are inadequate to properly control pollutants during construction as evidenced by their performance during or after storm events or as identified during inspections, the SWMP permittee shall immediately complete any modifications required to properly control pollutants or those noted during inspection. Modifications completed shall be physically noted in the SWMP plans. BMPs, or lack thereof, identified as inadequate based on a Town inspection shall be rehabilitated immediately.

6.11.5 Temporary BMPs

Temporary BMPs are structural or site planning BMPs that are utilized to minimize sediment or other pollutants during construction activities. These BMPs shall be removed from the site upon completion of site stabilization unless they are designated to remain by the SWMP or by the Town because, for example, they do not impede use or maintenance of the site or will biodegrade. This section presents

some specific structural and site planning BMPs that are to be used during construction. It also offers several reference documents that provide design and construction details for BMPs that are not specifically discussed in this section.

6.11.5.1 Vehicle Tracking

Vehicle tracking pads are an essential part of preventing sediment from leaving a construction site. Vehicle tracking pads shall be implemented at every exit point to the site, regardless of the type of equipment that will be exiting at each location. The stone used should be hard, durable, angular stone, resistant to weathering with a long dimension not less than 3 inches. Larger stone is preferable, and stone should have a minimum specific gravity of 2.6. Other means of keeping sediment on site may be acceptable with proper documentation and provided performance is maintained. Any damage to sidewalk, curb, or gutter shall be replaced by the permittee. The minimum dimension for each vehicle tracking pad is 20 feet wide by 50 feet long by 6 inches thick, although more length may be required if the minimum size does not provide adequate performance.

6.11.5.2 Sediment Basins

Sediment basins to capture construction site runoff shall be installed on construction sites that disturb more than 3 acres. Runoff is detained in sediment basins and slowly drained so that sediment may settle out before the runoff leaves the site.

For sites with less than 40 acres of disturbance, at least 66% of disturbed area shall drain to a sediment basin. Multiple basins may be more efficient to achieve this requirement than a single basin, depending on the site configuration. Each basin must have a way to drain detained runoff as well as an emergency overflow with a revetted overflow path for runoff exceeding the sediment basin design volume. Sediment basins should drain passively through an outlet structure designed to drain the full basin volume within 12 hours. Designs for outlet structures should be per the criteria references provided in 6.11.5.7. Sediment basin storage volume may also be actively drained by pumping through a sediment bag with the basin being pumped empty when the basin volume reaches 50% of capacity or when rain is forecasted within 24 hours. When pumping is proposed in lieu of a passive outlet structure but is not performed per this criteria, the owner and operator are subject to enforcement action for improperly maintaining the selected BMP.

Each sediment basin shall provide 1600 cubic feet of storage per acre of tributary area provided it is not utilized as a BMP during the months of March, April, or May. If a sediment basin is utilized as a BMP during March, April, or May, it shall provide 3200 cubic feet of storage per acre of tributary area.

For sites with 40 acres or more of disturbance, every acre of disturbance exceeding 40 acres shall drain to a sediment basin. For example, a site with 39.9 acres of disturbance would be required to drain 26.3 of those disturbed acres to a sediment basin. A site with 45 acres of disturbance would be required to drain 31.7 of those disturbed acres to a sediment basin. This criteria encourages owners and operators to minimize the area of site disturbance at any one time to less than 40 acres.

Sediment basin design elements that must be in accordance with the Volume 3 of the USDCM include a spillway crest length based on tributary drainage area, a 12-inch minimum distance between the overflow crest and the surrounding embankment, outlet protection for the spillway, outlet works, and embankment slopes.

6.11.5.3 Check Dams

Check dams may be used to slow runoff in drainageways to limit erosion and sediment transport. Different agencies have specified different cross sections for check dams in their BMP details, however, all agencies specify that the elevation of the crest of the downstream check dam should be equal to the downstream toe of the next upstream check dam. This may become unreasonable in

because of the steep grades of some drainageways. For check dams in Breckenridge, the following criteria apply.

1. For preliminary sizing and spacing, check dam height above existing grade shall be a minimum of 18 inches and a maximum of 3 feet. Check dams shall be spaced along the drainageway such that the crest of the downstream check dam is at the same elevation as the downstream toe of the next upstream check dam.
2. If preliminary sizing results in a check dam spacing of less than 200 feet (i.e. the drainageway is steeper than 1.5%), Check dam height may be increased to 4 feet or may spacing may be less than 200 feet for slopes up to 2%. If drainageway slope exceeds 2%, the SWMP preparer shall propose a check dam height and spacing that he or she believes will meet the intent of the intended purpose of the check dam. The proposal shall be discussed during a SWMP review meeting with the Town.
3. Check dam embedment in the underlying ground shall be at least 12 inches and stones used in the check dam shall have a D50 of at least 12 inches.
4. A plan view and sections of a typical check dam used on the site will be provided with the SWMP plan as an initial BMP.
5. All check dams must be removed as part of final stabilization unless designated or approved to remain by the Town.

6.11.5.4 Materials Storage and Stockpiles

Construction materials that are not earth or aggregate shall be stored on a stabilized staging area. Earth and aggregate may be stockpiled outside of a stabilized staging area, but earth materials must be bounded by silt fence or some other BMP that will prevent sediment from escaping the stockpile during a runoff event.

The stabilized staging areas shall be large enough to store all required materials, provide parking for vehicles and equipment on site, and accommodate loading and unloading activities. The stabilized staging area must be installed as an initial BMP, prior to any other construction activities. The size of the stabilized staging area will vary with each site but may be required to be enlarged if inspections show it is not sized sufficiently to contain all required items and activities. Each stabilized staging area shall consist of granular material at least 3 inches thick unless it is demonstrated that native materials provide adequate stabilization. If rutting occurs, or if the underlying subgrade becomes exposed, additional granular material will be required. Once construction is complete, the granular material shall be removed, and the site shall be stabilized in accordance with the final SWMP plan or landscape plan.

6.11.5.5 Temporary Stabilization and Winterization

All areas disturbed by construction or stockpiles shall be stabilized as soon as possible to reduce the duration bare soil is exposed to runoff. All disturbed areas which are either final graded or will remain inactive for a period of more than 30 days shall be stabilized after the completion of the grading activities. Acceptable temporary stabilization BMPs include surface roughening, seeding and mulching, erosion control blankets or turf reinforcement matting, and tarping for stockpiles. Temporary stabilization by revegetating should take place progressively as the project moves forward and as soon as feasible.

To prevent damage during spring runoff, all disturbed areas shall be temporarily stabilized with one of the acceptable methods listed above prior to winter. While the Town requires winterization activities by completed by December 1, it is recommended that winterization be completed by November 1.

6.11.5.6 Erosion Blanket

Any embankment, cut, or fill slope that is in its final graded state and steeper than 3H:1V shall be seeded and covered with erosion blanket within 30 days of final grading being completed. Erosion blanket installation shall be in accordance with the manufacturer's details and specifications which shall be included on the SWMP plan detail sheet.

6.11.5.7 Control Measure Specifications and Details

Unless the Town has included its own temporary BMP details or design guidance in this section, construction details and design procedures shall be as presented in the most recent version of one or more of the following references. Note that these documents are updated regularly and can be found via an internet search.

1. Colorado Department of Transportation Erosion Control and Stormwater Quality Guide and Standard Plan M-208-1.
2. Urban Drainage & Flood Control District Urban Storm Drainage Criteria Manual, Volume 3 Stormwater Quality.
3. Southeast Metro Stormwater Authority Grading, Erosion, and Sediment Control Manual.

The BMPs presented in the documents referenced above shall be designated in the SWMP where appropriate, and details for each BMP specified shall be included in the SWMP. Use of alternate BMPs not specified above is subject to approval by the Town.

6.11.6 Construction Site Inactivity

Temporary stabilization must be implemented for earth disturbing activities on any portion of the site where ground disturbing construction activity has permanently ceased, or temporarily ceased for more than 30 calendar days. Temporary stabilization methods may include, but are not limited to, hydromulching, tarps, soil tackifier, hydroseed, and erosion control blankets. The permittee may exceed the 30-day schedule when either the function of the specific area of the site requires it to remain disturbed, or physical characteristics of the terrain and climate prevent stabilization. The SWMP must document the constraints necessitating the alternative schedule, provide the alternate stabilization schedule, and identify all locations where the alternative schedule is applicable on the site map.

6.11.7 Final Stabilization

Final stabilization is reached when all surface disturbing activities at the site are complete and a uniform vegetative cover has been established with a plant density of at least 70% of pre-disturbance levels, or an equivalent amount of permanently stable surface has been constructed. Permanently stable surfaces include landscape rock, wood mulch, and landscape pavers. Only the vegetation specified in the SWMP planting plan or seed mix shall count toward plant density.

CHAPTER 7 GRADING & EXCAVATION

TABLE OF CONTENTS

7.1 PURPOSE	i
7.2 OTHER STANDARDS	i
7.3 PERMITS	i
7.4 GRADING	i
7.4.1 Geotechnical Engineer	i
7.4.2 Maximum Slope	ii
7.4.3 Earthen Berms	ii
7.4.4 Detention and Water Quality Features	ii
7.4.5 Retaining Walls	ii
7.4.6 Site Stabilization	iii
7.4.7 Revegetation	iii
7.5 DRAINAGE	iv
7.5.1 Positive Drainage	iv
7.5.2 Offsite Drainage	iv
7.5.3 Spa and Pool Drainage	v
7.6 ENVIRONMENTALLY SENSITIVE AREAS (ESA)	v
7.6.1 Setbacks	v
7.6.2 Wetland Delineation Surveys	vii
7.1 PURPOSE	i
7.2 OTHER STANDARDS	i
7.3 PERMITS	i
7.4 GRADING	i
7.4.1 Geotechnical Engineer	i
7.4.2 Maximum Slope	ii
7.4.3 Earthen Berms	ii
7.4.4 Detention and Water Quality Features	ii
7.4.5 Retaining Walls	ii
7.4.6 Site Stabilization	iii
7.4.7 Revegetation	iii
7.5 DRAINAGE	iv
7.5.1 Positive Drainage	iv
7.5.2 Offsite Drainage	iv

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

7.6 ENVIRONMENTALLY SENSITIVE AREAS (ESA).....v

7.6.1 Setbacks.....v

7.6.2 Wetland Delineation Surveys.....vi

LIST OF ATTACHMENTS – APPENDIX E

APPROVED SEED MIXES

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

7.1 PURPOSE

Development sites within the Town of Breckenridge's mountain environment frequently contain steep slopes, wetland areas, and perennial streams and may be located close to the Blue River. This chapter establishes standards and regulations for development to protect the environment and public health and safety. The standards in this section provide the minimum regulations for grading, excavation, and drainage. Special site conditions or constraints may justify additional requirements from the Town Engineer.

7.2 OTHER STANDARDS

This section provides standards and regulations for general grading, excavation, and drainage for all construction and property development, including work in the right-of-way, single family home development, large residential developments, and commercial property development. Additional grading and excavation standards are provided in the following standards:

1. Chapter 2 of these Standards provides submittal requirements for various types of grading and excavation projects.
2. Chapter 5 of these Standards provides grading requirements within or near streets and driveways.
3. Chapter 6 of these Standards provides information on grading of open channels, detention facilities, and stormwater features.
4. The Subsurface Infiltration Facilities Fact Sheet, included as an attachment to Chapter 6, provides additional requirements for subsurface infiltration facilities.
5. Chapter 8 of these Standards provides requirements and procedures for inspection and acceptance of grading and excavation work.
6. Chapter 9 of these Standards provides construction specifications pertaining to grading and excavation.
7. OSHA provides requirements for temporary trenching, grading, shoring, and other construction requirements.

7.3 PERMITS

Any grading or excavation work of any kind requires a permit prior to commencing work. An infrastructure permit, right-of-way permit, or building permit is required before beginning any grading or excavation activities. Additional Town, County, State, or Federal permits may be required as well. See Chapter 2 (Section 2.4) of these Standards for additional guidance on permits.

7.4 GRADING

The sections below set minimum grading requirements, including geotechnical engineering requirements, slope stability, maximum slopes, earthen berm requirements, detention ponds, retaining walls, and revegetation requirements.

7.4.1 Geotechnical Engineer

Sites with existing grades exceeding a 3H:1V slope will require a geotechnical report analyzing slope stability that is stamped by a geotechnical engineer licensed in the State of Colorado. The geotechnical engineer shall analyze the slope stability for the existing site, proposed structures, and driveways, and examine any impacts to adjacent structures or properties.

Sites with unique conditions, high groundwater, poor or expansive soils, previously mined areas, or any other geotechnical concerns shall require a geotechnical report stamped by a geotechnical engineer licensed in the State of Colorado.

7.4.2 Maximum Slope

A maximum slope of 3H:1V is recommended and preferred for all development in the Town. If existing topography makes it infeasible to provide 3H:1V slopes, slopes of 2H:1V may be allowed. Slopes exceeding 3H:1V require erosion netting or other erosion control systems as approved by the Town Engineer. Slopes should be designed at a maximum of 2.5H:1V, as 2H:1V design slopes often result in localized areas with slopes steeper than 2H:1V, which will not meet code nor pass inspection.

7.4.3 Earthen Berms

Earthen berms constructed for landscaping, screening, or sound mitigation shall be constructed at a maximum slope of 3H:1V. Berms shall be designed to appear natural and match surrounding topography; this should be accomplished through the following design standards:

1. Berms shall be designed with vertical and horizontal undulation. Vertical undulations shall be 50% of the maximum berm height and horizontal undulations shall be 25% of the maximum berm width. A variance may be granted for berms shorter than 100 feet.
2. Maximum height of berm shall be 10 feet.
3. Berms shall be connected to the existing grades at the bottom gradually with a vertical curve to make the berm more natural appearing.
4. Berms shall flatten near the top to appear more natural.

7.4.4 Detention and Water Quality Features

Detention and water quality feature grading shall be designed to balance aesthetics and maintenance. Grading shall be designed to add horizontal undulations so the features appear more natural and match the natural landscape, provided that the undulations do not negatively impact maintenance of the facility.

7.4.5 Retaining Walls

The maximum slope of unretained finished grades shall be 2H:1V. Slopes with proposed grading that will result in grades steeper than 2H:1V will require retaining walls. All retaining walls taller than 4 feet (measured from finished grade at bottom of wall to top of wall) shall be engineered. Engineered walls require the following to be submitted to the Engineering Division from a professional engineer licensed in the State of Colorado:

1. Detailed plan by Colorado professional engineer showing retaining wall details and stamped
2. Inspections during construction certifying all aspects of retaining wall construction meet plan requirements and good engineering practices
3. Final certification of the retaining wall construction by Colorado professional engineer

Multiple retaining walls constructed close to each other will be treated as a single wall for height calculation purposes unless the horizontal distance between the walls exceeds the height of the taller wall. For example, two 4-foot walls separated by only 3 horizontal feet will be treated as a single 8-foot wall and must meet the requirements for an engineered wall.

Walls designed to be less than 4 feet tall and not engineered, but ultimately constructed over 4 feet tall due to site grading, shall be documented, inspected, and certified by a registered professional engineer during construction. A single inspection post-construction will not meet the certification requirements for retaining walls over 4 feet tall.

All retaining walls, including walls less than 4 feet tall, shall be designed with free-draining, granular material for wall backfill, ~~and foundation drains shall be installed behind the wall.~~

Retaining walls connected to buildings or building egresses shall have railings installed and meet requirements of Title 8 of the Town Code (Building Regulations).

See Chapter 5 of these Standards for additional information on retaining walls. See Town Code for planning requirements related to retaining walls.

7.4.6 Site Stabilization

All disturbed areas shall be stabilized prior to final acceptance by Town and should be stabilized as soon as possible after completion of earth disturbance activities and no longer than 14 days after completion of earth work. For larger projects, grading shall be completed in phases and stabilized immediately after completion of a phase. Final stabilization must be a permanent feature designed and installed to prevent erosion and sediment runoff. Final stabilization methods shall be installed and maintained following good engineering, hydrologic, and pollution control practices. The following is a list of acceptable site stabilization methods in Breckenridge. Additional methods not listed below may be submitted to and approved by the Town Engineer.

1. Revegetation with native grass achieving an individual plant density of at least 70% of pre-disturbance levels. Pre-disturbance levels refer to pre-disturbance vegetation that would represent the naturally supported vegetation density in the area. See Section 6.12.1.7 below for additional information on revegetation.
2. Permanent Pavement and Buildings, including roofed buildings, concrete, and hot mix asphalt are considered final stabilized surfaces. Aggregate base course, fine gravel, and asphalt millings are generally not considered permanent pavement and shall not be used for final stabilization.
3. Hardscape surfaces, such as flagstone pavers.
4. Rip-rap, cobble, and large rock. A scour analysis shall be included in the drainage report when required for rock installed on steep slopes.
5. Other landscaping materials, including trees, shrubs, perennials, wood mulch, rock mulch, and turf grass. It is recommended that a landscape architect be used to design landscaping plans.

7.4.7 Revegetation

It is recommended that a revegetation plan be developed by a licensed professional landscape architect to develop a site specific revegetation and landscaping plan. The Town shall be consulted for approval of site specific topsoil and native seed requirements. A list of pre-approved seed mixes are included in Appendix G.

To achieve the highest likelihood of establishment of the specified vegetation, a 2-year maintenance plan from a certified landscaping company that understands native vegetation is required. Plantings shall be completed in the fall or late winter to provide the best odds of establishment. Irrigation is generally required for trees, shrubs, and perennials. Temporary irrigation systems are recommended to establish native grasses. The Town shall be consulted for approval of site specific topsoil and native

seed requirements. General requirements to improve successful vegetation establishment include the following:

1. Seeding all disturbed areas with an approved weed free native seed mix. Approved seed mixes for most sites in the Town of Breckenridge include the Middle Park Conservation District "Forest Mix" and the NRCS "Forest Mix." Alternative seed mixes may be required near environmentally sensitive areas, such as wetlands and the Cucumber Gulch Wildlife Preserve. Diverse early-serial seed mixes with the potential to fully occupy the site's botanical niches shall be selected. Alternate seed mixes shall be approved by Town Engineer.
2. Adequate seeding rates and seeding techniques coupled with soil amendments and fertilizer as determined by proper soil testing and Town construction specifications.
3. Preparing disturbed areas with a minimum depth of 3 inches of topsoil. Topsoil shall be free of rocks, weeds, and other invasive plant species.
4. Pretreating disturbed areas to remove invasive or noxious species.
5. Minimizing or eliminating the use of nitrogen as exotic weeds are often preferentially stimulated over native species.
6. Monitoring for non-target species and noxious weed seeds that are often present in a seed mix.
7. Developing an iterative weed management plan based on regularly scheduled monitoring.

See Chapter 9 for additional information on revegetation specifications.

7.5 DRAINAGE

The sections below set minimum grading and excavation requirements pertaining to drainage and stormwater flow patterns. These sections provide general guidance for site drainage and do not provide standards for water quality or detention requirements. See Chapter 6 of these Standards for water quality, detention, and other drainage requirements.

7.5.1 Positive Drainage

All residential and commercial buildings shall be graded with positive drainage away from building foundations. Positive drainage is defined as a minimum 2% grade perpendicular away from the building foundation for a minimum of 10 feet. Where pavement is adjacent to a building, the minimum slope may be reduced to 1%. Drainage swales, drywells, infiltration facilities, foundation drain pipe daylight, detention and water quality facilities, and all other drainage structures shall be a minimum of 10 feet from the edge of any building foundation [or structural element](#). Foundation drains shall not daylight in roadside ditches, on adjacent parcels, or areas that will drain directly onto adjacent parcels.

7.5.2 Offsite Drainage

Drainage from new development shall be designed to discharge to an infiltration facility, drainage swale, storm sewer, regional detention facility, stream, or other drainage conveyance. Grading shall be designed to prevent any developed drainage or altered drainage flows from crossing onto a neighboring property parcel unless a drainage easement exists on that parcel. Subdivisions shall be platted to add drainage easements for all areas where runoff drainage flows onto another parcel. In no case shall development worsen drainage issues for any downstream properties. Grading shall be designed to prevent erosion and any damage to adjacent structures, streets, or storm sewer infrastructure. Infiltration may be utilized in areas where applicable. Stormwater may drain into an approved location in the Town right-of-way, but it shall not drain directly onto streets, sidewalks, pedestrian paths, trails, or other areas where it could create public safety hazards. Infiltration facilities

shall be used in areas where drainage would otherwise cross a street, sidewalk, or other facility. See the subsurface infiltration facility fact sheet attached to Chapter 6 for additional information.

Drainage from existing developments shall be designed with preliminary stormwater treatment prior to discharging directly to a stream, wetland, or other body of water.

Snow storage areas for all development, including single family homes, shall be designed ~~not~~ to drain ~~toward away from~~ foundations, ~~nor directly onto~~ roadways, sidewalks, pedestrian paths, trails, or other areas where it could create public safety hazards. Snow storage shall be designed to drain into a permanent water quality facility or onto a vegetated area prior to discharging to a stormwater conveyance facility.

New development and redevelopment are both required to analyze and correct any existing inadequate drainage, including insufficient drainage away from buildings, runoff adversely affecting downstream properties, inadequately sized drywells, drainage exceeding storm sewer inlets, pipes, or other conveyance, or other drainage concerns identified by the Town Engineer.

7.5.3 Spa and Pool Drainage

Spas, swimming pools, and other water features installed through new development (existing homes replacing existing spas are exempted) shall meet the following drainage requirements:

1. Pools and spas shall be connected to a drywell meeting all requirements of these Standards. Pools and spas shall not drain into storm sewers, roads, or surface flow off property. Pools, spas, and their drainage shall not be located near environmentally sensitive areas. Within the Cucumber Gulch Protected Management Area (PMA), the Upper Blue Sanitation District may allow spas to be connected to the sanitary sewer. If the sanitary sewer connection is allowed, a drywell is not required.
2. Drains shall be designed to maintain a maximum flow rate of 10 gallons per minute. Drywell infiltration rate shall be designed to exceed the drainage flow rate.
3. Prior to draining a pool or spa, no chlorine, salts, or other chemicals shall be added to the water for a period of at least five days.

Formatted: List Paragraph, Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.25" + Indent at: 0.5"

7.6 ENVIRONMENTALLY SENSITIVE AREAS (ESA)

Environmentally sensitive areas (ESA) are defined as wetlands, streams, lakes, ponds, Cucumber Gulch Wildlife Preserve, and other special wildlife habitat areas. These areas require special requirements to protect their sensitive nature during development. The Town and the developer shall work in conjunction with the Environmental Protection Agency (EPA), Army Corps of Engineers (USACE), State Engineer's Office Water Commissioner, and the Natural Resource Conservation Service (NRCS). For floodplain development regulations, see Title 10 of the Town Code.

7.6.1 Setbacks

No structures or soil disruption shall be located within 25 feet of the top of the banks or delineated boundary of all ESAs. The setback requirements also apply to all channels draining 20 acres or more. Exceptions to the setback requirements may be allowed if one of the following conditions is met and approved by the Town Engineer:

1. Development sites with the most recent plat being recorded prior to January 1, 1986 and platted in a manner which does not allow a feasible development option meeting the 25-foot disturbance setback. This exception only applies if the disturbance setback prohibits any feasible development and the developer demonstrates there are no feasible alternatives to

eliminate disturbance within the setback. Additionally, sites that were platted prior to January 1, 1986, but that were re-platted after January 1, 1986, do not qualify for this exemption.

2. The ESA has previously been mined or extensively disturbed in the area adjacent to the proposed development, resulting in dredge tailings in the area. In this case, the setback may be waived if the developer submits a plan to implement channel, wetland, environmental, or other water body improvements which serve to reclaim, stabilize, revegetate, or enhance the ESA.
3. Work is proposed in the 25-foot setback area (but not within the ESA boundary), the work is considered minor (no permanent structures) in the setback area, and acceptable measures are implemented to prevent an increase of sediment or other contaminants that exceeds historical rates as determined by the Town Engineer.
4. Areas where there are no other feasible methods for development without encroachment into the ESA setback and the encroachment is necessary for critical infrastructure. To meet this exemption, the developer must demonstrate there are no feasible alternatives to eliminate disturbance within the setback. Only infrastructure, such as roads and utilities, will be considered within the ESA. Residences and structures will generally not be granted an exemption to be constructed within an ESA.
5. The wetlands or other environmentally sensitive areas have encroached into a detention, stormwater quality, or another type of stormwater feature since the development of the feature. Maintenance activities within the stormwater feature shall be allowed in these cases.

If any of the above exemptions to the setback requirement is granted by the Town Engineer, the following requirements shall be met:

1. Acceptable measures shall be designed, installed, and maintained to prevent an increase of sediment or other contaminants that exceeds historical rates, both during construction and in the final condition.
2. If ESA improvements are approved per condition 2 above, the water body shall be hydrologically contained to limit impacts until the improvements are completed. For stream restoration improvements, a bypass channel shall be designed for the 25-year storm and for a minimum distance of 25 feet above and below the channel restoration work. The bypass channel shall either be a plastic, metal, or concrete culvert or shall be an open channel stabilized with scour protection designed for the 25-year storm.
3. If wetlands are disturbed, wetland mitigation shall be completed at a minimum of a 1:1 ratio or the ratio required by the USACE, whichever is greater. Wetland mitigation for Waters of the US shall meet all requirements of the USACE. A financial guarantee shall be submitted to the Town guaranteeing the wetlands mitigation for a minimum period of 3 years to ensure successful plant establishment for all wetland plantings. A wetland mitigation plan shall be submitted which includes the following:
 - a. The amount, location, and acreage of wetland fill, removal or other alteration proposed.
 - b. The proposed mitigation improvements.
 - c. A grading, erosion control, and revegetation plan, including plant material to be used for revegetation and soil stabilization measures.
 - d. A narrative explaining how there are no feasible alternatives to disturbing the wetlands, how the wetland disturbance is being minimized to the extent possible, how the wetlands will be mitigated, and how the project will not violate an applicable laws or regulations.

- e. Other applicable permits such as a USACE 404 permits (if site is determined to be a jurisdictional wetland).
4. Disturbed areas within the ESA or ESA setback shall be revegetated with an appropriate seed mix. Revegetation of ESA and ESA setbacks shall be monitored and certified at revegetation.

7.6.2 Wetland Delineation Surveys

Wetland boundaries shall be shown on all subdivision plats within the Town of Breckenridge. If the Town believes there is any evidence that a site subject to ~~disturbance-any sized-development~~ may contain wetlands, either not shown on the plat or with an incorrect boundary, the Town may require the developer to obtain and submit a wetlands delineation survey completed in accordance with Corps of Engineers Wetlands Delineation Manual and all USACE guidelines~~by an independent third party consultant specializing in wetlands delineations as recognized by the USACE.~~

If a developer believes that a wetland shown on a plat is incorrect, the developer may obtain a wetlands survey ~~by an independent third party consultant specializing in wetlands delineations as recognized by the USACE~~in accordance with the Corps of Engineers Wetlands Delineation and submit it to the Town Engineer for review. The wetlands survey shall be conducted during the months of June, July, or August.

Wetland delineations shall be updated after 5 years to reflect current wetland conditions. Wetland boundaries shown on plats and other locations will be considered outdated after 5 years and will require a new wetlands survey delineation completed in accordance with the Corps of Engineers Wetlands Delineation Manual~~by an independent third party consultant specializing in wetlands delineations as recognized by the USACE~~by the developer.

CHAPTER 8 INSPECTION & ACCEPTANCE

TABLE OF CONTENTS

8.1	INTRODUCTION	1
8.2	REFERENCES TO OTHER DOCUMENTS	1
8.3	INSPECTION AND ACCEPTANCE PROCESS	1
8.3.1	Infrastructure Permit	1
8.3.2	Building Permit (without associated infrastructure permit)	2
8.3.3	Right of Way Permit.....	2
8.4	ENGINEERING DIVISION INSPECTIONS	3
8.4.1	Building Permit	3
8.4.1.1	Pre-Pavement/Pre-Landscaping Inspection	3
8.4.1.2	Certificate of Occupancy Inspection	3
8.4.1.3	Stormwater Management Inspection	4
8.4.1.4	Bond Release Inspection.....	4
8.4.2	Right-of-Way Permit	4
8.4.2.1	Utility Inspection.....	4
8.4.2.2	Pre-Pavement Inspection	4
8.4.2.3	Completion Inspection	4
8.4.2.4	Stormwater Management Inspection	4
8.4.2.5	Two Year Bond Re-Inspection	4
8.4.3	Infrastructure Permit	4
8.4.3.1	Utility Inspection.....	5
8.4.3.2	Pre-Pavement Inspection	5
8.4.3.3	Initial Acceptance Inspection	5
8.4.3.4	Other Inspections.....	5
8.4.3.5	Stormwater Management Inspection	5
8.4.3.6	Final Acceptance Inspection.....	5
8.5	INITIAL ACCEPTANCE	5
8.6	WARRANTY	6
8.7	RECORD DRAWINGS	7
8.8	FINAL ACCEPTANCE	8

LIST OF ATTACHMENTS – APPENDIX F

BUILDING PERMIT INSPECTION FORM

ROW INSPECTION FORM

EXAMPLE ENGINEER'S IMPROVEMENT SUMMARY LETTER

EXAMPLE TESTING FIRM LETTER

8.1 INTRODUCTION

This chapter includes information about the Engineering Division inspection and acceptance procedures and protocols for different types of projects. It also includes information on occupancy requirements and how different types of permits and projects may be closed. This information is intended to apply to activities that occur after initial permits are issued.

8.2 REFERENCES TO OTHER DOCUMENTS

Titles 9 and 10 of the Town Code offer additional information on inspections and acceptance. Chapter 2 of these Standards includes information on the types of permits required by the Town and the submittals required to receive those permits. This chapter only includes the inspection and acceptance procedures of the Engineering Division; permit holders shall reference the Town Code and contact the Community Development Department for additional requirements. Permit holders shall also reference County, State, and Federal regulations for procedures on inspection and acceptance requirements relating to those permits.

8.3 INSPECTION AND ACCEPTANCE PROCESS

The Engineering Division inspection and acceptance process for each type of permit, from permit issuance to final acceptance, is outlined below. Section 8.3.1 to Section 8.3.3 provides an overview of the inspection and acceptance steps for each type of permit; the subsequent sections provide additional detail on the inspections and acceptance steps outlined in Section 8.3. The intent of this section is to provide a summary of steps that must be completed once each permit is issued.

8.3.1 Infrastructure Permit

The infrastructure permit holder shall follow the steps below after receiving an infrastructure permit:

1. **Preconstruction Meeting** – A preconstruction meeting with the Engineering Division is required prior to beginning construction activities.
2. **Begin Construction** – Construction activities may begin only after permit holder has obtained all necessary permits, satisfied all requirements of the Breckenridge Town Code and these Standards, and attended a preconstruction meeting with the Engineering Division.
3. **Subdivision Improvement Agreement** – A Subdivision Improvement Agreement (SIA) will be required if the project requires a subdivision plat and all subdivision improvements are not completed prior to the subdivision plat being recorded. See Title 9 of Town Code for more information on Subdivision Improvement Agreements.
4. **Inspections Prior to Initial Acceptance** – The Engineering Division shall complete inspections throughout the construction process. See Section 8.4 below for the Engineering inspections required for different permit types.
5. **Completion of Work** – Permit holders shall notify the Engineering Division once all improvements required by the construction plans and all agreements have been completed.
6. **Initial Acceptance Inspection** – The Engineering Division shall inspect the improvements for compliance with Standards, plans, specifications, and agreements.
7. **Correction of Deficiencies** – If the Engineering Division finds any improvements not to be in compliance with the Standards, plans, specifications, or any agreements, the Engineering Division will notify the permit holder who then must correct the deficiencies and notify the Engineering Division when the site is ready for another inspection.

8. Record Drawings – The permit holder shall submit record drawings (also referred to as As-Built Drawings) to the Engineering Division in accordance with the requirements in Section 8.7.
9. Initial Acceptance – After the permit holder satisfactorily corrects deficiencies, submits record drawings and the warranty surety, the Engineering Division shall grant Initial Acceptance.
10. Warranty Period – The warranty period shall last for two years after initial acceptance. The permit holder shall maintain the improvements during this period. Private infrastructure shall not require a warranty period.
11. Final Acceptance – The permit holder shall request a final inspection of improvements no later than 45 days prior to the end of the warranty period. The permit holder shall repair any deficiencies prior to the end of warranty period. Once deficiencies are corrected, the Engineering Division shall grant final acceptance and release the warranty surety.

8.3.2 Building Permit (without associated infrastructure permit)

The building permit holder shall follow the steps below after receiving a building permit when there is no associated infrastructure permit:

1. Begin Construction – Construction activities may begin only after permit holder has obtained all necessary permits and satisfied all requirements of the Breckenridge Town Code and these Standards.
2. Inspections Prior to Certificate of Occupancy – The Engineering Division shall complete inspections throughout the construction process. See Section 8.4 below for the Engineering Division inspections required for different permit types.
3. Certificate of Occupancy – The Certificate of Occupancy inspection shall be requested when all improvements are completed.
4. Completion Guarantee – Permit holders are encouraged to complete all site work prior to October 31st. If the permit holder does not complete all improvements by October 31st, and desires to obtain the certificate of occupancy prior to May 1st, a preliminary Certificate of Occupancy inspection shall be scheduled by the permit holder with Engineering. Engineering will require a financial guarantee (surety) in the form of a letter of credit, bond, or cash deposit shall be submitted to the Engineering Division. The Town Engineer shall determine the financial guarantee amount by either assessing 125% of the remaining work value or assessing a general completion amount of \$5,000 if the scope of the uncompleted work cannot be determined. Once all improvements are complete, the permit holder shall request an a final inspection. The surety will be released once the Engineering Division determines improvements are complete.

Commented [JP1]: Planning does not do anything other than a cash deposit unless Engineering does something separate in the SIAs etc...

Commented [CM2R1]: Agreed

8.3.3 Right of Way Permit

The right-of-way permit holder shall follow the steps below after receiving a right-of-way permit:

1. Begin Construction – Construction activities may begin only after permit holder has obtained all necessary permits and satisfied all requirements of the Breckenridge Town Code and these Standards.
2. Inspections Prior to Initial Acceptance – The Engineering Division shall complete inspections throughout the construction process. See Section 8.4 below for the Engineering Division inspections required for different permit types.
3. Completion Inspection – The completion inspection shall be requested when all improvements are completed.
4. Warranty Period – The warranty period may begin once the completion inspection has been passed.

5. Two Year Bond Re-Inspection - The permit holder shall request a final inspection of improvements no later than 45 days prior to the end of the warranty period. The permit holder shall repair any deficiencies prior to the end of warranty period. Once deficiencies are corrected, the Engineering Division shall grant final acceptance and release the warranty surety.

8.4 ENGINEERING DIVISION INSPECTIONS

Inspections are required at key steps of the construction process to help provide general compliance with plans and specifications. However, inspections completed by the Engineering Division do not provide final assurance of compliance with specifications and do not preclude the Engineering Division from imposing corrective actions in the future. The Engineering Division may require the permit holder to remove, replace, or repair items, or to perform other corrective actions if improvements are ever found to not comply with plans, specifications, or Town Standards.

The permit holder is required to schedule all inspections with the Engineering Division, other than those for stormwater management, at the time indicated for each permit using the contact information on the applicable permit. Failure of the permit holder to schedule inspections at the appropriate time may result in stop work orders, removal and replacement of improvements, fines, or other penalties. The stormwater management inspections shall be scheduled by the Engineering Division. The sections below detail the permits that will require an inspection from the Engineering Division.

8.4.1 Building Permit

A Building Permit may require up to four separate inspections from the Engineering Division, as detailed in this section. Inspections from the Community Development Department will also be required. The Community Development Department shall be contacted to confirm the required inspections. Inspections for building permits are encouraged to be completed between May 1 and November 1. If a final inspection is required outside these dates, a ~~completion bond~~ cash deposit (surety) may be required. Building permit inspections shall be scheduled through the contact information provided on the building permit form. Permit holders may request additional inspections at critical steps during construction if needed.

8.4.1.1 Pre-Pavement/Pre-Landscaping Inspection

The building permit holder shall schedule a pre-pavement/pre-landscaping inspection with the Engineering Division prior to placement of pavement, final topsoil, seeding, and landscaping. Inspection shall generally include the items shown on the inspection form included in Appendix H.

Commented [AG3]: Add drywell/ foundation drain?

8.4.1.2 Preliminary Certificate of Occupancy Inspection

The preliminary Certificate of Occupancy inspection only applies to projects completed between November 1st and April 31st of each year. If site work cannot be completed by November 1st, the permit holder shall schedule a preliminary inspection prior to November 1st. Any incomplete work shall require a financial guarantee per Section 8.3.2.

8.4.1.2.3 Certificate of Occupancy Inspection

The building permit holder shall schedule a certificate of occupancy inspection with the Engineering Division after completion of all grading, pavement, landscaping, site stabilization, and all other site work. Inspection shall generally include the items shown on the inspection form included in Appendix H.

8.4.1.34 Stormwater Management Inspection

The Engineering Division will conduct stormwater management inspections of sites to ensure that stormwater controls have been installed per the approved plans and are functioning adequately. Inspections will be scheduled periodically throughout construction and may occur without notice.

8.4.1.45 Bond Release Inspection

If there is completion bond for the project, the building permit holder will schedule a bond release inspection with the Engineering Division for any work completed after the issuance of the certificate of occupancy.

Commented [JP4]: Surety?

8.4.2 Right-of-Way Permit

A Right-of-Way Permit may require up to four separate inspections from the Engineering Division. No work in the right-of-way or right-of-way inspections shall occur between November 1 and May 1. The types of inspections from the Engineering Division that may be required for a right-of-way permit are detailed in the sections below. Right-of-way permit inspections shall be scheduled through the contact information provided on the permit form.

8.4.2.1 Utility Inspection

The Engineering Division will determine utility inspection requirements prior to start of the project. Utility inspections may be required prior to backfill of utilities to ensure utilities are constructed in accordance with the appropriate construction specifications. Major features shall be inspected prior to utility backfill. The right-of-way permit holder shall call to schedule an inspection at least 48 hours prior to the utility being backfilled.

8.4.2.2 Pre-Pavement Inspection

The right-of-way permit holder shall call to schedule a pre-pavement inspection at least 48 hours prior to the placement of concrete, asphalt, or other types of pavement. Inspection items shall include grading, subgrade, and concrete forms for sidewalks, curbs, curb ramps, and driveway curb cuts.

Commented [AG5]: This is in there twice

Commented [CM6R5]: This is for ROW permits and then one above is for SFH

8.4.2.3 Completion Inspection

The right-of-way permit holder shall call to schedule a completion inspection after completion of all improvements, pavement, site stabilization, and restoration. Inspection shall generally include the items shown on the inspection form. Once the site passes the completion inspection, the 2-year bond and warranty period process can be initiated.

8.4.2.4 Stormwater Management Inspection

The Engineering Division will conduct stormwater management inspections of sites to ensure that stormwater controls have been installed per the approved plans and are functioning adequately. Inspections will be scheduled periodically throughout construction and may occur without notice.

8.4.2.5 Two Year Bond Re-Inspection

The Engineering Division will schedule an inspection of all improvements one month before the end of the two-year warranty bond period. If defects are found in any of the improvements, the right-of-way permit holder shall be notified, and defects shall be repaired by the permit holder.

8.4.3 Infrastructure Permit

The types of inspections that may be required for an infrastructure permit are detailed below.

8.4.3.1 Utility Inspection

The Engineering Division will determine utility inspection requirements prior to start of the project. Utility inspections may be required prior to backfill of utilities to ensure utilities are constructed in accordance with the appropriate construction specifications. If an inspection is required prior to utility backfill, the right-of-way permit holder shall call to schedule an inspection at least 48 hours prior to the utility being backfilled.

8.4.3.2 Pre-Pavement Inspection

The infrastructure permit holder shall call to schedule a pre-pavement inspection at least 48 hours prior to the placement of concrete, asphalt, or other types of pavement. Inspection items shall include grading, subgrade, and concrete forms for sidewalks, curbs, curb ramps, and driveway curb cuts.

8.4.3.3 Initial Acceptance Inspection

The infrastructure permit holder shall call to schedule an initial acceptance inspection after all improvements, pavement, site stabilization, and restoration are complete. Inspection shall include all infrastructure, public improvements to be conveyed to the Town, private improvements, utilities, detention and permanent stormwater quality features, and all other site work. Once the site passes the initial acceptance inspection, the 2-year bond and warranty period process can be initiated. The initial acceptance process is discussed in more detail in Section 8.5.

8.4.3.4 Other Inspections

The Engineering Division will determine if additional inspections are necessary during the pre-construction meeting and will establish those with the developer. The Engineering Division also may require additional inspections throughout the project duration. These may include structural concrete, structural steel, reinforcing steel, and backfill compaction inspections.

8.4.3.5 Stormwater Management Inspection

The Engineering Division will conduct stormwater management inspections of sites to monitor that stormwater controls have been installed per the approved plans and functioning adequately. Inspections will be scheduled by the Engineering Division periodically throughout construction and may also occur without notice.

8.4.3.6 Final Acceptance Inspection

The Engineering Division will schedule an inspection of all improvements at the end of the two-year warranty bond period. If defects are found in any of the improvements, the infrastructure permit holder shall be notified, and defects shall be repaired by the permit holder.

8.5 INITIAL ACCEPTANCE

For all projects that are issued an infrastructure permit, initial acceptance generally indicates that the project has been completed to the satisfaction of the Engineering Division and that the 2-year bond (surety) process (warranty period) can be initiated. Initial acceptance requires the following at a minimum:

1. Construction Plans – Plans shall be submitted for approval clearly identifying public improvements to be conveyed to Town.
2. Preconstruction Meeting – A pre-construction meeting between an Engineering Division representative, the Project Engineer, developer, and contractor shall be held prior to the start

of construction. The meeting shall confirm the scope of work, inspection requirements, and testing requirements for the project.

3. Initial Acceptance Submittals:

- a. Material testing reports & testing firm letter – Material testing shall be completed in accordance with the Town specifications. An example testing firm letter is included as an attachment to Appendix H and shall be signed and stamped by a Colorado Professional Engineer to certify that all test procedures were in conformance with the approved plans and specifications.
- b. Inspection & construction observation reports – Inspection and construction observation required to be performed by the Project Engineer shall be established during the pre-construction meeting. Reports shall be certified by the Project Engineer and shall certify that construction was in conformance with approved plans and specifications.
- c. Engineering Record Drawings – Prior to issuance of initial acceptance, record drawings shall be submitted to the Engineering Division that meet the requirements of Section 8.7.
- d. As-built survey of detention and water quality facilities and certification by a professional engineer licensed in the state of Colorado certifying the facility meets the detention and water quality requirements.
- e. As-built survey of main features of underground utilities. Examples include utility surface locates, manholes, valves, inlets, hydrants, junction boxes, and other exposed features. Survey of underground facilities prior to backfill may be required at critical locations. The surveyed features shall be drawn electronically and submitted in DWG and PDF formats.
- f. Other documentation – Additional documentation, as required by Town Engineer, shall be submitted to the Engineering Division prior to initial acceptance.

4. Initial Acceptance Request – An initial acceptance request shall be submitted in writing to request an initial acceptance inspection after all initial acceptance submittals have been submitted. An improvements summary letter shall be submitted with the initial acceptance request. An example improvements summary letter is included as an attachment to Appendix H. The initial acceptance request shall only be submitted if the work has been fully completed in accordance with the approved plans and specifications. All work and known punch list items must be complete prior to submitting the request.

- a. Work Acceptable. If the work has been completed satisfactorily for initial acceptance, the Town Engineer will issue a written notice of initial acceptance to the permit holder.
- b. Work not Acceptable. If the work has not been completed satisfactorily, the Town Engineer will provide the permit holder with a punch list of items to be completed. Once the punch list items are completed, the permit holder may request a subsequent inspection.

5. Warranty Surety – If the permit holder fails to complete punch list items satisfactorily within 30 days, the Town may utilize the warranty surety to complete improvements. The Town may also withhold additional permits or certificates of occupancy.

8.6 WARRANTY

For permits requiring a warranty, the permit holder shall warrant that all public improvements shall remain free from defects for a period of two years from the date the Town issues initial acceptance of the improvements. This period may be referred to as the two-year warranty period, warranty period, the two-year bond period, or initial acceptance period. During the two-year warranty period, any defect determined to exist with respect to such improvements shall be repaired or the improvement replaced at the sole cost of the permit holder.

The permit holder shall be required to file a warranty surety in the form of a warranty bond, cash bond, or irrevocable letter of credit with the Town in a form acceptable to the Town Attorney, prior to initial acceptance of any public improvements, in an amount equal to 25% of the original cost of the public improvements, in order to assure the satisfactory maintenance of the improvements for a period of two years after the date of initial acceptance by the Town. Such bond shall guarantee all public improvements constructed by the permit holder remain free from defect for the required two-year period.

If initial acceptance is reached prior to obtaining final site stabilization (70% revegetation), the permit holder shall be responsible for maintenance of all temporary and permanent stormwater quality features until final stabilization of the site is achieved. This shall include sweeping of street and sidewalks, and maintenance of detention ponds, water quality features, and storm sewer infrastructure. The permit holder shall be responsible for the maintenance of trees, shrubs, and other landscaping features during the two year warranty period.

8.7 RECORD DRAWINGS

Record drawings, also called as-built drawings, are to be submitted to and accepted by the Town Engineer prior to final acceptance of any public improvements. As-built drawings shall be produced under the direction of and stamped by a Colorado registered professional engineer to assure compliance with original design drawings. Certification shall be presented along with the as-built drawings stating such compliance.

One set of as-built drawings shall be submitted to the Engineering Division within 30 days of completion of construction (initial acceptance). Drawings shall be submitted electronically in DWG and PDF format so that they will print to scale on 11" x 17" paper. Each drawing sheet shall include a title block, scale, north arrow, original and revision dates, and professional engineer's stamp when applicable. Title blocks shall be along the bottom or right margin of each drawing. Survey control and project benchmarks including datum shall be included.

Manufacturer's literature and product data, including catalog sheets, descriptive literature, product warranties, and any O&M manuals, for all materials and equipment used, shall be provided with as-built drawings.

The construction plans shall be updated with all design changes that occurred after issuance of infrastructure permit. Record drawings shall also identify actual constructed locations and dimensions of street improvements, signage, striping, street lights, swales, WQ/detention ponds, inlets, stormwater improvements, and other infrastructure. For detention and water quality facilities, record drawings shall identify the as-built locations of all inlets and outlets, the as-built grading of the site for all ponds, and as-built details of the outlet structure including the sizes and elevations of all orifices and weirs that may convey water out of the facility. Record drawings shall also document locations and elevations of underground utilities. Record drawings shall identify any other conditions that vary from the approved plans and specifications, or any other information requested by the Town Engineer.

Detention and water quality facilities shall be surveyed, added to the record drawings, and stamped by the engineer certifying the facilities are in compliance with the design.

Underground utilities shall be surveyed and added to the record drawings submitted by surveying surface utility locates, manholes, valves, inlets, hydrants, junction boxes, and other exposed features. Survey of underground facilities prior to backfill may be required at critical locations.

8.8 FINAL ACCEPTANCE

Final acceptance requires the following at a minimum:

1. Final Acceptance Inspection Request – The permit holder shall request a final acceptance inspection in writing within 45 days of the expiration of the warranty period.
2. Final Acceptance Inspection and Punch List – The Engineering Division shall inspect all public improvements for the project and shall compile a written final punch list of items requiring repair or replacement and any defective or unsatisfactory conditions resulting from materials or workmanship that are defective, inferior, or not in accordance with project plans and specifications.
3. Re-Inspection – If repair or replacement of public infrastructure is required, the permit holder shall complete such repair or replacement within 30 calendar days. Once completed, the permit holder shall contact the Engineering Division for re-inspection.
4. Notice of Final Acceptance – Once all punch list items are completed to the satisfaction of the Engineering Division, and after the record drawings have been submitted and accepted by the Town Engineer, the Town Engineer shall issue a written notice of final acceptance of improvements and shall release warranty surety.
5. Warranty Surety – If the permit holder fails to complete the punch list items satisfactorily within 30 calendar days, the Engineering Division may utilize the warranty surety to complete the punch list items. The Engineering Division may also withhold additional permit approval or certificates of occupancy.

CHAPTER 9 CONSTRUCTION SPECIFICATIONS

TABLE OF CONTENTS

9.1	PURPOSE	1
9.2	TOWN CONSTRUCTION SPECIFICATIONS.....	1
9.3	REVISIONS AND REPLACEMENTS OF CONSTRUCTION SPECIFICATIONS	1
9.4	TOWN STANDARD DETAILS	2

LIST OF TABLES

Table 9.1.	Town Construction Specifications by Type of Construction	1
Table 9.2.	Town Standard Details.....	2

LIST OF ATTACHMENTS – APPENDIX G

TOWN STANDARD DETAILS

LIST OF ATTACHMENTS – APPENDIX H

TOWN REVISIONS AND REPLACEMENTS OF ROAD AND BRIDGE CONSTRUCTION
STANDARDS

9.1 PURPOSE

This chapter of the Engineering Standards establishes the construction specifications that shall be used within the Town for various categories of construction. These specifications shall be used for all public projects in the Town, as well as all private projects constructing public infrastructure to be owned by the Town. Construction specifications are not design standards. Construction specifications, also known as construction standards, include items such as materials requirements, construction procedures and tolerances, and required testing and performance metrics. ~~The Town expects to update this chapter and the attachments over time as the unique goals and values of the Town and local physical conditions dictate.~~ Project special specifications may be submitted by the developer for unique or project-specific conditions. The Town Engineer may also require additional specifications for different projects.

9.2 TOWN CONSTRUCTION SPECIFICATIONS

The most recent edition of the documents included in Table 9.1 are hereby adopted by reference as the Town of Breckenridge Construction Specifications, except as specifically amended by the provisions of this chapter, for the types of construction shown in Table 9.1.

Where the Town of Breckenridge Construction Specifications in Table 9.1 do not include a specification required for the type of construction listed, the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction shall apply.

The documents in Table 9.1 shall apply unless they are superseded by revisions or replacements the Town develops included herein. The most recent revision of each document listed in Table 9.1 shall be used. Each user of these Engineering Standards is encouraged to review this chapter frequently as it may be updated regularly.

Where two different construction specifications overlap or conflict, the more stringent specification shall apply. Consult with the engineering division for any conflicts or inconsistencies between different specifications.

Table 9.1. Town Construction Specifications by Type of Construction

Type of Construction	Town Construction Specifications
Water Line	Town of Breckenridge Water Construction Standards
Sanitary Sewer	Upper Blue Sanitation District Construction Standards
Open Channels	Mile High Flood District (MHFD) Construction Specifications (Division 3 – 33)
Vegetation	Mile High Flood District (MHFD) Construction Specifications (Division 3 – 33) Appendix H of these Standards (Seed Mixes)
Residential Building	Title 8 of Town Code
Commercial Building	Title 8 of Town Code
Industrial Facility	Title 8 of Town Code
Streets	CDOT Standard Specifications for Road and Bridge Construction

9.3 REVISIONS AND REPLACEMENTS OF CONSTRUCTION SPECIFICATIONS

To reflect the Town's unique goals and values or address local physical conditions, the Town may choose to amend, revise, or replace some or all of any of the Town Construction Specifications included in Table 9.1 per the sections below.

9.3.1 Town of Breckenridge Water Construction Standards

Retain all sections.

9.3.2 Upper Blue Sanitation District Construction Standards

Retain all sections.

9.3.3 MHFD Construction Specifications (Divisions 3 – 33)

Retain all sections.

9.3.4 Title 8 of Town Code

Retain all sections.

9.3.5 CDOT Standard Specification for Road and Bridge Construction

Revisions and replacements of the CDOT Standard Specification for Road and Bridge Construction are included in Appendix [H](#).

9.4 TOWN STANDARD DETAILS

The Town uses the standard construction details listed in Table 9.3. It is anticipated this list will be updated as new standard details are developed. The Town's standard details are included as attachments to this chapter.

Table 9.3. Town Standard Details

Detail	Title	Number of Pages
Drawing 1	Transit Turnouts	1
Drawing 2	Cul-De-Sac	1
Drawing 3	Driveway Details	3
Drawing 4	Curb, Gutter, Sidewalk, and Pavement Details	5
Drawing 5	Curb Ramp Details	26
Drawing 6	Asphalt Details	2
Drawing 7	Utility Trench Details	3
Drawing 8	Lighting Details	7
Drawing 9	Typical Roadway Sections	4

CHECKLIST 7

BUILDING PERMIT (WITHOUT INFRASTRUCTURE PERMIT) REQUIREMENTS

This is the checklist of items to be submitted to the Engineering Division for building permit applications without an associated infrastructure permit. Refer to the Town Code for other Town Division submittal requirements.

All applicable items shall be included with the submittal. The table below may not contain all information necessary for a project, and the Town Engineer may require additional information. Any items not applicable shall be specified and justified in the comments section at the bottom of the checklist.

Building permit applications shall be obtained and submitted through the Town of Breckenridge Building Department. Town of Breckenridge Community Development Department and Building Department shall be contacted for a list of their submittal requirements.

For questions about these requirements or to schedule a meeting, please email the Town of Breckenridge Engineering Division at engineeringinspection@townofbreckenridge.com

Project Name: _____

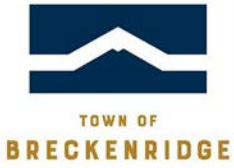
Project Address: _____

Submittal (circle one): Preliminary Final

Provided	Not Applicable	Plan Items	Office use
		General Formatting (all plan sheets)	
		Project title in which project is to be filed	
		Date of drawing preparation & revisions	
		North arrow & drawing scale	
		Site Plan	
		<i>Plat Compliance</i>	
		Legal description of property & physical street address. Legal description may be found through the Summit County online GIS parcel query tool	
		Existing & proposed property lines	
		Existing & proposed right-of-way & dimensions	
		Existing & proposed easements & dimensions	
		Temporary & permanent survey monuments	
		Building footprint (show foundations & roof eaves), envelope, & building setbacks	
		<i>Utilities</i>	
		Existing & Proposed Utilities. Show existing & proposed location of all utilities & connections including all boxes, poles, structures, & utility alignments for electric, gas, cable, telephone, fiber, sewer, & water. Utility structures shall be in easements	
		<i>Wetlands, Floodplains, & other Hazard Areas</i>	

Provided	Not Applicable	Plan Items	Office use
		Wetland boundaries & 25' wetland setback boundaries	
		100-year floodplain & other flood hazard area boundaries	
		25' setback boundaries from top of stream banks, lakes, & other water bodies	
		Protective Management Area (PMA) limits & other special protective or hazard areas	
		Identification of areas with slope stability concerns	
		Identification of areas with geotechnical, environmental, archaeological, or historical significance	
		Identification of any hazardous concerns	
		<i>Grading & Drainage</i>	
		Existing topography (1-foot contours) prepared by a registered surveyor	
		Proposed Topography (1-foot contours showing finished grade)	
		Maximum 2:1 slope allowed on all finished grading (3:1 preferred)	
		Retaining wall heights & locations (retaining walls > 4 feet in height require design by Colorado licensed Professional Engineer)	
		Culvert locations, material, & dimensions. (18" minimum diameter & 1% minimum slope for culverts in ROW)	
		Foundation drain locations & daylight	
		Drywell location (10' minimum from building) and detail . See drywell fact sheet in Chapter 6 for additional requirements & guidance.	
		Proposed outfall locations of developed drainage, drainage arrows, & swale locations	
		Positive drainage shown around building	
		Detention & permanent water quality features shown (if required)	
		CDPHE Stormwater Discharge Permit (for projects resulting in at least one acre of disturbance)	
		<i>Driveway & Parking</i>	
		Maximum 8% grade at any point along centerline of driveway alignment	
		Maximum 4% grade for first 20' from roadway intersection	
		Match cross slope of roadway for first 5' of driveway from roadway intersection	
		Driveways dimensions meet requirements of Chapter 5 (12' min width & 20' max width for SFH)	
		Sidewalk driveway cut meets Town standard detail	
		Driveway intersections roadway at 90 degrees	
		Driveway surface & section dimensions shown	
		One driveway access allowed (no duplicate or circular driveway cuts)	
		Minimum driveway separation met from neighboring driveway (30' min for SFH)	

Provided	Not Applicable	Plan Items	Office use
		Snow storage areas shown (see Town Code for snow storage requirements)	
		Parking spaces & vehicle turnaround areas shown (see Town Code for parking requirements). Vehicles able to turnaround/back out of garage	
		Minimum Sight Distance for driveway access (200' min)	
		Easement submitted for shared driveway access with neighboring property	
		<i>Landscaping</i>	
		Landscaping plan shall be submitted in accordance with requirements in Town Code	
		Landscaping in snow storage easements shall not obstruct ability to stack snow	
		Landscaping not located in ROW	
		Landscaping located in easements meets requirements of Chapter 3	
		<i>ROW</i>	
		No retaining walls, boulders, stone headwalls, or small rock located in ROW	
		No address monuments or mail boxes in ROW	
		Snowmelt system in or near ROW meets requirements of Chapter 5	
		No fences, private lighting, trees, landscaping, signage, or any other structures shown in ROW without Engineering approval & encroachment license submitted	
		<i>Other</i>	
		Existing & proposed sidewalks, trails, street lights, signage, & any other structures or significant features shown on plans	
		Construction details as required for construction of improvements	
		Construction Management Plan	
		Construction Stormwater Management (wattles, silt fence, tracking pads, etc.)	
		Construction Stormwater BMP Details (wattles, silt fence, etc.)	
		Revegetation notes or other final stabilization plans	
		Construction fencing location	
		Material & equipment staging locations	
		Dumpster & portalet locations	
		Vehicle parking locations & construction access location	
		Other Submittals	
		Soils report & other site reports	
		Floodplain Development Permit	
		Encroachment License Agreement (required for any permanent improvements proposed within Town ROW)	



Application ID Number: _____

TOWN OF BRECKENRIDGE INFRASTRUCTURE PERMIT APPLICATION

This application form shall be filled out and submitted to the Engineering Division before an Infrastructure Permit will be issued.

Project Name: _____ Development Permit #: _____

Property Owner: _____

Applicant/Agent (If different than Owner): _____

Mailing Address: _____ Phone Number: _____

Email Address: _____

Street Address of Property: _____

Legal Description of Property: _____

Project Description:

Approximate area of disturbance: _____

Will there be development or grading in a floodplain? Yes___ No___

Will there be work within a Town Right-of-Way? Yes___ No___

Will there be work within CDOT Right-of-Way? Yes___ No___

Will there be wetlands disturbance? Yes___ No___

Will there be utility work? If yes, describe utility types, approximate lengths, and if there is a planned connection to the Town of Breckenridge water or storm sewer system:

Is stormwater detention required? Yes___ No___

Is permanent water quality required? Yes___ No___

Anticipated construction start date: _____

Is preconstruction meeting scheduled with the Engineering Division? Yes___ No___

Anticipated length of construction: _____

The applicable items in the table below must be included with the Infrastructure Permit application. Failure to do so will result in denial of the Infrastructure Permit and a requirement to resubmit. Any items not applicable to the project shall be noted and justified below. Additional details on the requirements of the Infrastructure Permit are in Chapter 2.

Provided	Not Applicable	Infrastructure Permit Items	Office use
		Infrastructure Permit application form	
		Completed a Applicable checklists 1 – 6 for various submittals	
		Final civil construction drawings	
		Technical specifications	
		Final Drainage Report	
		Final Traffic Impact Study	
		Method of Handling Traffic (MHT) or Traffic Control Plan (TCP)	
		Stormwater Management Plan (SWMP) and/or CSMP	
		Development Permit	
		Building Permit	
		Right-of-Way Permit	
		Floodplain Development Permit	
		CDPHE Stormwater Construction Permit	
		ACOE, CDOT, Summit County, or other permits as applicable	
		Subsurface Utility Engineering documentation	
		Permanent Survey Monumentation documentation	

Application ID Number: _____

List of submittal items not applicable to project and justification for non-applicability:

The undersigned certifies that the information provided is correct and that this application does not authorize work until an infrastructure permit is granted. The undersigned further certifies that s/he will comply with all inspections and acceptance procedures in the Town's Engineering Standards:

Applicant Signature: _____ Date: _____

Permit Status: Granted _____ Denied _____

Reason for denial: _____

Staff Signature: _____ Title: _____

Printed Name: _____ Date: _____

FACT SHEET

SUBSURFACE INFILTRATION FACILITIES

1.0 Definition

This fact sheet provides design standards for drywells, infiltration trenches, infiltration galleries, and other subsurface infiltration structures used for permanent stormwater treatment facilities in areas with natural high infiltration rates. These types of subgrade infiltration facilities will collectively be known as drywells by this document. Drywells provide either stormwater quality treatment or stormwater detention by collecting surface stormwater runoff, temporarily storing it underground, and then discharging it primarily through infiltration into the surrounding soils. Drywells vary in form and include underground concrete structures, trenches or other excavations filled with granular material.

2.0 Purpose

The purpose of drywells is to provide stormwater quality treatment or stormwater detention through temporary subsurface storage and subsequent infiltration into surrounding soils. Drywells are typically selected for single family homes, small or constrained sites, and steep sites. On sites where space and topography permits, above ground detention and water quality facilities are preferred over drywells for ease of inspection and maintenance.

3.0 Drywell Advantages

1. Utilize the typically highly permeable soils in Breckenridge to provide groundwater recharge
2. Meet the stormwater detention and permanent water quality requirements of Chapter 6
3. Filter contaminants through filtration
4. Utilize site area efficiently
5. Provide environmental benefits by augmenting low flows in streams and reducing the thermal impacts of above ground detention facilities

4.0 Drywell Disadvantages

1. Susceptible to clogging and reduced infiltration rates
2. Difficult to inspect and maintain, increasing the potential for clogging or reduced performance
3. Risk being neglected because they are not readily visible, reducing maintenance frequency
4. Create potential for groundwater contamination issues
5. Require pretreatment to reduce high sediment loads quickly reducing infiltration capacity

5.0 Site Suitability

Drywells are not suitable for all sites where they may have negative impacts to other structures and properties. Drywells will not meet the requirements of Chapter 6 or function adequately for their full life cycle unless the site and the drywell meet certain requirements. Drywells and sites must meet the following criteria to be allowable as detention or stormwater treatment facilities:

1. Area draining to the drywell must be less than one acre.
2. A pretreatment facility is required upstream of the drywell.
3. Existing soils must be hydrological group A or B and infiltration must be at least 1 inch per hour as tested at the proposed elevation of the bottom of the drywell.

4. Drywells must be located at least 10 feet from building foundations or other structures, at least 10 feet from water lines and at least 100 feet from water source wells.
5. Drywells must be located at least 300 feet from an active waterway.
6. Drywells must be located a sufficient distance (at least 25 feet) from wetlands and other sensitive areas to prevent harmful effects.
7. Runoff draining to the drywell must not be contaminated with pollutants other than sediment. Runoff exposed to other pollutants such as oils, fuels, detergents, industrial or agricultural chemicals, etc. may not drain to a drywell.
8. Bottom of drywell shall be at least 3 feet above the seasonally high groundwater as measured by a geotechnical investigation.

6.0 Design

The following design guidelines are typical standards required for drywell design. Special site conditions may lead to additional requirements as determined by the Town Engineer. Each drywell design, ~~except those used for an individual single family home site,~~ shall be designed and stamped by a Colorado Licensed Professional Engineer. ~~Drywells for an individual single family home, which primarily receive runoff from foundation and roof drains, are exempted from several of the requirements below.~~ Drywells serving multiple single family homes are not exempt from the requirements.

7.0 Infiltration Test

Testing shall be conducted by a geotechnical engineer on the site to determine infiltration rates and soil types at the location and depth of the proposed drywells. Infiltration tests shall be conducted at a minimum of every 75 feet for infiltration trenches. The lowest infiltration rate shall be used for design. Drywells for single family home sites may be exempt from an infiltration test; however, soils shall be analyzed from soils reports and other sources to evaluate their suitability to infiltrate runoff. Single family homes may be exempted from the infiltration test requirement if the drywell only receives water from roof drainage and foundation drains.

8.0 Pretreatment

Drywells cannot receive stormwater that has not been pretreated, unless the only source of the stormwater is roof runoff and/or foundation drainage. Pretreatment is required to allow coarse sediment and trash to settle out and prevent premature clogging and failure of drywell. Examples of pretreatment include forebays, concrete manholes with BMP snout and bioskirt, sediment basins, and vegetated buffer strips. Single family home sites are exempt from pretreatment. Single family homes are exempted from the pretreatment requirement if the drywell only receives water from roof drainage and foundation drains.

9.0 Depth and Location

Drywells shall be located at least 10 feet from building foundations and 100 feet from water wells. The bottom of each drywell shall be at least 9 feet below the surface or extend to clean cobble rock without fines (minimum rock size greater than 2 inches in diameter) -to prevent freezing during winter.

10.0 Design Details

Drywells designs vary widely and include concrete manholes without a bottom and drain holes in the walls, excavated pits backfilled with clean rock, linear trenches backfilled with clean rock, and



underground perforated pipes surrounded by a clean aggregate layer. [An engineered drywell detail shall be designed and submitted for all installations, including single family homes.](#) Below is a list of design considerations for various drywells:

1. Drywells in areas receiving vehicular traffic shall be HS-20 rated.
2. Drywell manholes shall have 24-inch inlet grates. If grates are located near a roadway or pedestrian area, the grate shall meet AASHTO bicycle and ADA guidelines.
3. Drywell manholes shall be backfilled outside the structure with 1.5-inch to 3-inch crushed and washed stone with a minimum of 40% porosity for a minimum distance of 18 inches.
4. Drywell manholes shall contain perforations with a 1-inch minimum diameter and shall not have a bottom.
5. Trenches shall be backfilled with 1.5-inch to 3-inch crushed and washed stone with a minimum of 40% porosity.
6. Trenches may have filter fabric installed 12 inches below surface to assist with maintenance.
7. Filter fabric shall not be installed at the bottom of drywells.
8. A 6-inch to 12-inch sand layer shall be installed under the bottom of drywells if infiltration rates exceed 4 inches per hour or if the drywell is installed near a sensitive area, such as wetlands, the Blue River, perennial streams, or Cucumber Gulch PMA.
9. Overflow outlets are required to convey flows that exceed the capacity of the drywell. Overflow outlets shall convey runoff to a swale or storm sewer and shall be designed to prevent erosion and damage to neighboring properties.

11.0 Volume

The appropriate WQCV or detention volume shall be calculated using the guidance in Chapter 6. A factory of safety of 1.5 shall be applied to the calculated volume to account for clogging and reductions in the infiltration rate. Drywells shall be designed to infiltrate the entire design volume within 72 hours.

12.0 Maintenance

An Operations and Maintenance Plan (O&M Plan) shall be submitted that meets the requirements of Chapter 6. Minimum requirements include:

- Drywells shall not be placed in service until construction is complete and revegetation of the site is established.
- Drywells shall be inspected and maintained annually for sediment and debris.
- Drywells shall be inspected after storms exceeding 1 inch to ensure it is functioning properly and that no water is ponding above the drywell.
- Pretreatment facilities shall be inspected twice annually and sediment and debris shall be removed.
- If a drywell clogs or fails, complete rehabilitation is required to restore storage capacity and infiltration rates.

TOWN OF BRECKENRIDGE, COLORADO
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION
ROAD AND BRIDGE CONSTRUCTION SPECIFICATIONS

GENERAL STATEMENT

Sections 100 through 717 of the Standard Specifications for Road and Bridge Construction, 2022 edition, or most recent version, published by the Colorado Department of Transportation (CDOT), State of Colorado, supplemented or amended by the State and by these specifications, shall govern all road and bridge construction work within Town jurisdiction or ownership. In cases of conflict between the CDOT specifications and other specifications, the supplements and amendments listed below or in the project Special Provisions shall govern. The Special Provisions (if any) contained in the Bid Documents shall have precedence over all other specifications.

When a reference is made to ASTM, AWWA, AASHTO, or other specifications or methods, it shall be understood to mean the latest edition or revision of said specification as amended and issued at the time of the Invitation to Bid.

The Method of Measurement and Basis of Payment for the items of work specified herein and in the CDOT specifications apply only to Town of Breckenridge projects and are not required to be used on projects which are administered and paid for by private developers or other agencies. References to the Town of Breckenridge General Conditions apply only to Town of Breckenridge projects are not required to be used on private development projects.

The Method of Measurement and Basis of Payment will be based on CDOT specification except where modified in these Documents.

The current CDOT Standard Specifications for Road and Bridge Construction can be accessed here:

<https://www.codot.gov/business/designsupport/cdot-construction-specifications/2022-construction-specifications/2022-specs-book/2022-standard-specifications-book>

STANDARD SPECIAL PROVISIONS

All CDOT Standard Special Provisions published at the time of construction commencement shall apply and be included as part of these specifications.

PROJECT SPECIAL PROVISIONS

The following Project Special Provisions apply to this project and shall take precedence over specifications or plans and supplement or amend the CDOT Standard Specifications and the Town modifications listed below:

DIVISION 100

GENERAL PROVISIONS

SECTION 101: DEFINITION AND TERMS

Retain Section 101 and add the following:

Where Department, Department of Transportation, CDOT or any other reference to the Colorado Department of Transportation is used within these Specifications, replace with "Town". Any reference to CDOT engineer, personnel, or form shall be replaced with the appropriate Town engineer, personnel, or form. Town Engineer refers to the Town of Breckenridge Town Engineer or Town Engineering Representative selected by the Town Engineer. Where these Specifications reference Section 100, replace with "Town of Breckenridge General Contract Conditions."

101.01 Abbreviations. Add the following abbreviations:

CAPA	Colorado Asphalt Pavement Association
HMA	Hot Mix Asphalt
SSFRB	Town of Breckenridge Standard Specifications for Road and Bridge Construction (latest edition)
TEDS	Transportation Engineering Design Standards (latest edition)
QAT	Quality Assurance Technician

101.02 Definitions, alphabetically

ADD or REVISE Definitions as Follows:

Award. REPLACE "Department" WITH "Town".

Bidder. In the CDOT definition REPLACE "Department" WITH "Town".

CDOT Resident Engineer. DELETE in its entirety and REPLACE WITH: "Town Engineer".

Contract. DELETE in its entirety. See definition in the *Town General Contract Conditions*.

Contract Modification Order. DELETE in its entirety. See "change order" definition in the *Town General Contract Conditions*.

Contract Time. DELETE in its entirety. See definition in the *Town General Contract Conditions*.

Contractor. DELETE in its entirety. See definition in the *Town General Contract Conditions*.

Department. REVISE to read: "Department of Public Works, Town of Breckenridge, Colorado."

Engineer. DELETE in its entirety and REPLACE WITH "The Project Engineer, who may be a Town employee or hired consultant who has been appointed or authorized by the Town to oversee the technical aspects of the work and to administer the Contract on behalf of the Town. The term "Engineer" may also apply to a Professional Engineer hired by a developer to design and/or administer the construction of public infrastructure in accordance with a development approved by or contracted for/or with the Town."

Force Account Work. REVISE to read: "Work paid for on the basis of actual costs plus approved additives, in accordance with the General Contract Conditions."

Laboratory. REVISE to read: "Any testing laboratory designated by the Engineer."

Planned Force Account. DELETE in its entirety.

Plans. REPLACE "Department" WITH "Town".

Pre-construction Conference. DELETE in its entirety. See definition in the *Town General Contract Conditions*.

Project. DELETE in its entirety. See definition in the *Town General Contract Conditions*.

Project Engineer. REPLACE "Chief Engineer's" WITH "Town's". REPLACE "CDOT" WITH "Town".
REPLACE "Resident" with "Town."

Proposal Form. REVISE to read: "The documents furnished by the Town on which the offer of a bidder is submitted. Also called Bid Proposal or Bid Form."

Proposal Guaranty. REVISE to read: "Bid guaranty as defined in the *Town General Contract Conditions*."

Region Transportation Director. DELETE in its entirety.

Shop Drawings. DELETE in its entirety. See definition in the *Town General Contract Conditions*.

Specifications. DELETE in its entirety. See definition in the *Town General Contract Conditions*.

State. DELETE and replace with Town of Breckenridge acting through its authorized representative.

Supplemental Specifications. DELETE in its entirety. See definition of Supplementary Conditions in the *Town General Contract Conditions*.

TOWN. Town of Breckenridge, Colorado.

Work. DELETE in its entirety. See definition in the *Town General Contract Conditions*.

Workplace Violence. REPLACE "CDOT" WITH "Town".

SECTION 102: BIDDING REQUIREMENTS AND CONDITIONS

Retain Section 102.03

DELETE and REPLACE remainder of Section 102 with the Town of Breckenridge, General Contract Conditions.

SECTION 103: AWARD AND EXECUTION OF CONTRACT

DELETE and REPLACE with the Town of Breckenridge, General Contract Conditions.

SECTION 104: SCOPE OF WORK

DELETE and REPLACE with the Town of Breckenridge, General Contract Conditions.

SECTION 105: CONTROL OF WORK

DELETE and REPLACE with the Town of Breckenridge, General Contract Conditions.

SECTION 106: CONTROL OF MATERIAL

DELETE and REPLACE with the Town of Breckenridge, General Contract Conditions.

SECTION 107: LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

DELETE and REPLACE with the Town of Breckenridge, General Contract Conditions.

SECTION 108: PROSECUTION AND PROGRESS

DELETE and REPLACE with the Town of Breckenridge, General Contract Conditions.

SECTION 109: MEASUREMENT AND PAYMENT

109.01 RETAIN and ADD: "Measurement and payment shall be made per the contract and technical specifications. The contractor shall be responsible, in the presence of the Owner, or Owner's representative, for verifying all measurements and quantities required for payment by the unit price method. Contractor shall provide necessary equipment, workers, and survey personnel as required for measurements.

Payment shall not be made for defective work and rejected work.

Items paid by Lump Sum shall not be measured. Unit price shall include all costs to complete all work shown in plans, regardless of whether all items are written in work description.

Quantities stated in the contract are estimated quantities only and it is understood the actual quantities in the field may vary from those estimated. Actual quantities will be measured in the field, unless specified otherwise in the bid item descriptions. Work required in this section includes all expenses to complete the individual bid items per the plans and specifications. Unit bid prices, as quoted in the bid schedule, shall constitute full compensation for materials, labor, equipment, rentals, permits, overhead, profit, incidentals, risk, loss, damage, and all other items of work and expense required for the complete construction of each pay item per the plans and specifications. Any items or like item not specifically mentioned as a bid item is considered incidental to the project and all costs associated with these items must be included in the bid items listed."

DELETE and REPLACE remainder of Section 109 with the Town of Breckenridge, General Contract Conditions.

DIVISION 200

EARTHWORK

SECTION 201: CLEARING AND GRUBBING

- 201.02 DELETE the first paragraph of 201.02 and replace with “The Contractor shall meet with Town Representative and designate all trees, shrubs, and plants to be removed. Every object not designated for removal shall be protected by Contractor. Any object not designated for removal that is damaged shall be repaired or replaced as directed at the Contractor’s expense.”

ADD: “Trees designated to be cleared, removed or limbed shall be the property of the Contractor.

As the property of the Contractor, all cleared stumps, roots, willows, shrubs, and limbs shall be disposed of by the Contractor.

Hand grubbing may be required in roadway sections to ensure that no organic materials will be present in the road section.

Any tree, shrub, or other object that is designated to remain and is damaged shall be repaired or replaced as directed by the Town Engineer, at the Contractor’s expense. All surface objects, trees, stumps, roots, and other protruding obstructions not designated to remain shall be cleared and grubbed, including mowing, as required. Undisturbed stumps, roots, and nonperishable solid objects located two feet or more below subgrade or embankment slope may remain in place. Except in areas to be excavated, all holes resulting from the removal of obstructions shall be backfilled with suitable material and compacted. No material or debris shall be disposed of within the project limits. Branches or shrubs shall be removed as directed. All trimming shall be done in accordance with good tree surgery practices, and Town of Breckenridge direction.”

SECTION 202: REMOVAL OF STRUCTURES AND OBSTRUCTIONS

- 202.02 ADD: “Excess material generated by the installation of the drains, sewers and water mains shall be removed and disposed of by the Contractor. Final grade at the trenches shall match subgrade of the road reconstruction.” This work shall be incidental of paying for installation services.
- 202.03 ADD: Any salvable material, including signs, sign poles, street light poles, luminaires, hydrants, and other materials shall be hauled and delivered by the Contractor to Town’s Public Works Yard at 1095 Airport Road. The Town Representative shall determine if materials encountered during the work are salvable and whether the Town desires to keep the material. The Town reserves the right to retain ownership of any materials encountered, including boulders, excavated material, gold, historic materials, and any other materials, artifacts, or equipment encountered.
- 202.07 ADD: New concrete shall match existing concrete. The vertical difference between new and existing concrete shall be less than 1/16”. The Contractor shall grind existing concrete where needed to provide a smooth transition with no vertical differences greater than 1/16”. Existing concrete shall be doweled into new concrete.
- 202.09 ADD: “Milling is the same operation as planing.

The designated asphalt shall be removed and disposed of by the Contractor.

Irregularities and distresses on the milled or unfinished surface, such as, but not limited to, delamination, raveling, and potholes that are identified by the Project Manager shall be

repaired as soon as possible. Asphalt identified by the Town Engineer as distressed after milling shall be removed and patched as directed by the Town Engineer. Additional patching shall be paid separately. Milled surfaces shall be drivable and shall not have any vertical drops (temporary asphalt shall be tapered at edges of milled areas). Milled edges shall be clean vertical faces and may require re-milling, saw cutting, or other methods to reestablish vertical edges prior to paving.

New asphalt shall match existing asphalt. The vertical difference between new and existing asphalt shall be less than 1/16". The contractor shall grind existing asphalt pavement where needed to provide a smooth transition with no vertical differences greater than 1/16".

SECTION 203: EXCAVATION AND EMBANKMENT

203.06 DELETE the first paragraph of Section 203.06 and REPLACE with the following:

"When Contractor Process Control is required, the Contractor's Process Control Representative shall be certified with CDOT's Excavation, Embankment, and Soil Inspection certification course."

DELETE the third paragraph of Section 203.06 and REPLACE with the following

"Unless a thickness is otherwise specified in the Contract, the upper 3 inches of the ground surface will be considered topsoil and shall be removed in accordance with Section 207 prior to placement of embankment fill."

203.12 DELETE Pay Item "Blading", "Dozing", and "Proof Rolling". Costs of Blading, Dozing, and Proof Rolling shall not be paid separately. All costs associated this work shall be included in Unclassified Excavation and Embankment Material unit costs.

SECTION 206: EXCAVATION AND BACKFILL FOR STRUCTURES

206.06 DELETE paragraph (b) and replace with the following:

For pipes, a profile will be made along the bottom of the center line extending 18 inches beyond the end of the structure, including end sections. Material excavated between this profile and existing grade will not be measured for payment but shall be included in the pipe unit cost. Backfill placed between the pipe profile and the existing grades will not be measured for payment but shall be included in the pipe unit cost. In embankment sections, fill placed above the existing ground will be paid through the embankment unit cost.

206.07 Delete pay item "Bed Course Material" and "Filter Material". All costs of bed course material and filter material shall be included in the unit cost of the pipe/structure.

SECTION 207: TOPSOIL

RETAIN all sections.

SECTION 208: EROSION CONTROL

208.03 ADD the following:

"The Town Engineer may combine the Environmental pre-construction conference with the project pre-construction meeting"

208.04 DELETE paragraph (c)

208.12 DELETE section in its entirety and replace with the following:

"Erosion Control items will not be paid separately but shall be paid as a Lump Sum. The Erosion Control unit cost shall include all equipment, materials, labor, and other costs to complete all erosion control shown on the plans and to comply with Town and CDPHE standards. Unit cost shall include wattles, silt fence, aggregate bags, erosion logs, vehicle tracking pads, inlet protection, concrete washouts, sweeping, and all other work required."

SECTION 209: WATERING AND DUST PALLIATIVES

209.07 ADD the following:

"Water will be provided by the Town of Breckenridge Water Division through its bulk water station at 1095 Airport Road, Breckenridge, CO or through a hydrant near the site. If an on-site hydrant is to be used, a hydrant valve and meter shall be obtained from the Town of Breckenridge Water Division. The Contractor will be responsible for obtaining a meter and all paperwork from the Water Division. Water will be metered. Payment shall not be made separately for water.

209.08 DELETE "Water" and "Water (Landscaping)" pay items. Water will not be paid for separately but shall be included in the cost of the work.

SECTION 210: RESET STRUCTURES

210.10 ADD the following:

The Contractor shall replace all valve boxes, manholes, and other structures damaged during construction at the cost of the Contractor. Contractor shall remove and clean any debris that enters valve boxes and manholes during construction.

210.13 ADD the following:

Payment will be made under:

Pay Item	Pay Unit
Adjust Valve Box/ Manhole	Each

Adjustments that include adding, removing, or replacing a manhole cone or barrel section will be paid for under the Section 210 pay item, Modify Manhole.

Cleaning designated valve boxes will be paid for under the Section 202 pay item, Clean Valve Box.

ADD the following section immediately after 210.13:

210.14 Heated Pavement Systems. Heated pavement systems, also referred to as snowmelt systems, damaged or modified from construction, shall be reset and repaired by Contractor. Contractor shall place two layers of welded wire fabric, 25 psi insulation, pex tubing, expansion joint and dowels at connection to existing. Contractor shall charge the system with glycol, pressure test for 24 hours and complete all other concrete and mechanical work required. If the snowmelt system is required to be modified per the contract documents, the work will be paid under repair snowmelt system or heated pavement pay item. If the Contractor damages a snowmelt system not intended for removal, repair, or modification per the contract documents, the Contractor shall be responsible

for all costs of repair. The Contractor shall be responsible for the following mechanical requirements:

1. PEX tubes shall be spliced and pressure tested for a minimum of 24 hours by a licensed mechanical contractor.
2. Pressure test shall be at least 1.5 times operating pressure and 100 psi minimum.
3. Piping and splices shall be per Town Building Code and current edition of International Mechanical Code.
4. Town Engineering and Town Building Divisions to inspect splices and pressure test.
5. Insulation and welded wire fabric to be installed beneath tubing.
6. Snowmelt system to be under pressure during placement and cure of concrete.

SECTION 212: SEEDING, FERTILIZER, SOIL CONDITIONER, AND SODDING

212.05 ADD the following at the end of paragraph (a):

“6” of approved topsoil shall be placed on the prepared ground prior to placing any sod.”

212.06 ADD the following at the end of paragraph (a):

“3” minimum of approved topsoil shall be placed on the prepared ground prior to planting native grass.”

SECTION 213: MULCHING

213.03 ADD the following to paragraph (e):

Wood chip mulch shall be a natural, non-stained, shredded cedar mulch. Non-plastic weed control fabric, 5 oz minimum weight, shall be installed beneath the mulch and included in the unit cost of the mulch.

SECTION 214: PLANTING

214.02 ADD the following:

After delivery of plant material, the Contractor shall contact the Engineer for approval of all plant material. The Contractor shall remove and replace rejected materials immediately from the site at their expense.

214.03 ADD the following to paragraph (a):

Installation of plant materials will not be permitted until earthwork, topsoil and adjacent site improvements are substantially complete.

ADD the following to the end of section 214.03:

No trees shall be removed from the project site until marked for removal with Town Representative. All new landscaping, including trees, shrubs, grass, perennials, and mulch, shall be marked with flags or marking paints and approved by Town Representative prior to planting.

Contractor shall implement weed control measures to prevent and remove weed growth from all disturbed areas throughout the establishment period. Weed control measures may include the following:

- i. Watering topsoil prior to seeding and applying acceptable herbicides to topsoil prior to planting
- ii. Installation of weed control barriers in mulch beds
- iii. Application of localized herbicides to eliminate weed growth
- iv. Mechanical removal of weeds

214.04 DELETE “Establishment period begins immediately and lasts a period of 12 months” and replace with:

”The establishment period shall be two years, or the duration of time from installation until all plant material maintains a healthy and vigorous growing condition, whichever is greater. The warranty period for plantings shall equal the establishment period.”

REPLACE paragraph (1) with the following:

- (1) “Watering in Irrigated Areas. Trees and shrubs planted at all locations on the project shall be watered within four hours of planting and then daily for the first month. After the first month, trees and shrubs shall be watered twice a week until the end of the establishment period. Between the months November through April, watering is not required.”

214.06 DELETE Pay Item “Landscape Maintenance” and add the following:

Landscape maintenance and all associated costs for the establishment period per Section 214 shall be included in the tree, shrub, perennial, or other individual landscape pay item.

SECTION 215: TRANSPLANTING

RETAIN all sections.

SECTION 216: SOIL RETENTION COVERING

RETAIN all sections.

SECTION 217: HERBICIDE TREATMENT

RETAIN all sections.

SECTION 250: ENVIRONMENTAL, HEALTH AND SAFETY MANAGEMENT

RETAIN all sections.

DIVISION 300

BASES

SECTION 304: AGGREGATE BASE COURSE

304.04 DELETE AND REPLACE with: "Following utility construction, base materials shall be placed to the minimum depth as shown on the plans. If the required compacted depth of the aggregate base course exceeds 6 inches, it shall be constructed in two or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches. When vibratory or other approved types of special compacting equipment are used, the compacted depth of a single layer may be increased to 8 inches upon approval of TOB representative, provided that specified density is achieved.

SECTION 306: RECONDITIONING

RETAIN all sections.

SECTION 307: LIME TREATED SUBGRADE

307.04 DELETE and REPLACE the first sentence of the first paragraph so that it reads: "The Contractor shall construct one or more compacted courses of treated material, to the depth specified in the Contract and/or Construction Drawings."

307.12 REPLACE Table 307-1 with the following:

Table 307-1

SCHEDULE FOR MINIMUM SAMPLING AND TESTING

In Place Soil Density and Moisture Content	AASHTO T 191 ASTM D 2167	One test for each 1,000 square yards (not less than one test per day).
	AASHTO T 239 AASHTO T 238 ASTM D 2216 AASHTO T 191 and ASTM D 2216	Shall be performed every tenth nuclear method density test
Atterberg Limits	AASHTO T89 & T90	One test per 2,000 tons
Moisture-Density	AASHTO T180	One test per soil type Relationships
Gradation	AASHTO T27 and T11	One test per 2,000 tons
Thickness		One test per 5,000 square yards
Resilient Modulus	AASHTO T 294	Upon request by the Agency

SECTION 308: MECHANICAL STABILIZED SUBGRADE

DESCRIPTION

308.01 Item includes mechanically stabilized subgrade of base, subbase course and/or subgrade improvement in the construction of paved or unpaved roadways. Design details for geogrid reinforcement, such as geogrid type, fill thickness, pavement cross-section and associated details, shall be as shown on the contract drawings. Work consists of:

A. Purpose

The purpose of the work shall be to provide a stabilized paving platform section on which paving materials can be placed. This Item shall not be used to retain moisture in subgrades unless retaining moisture in the section can be assured. This specification shall be used for a construction platform and not as a means of mitigating swell.

MATERIALS

308.02. Definitions

Mechanically Reinforced: Placement of a geogrid immediately over a soft subgrade soil in order to improve the bearing capacity and mitigate deformation of the subgrade soil. The goal of this application may be to reduce deeper excavation requirements, improve construction efficiency, reduce the amount of aggregate subbase or base material required, provide a stiff working platform for pavement construction, or combination of these.

Geogrid: A biaxial polymeric grid formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth to function primarily as reinforcement.

Multi-Layer Geogrid: A geogrid product consisting of multiple layers of grid which are not integrally connected throughout.

Extruded Geogrid: A geogrid product formed by extrusion of a polypropylene or polypropylene/polyethylene copolymer sheet followed by its perforation with a precise arrangement of holes and subsequent stretching, or drawing, into the finished product.

Woven Geogrid: A geogrid product formed by weaving discrete strips of polymer into a network. These geogrids usually require a protective coating to protect the polymer from pre-mature degradation.

Minimum Average Roll Value (MARV): Value based on testing and determined in accordance with ASTM D4759-92.

True Initial Modulus in Use: The ratio of tensile strength to corresponding zero strain. The tensile strength is measured via ASTM D6637 at a strain rate of 10 percent per minute. Values shown are MARVs. For multi-layer geogrid products, rib tensile testing shall be performed on the multi-layer configurations, as prescribed by ASTM D6637

Junction Strength: Breaking tensile strength of junctions when tested in accordance with GRI-GG2 as modified by AASHTO Standard Specification for

Highway Bridges, 1997 Interim, using a single rib having the greater of 3 junctions or a minimum 8-inch machine direction sample and tested at a strain rate of 10 percent per minute based on this gauge length. Values shown are MARVs. For multi-layer geogrid products, junction strength testing shall be performed across junctions from each layer of grid individually, and results shall not be assumed as additive from single layers to multiple layers.

Flexural Stiffness (also known as Flexural Rigidity): Resistance to bending force measured via ASTM D1388-96, Option A, using specimen dimensions of 864 millimeters in length by 1 aperture in

width. Values shown are MARVs. For multilayer geogrid products, flexural stiffness testing shall be performed directly on the multi-layer configuration without using any connecting elements other than those used continuously throughout the actual product, and results shall not be assumed as additive from testing performed on a single layer of the multi-layer product.

Aperture Stability Modulus (also known as Torsional Rigidity or Torsional Stiffness): Resistance to in-plane rotational movement measured by applying a 20 kg-cm (2.0 m-N) moment to the central junction of a 9-inch by 9-inch specimen restrained at its perimeter. Values shown are MARVs. For multi-layer geogrid products, torsional stiffness testing shall be performed on each layer of grid individually, and results shall not be assumed as additive from single layers to multiple layers.

Granular Fill Material: The preferred gradation for base reinforcement application is well-graded crushed aggregate fill with a maximum particle size (100 percent passing) of 1 ½ inches, and less than 10% fines (passing the #200 sieve). Recycled concrete may be used as granular fill to stabilize subgrade. Recycled concrete shall have a sulfate content of less than 3000 ppm. Recycled concrete shall be mixed and placed per the contract documents or the guidance of the project geotechnical engineer.

308.03 Manufacturers. All manufacturers will be considered provided they meet the submittal process as per Item 6.6 and per Table 308.04 (All values are minimum average roll values unless a range or characteristic is indicated):

308.04 Geogrid Material Properties

A. Structural Soil Reinforcement Geogrid: The geogrid shall be integrally formed and deployed as a single layer having the following characteristics according to Table 308.04

Table 308.04

Property	Test Method	Units	Type 1	Type 2
Aperture Stability Modulus at 20 cm-kg (2.0 m-N)	Kinney (2001)	m-N/deg	0.32	0.65
Rib Shape	Observation	N/A	Rectangular or Square	Rectangular or Square
Rib Thickness	Calipered	In	0.03	0.05
Nominal Aperture Size	I.D. Calipered	In	1.0 to 1.5	1.0 to 1.5
Junction Strength	GRI-GG2-2000 ¹	ratio	NOTE 1	NOTE 1
Flexural Rigidity	ASTM D1388-96 ²	Mg-cm	250,000	750,000
Minimum Tensile Strength @ 2% Strain:	ASTM D6637-01 ⁴			
- MD ³		Lb/ft	280	410
- CMD ³		Lb/ft	450	620
Minimum Tensile Strength @ 5% Strain:	ASTM D6637-01 ⁴			
- MD ³		Lb/ft	580	810
- CMD ³		Lb/ft	920	1,340

NOTES:

1. The ratio of Junction Strength/Ultimate Tensile Strength must meet or exceed 75%.
2. Resistance to bending force measured via ASTM D-5732-95, using specimens of width two ribs wide, with transverse ribs cut flush with exterior edges of longitudinal ribs (as a "ladder"), and of length sufficiently long to enable measurement of the overhang dimension.
3. MD = machine direction (along roll length); CMD = cross-machine direction (across roll width).
4. True resistance to elongation when initially subjected to a load determined in accordance with ASTM D6637 without deforming test materials under load before measuring such resistance or employing "secant" or "offset" tangent methods of measurement so as to overstate tensile properties.

B. Geotextile materials shall not be considered as an alternate to geogrid materials for subgrade improvement or base or sub-base reinforcement applications. A geotextile may be used in the cross-section to provide separation, filtration or drainage; however, no structural contribution shall be attributed to the geotextile.

308.05 Execution

A. Examination

The CONTRACTOR shall check the geogrid upon delivery to verify that the proper material has been received. The geogrid shall be inspected by the CONTRACTOR to be free of flaws or damage occurring during manufacturing, shipping, or handling.

308.06 Delivery, Storage, and Handling

A. Storage and Protection

Prevent excessive mud, wet concrete, epoxy, or other deleterious materials from coming in contact with and affixing to the geogrid materials.

Store at temperatures above -20 degrees F (-29 degrees C).

Rolled materials may be laid flat or stood on end.

Geogrid materials should not be left directly exposed to sunlight for a period longer than the period recommended by the manufacturer (as per ASTM D4355).

B. Preparation

The subgrade soil elevation shall be prepared at the proper elevation and alignment as directed by the engineer or as indicated on the construction drawings.

C. Installation

The geogrid shall be installed in accordance with the installation guidelines provided by the manufacturer or as directed by the engineer.

The geogrid may be temporarily secured in place with ties, staples, pins, sand bags or backfill as required by fill properties, fill placement procedures or weather conditions or as directed by the engineer.

D. Granular Fill

Compaction – Standard compaction methods may be used unless the soils are very soft. In these cases, static instead of vibratory compaction is prudent, particularly over silty subgrades.

Compaction is then achieved using a light roller. Keeping fill moisture content near optimum will make compaction more efficient. Water spray is most effective with sand fill. Compact aggregate fill to project specifications, after it has been graded smooth and before it is subject to accumulated traffic.

Vehicle Operation Over Geogrids- A minimum loose fill thickness of 6 inches is required prior to operation of vehicles over the geogrid. Turning of vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid. When underlying substrate is trafficable with minimal rutting, rubber-tired equipment may pass over the geogrid reinforcement at slow speeds (less than 10 mph) when integrally-formed geogrids are used.

This shall not be allowed with coated geogrids and sharp turning movements shall be avoided.

E. Inspection

The owner or owner's representative may randomly inspect geogrid before, during and after (using test pits) installation.

Any damaged or defective geogrid (i.e. frayed coating, separated junctions, separated layers, tears, etc.) will be repaired/replaced in accordance with Item 308.06F.

F. Repair

Any roll of geogrid damaged before, during and after installation shall be replaced by the CONTRACTOR at no additional cost to the OWNER.

Proper replacement shall consist of replacing the affected area adding 3ft (1m) of geogrid to either side of the affected area.

308.07 Submittals

A. Submittal Procedure – 30 days prior to Notice to Proceed.

1. Submit geogrid product sample approximately 4 inches by 7 inches or larger three days prior to installation.

2. Submit geogrid product data sheet, certification, and/or independent full scale laboratory testing from the manufacturer that the geogrid product supplied meets the requirements of Table 6.4-1
3. Submit manufacturer's installation instructions and general recommendations.
4. A list of 5 comparable projects that are similar in terms of size and application, within the state of Colorado, and where the results of using the specific geogrid material can be verified after a minimum of 1 year of service life.
5. Additional information as requested by the engineer to fully evaluate the product.

B. Quality Assurance

Pre-Construction Conference - Prior to the installation of the geogrid, the CONTRACTOR shall arrange a meeting at the site with the geogrid material supplier and, where applicable, the geogrid installer. The OWNER and the ENGINEER shall be notified at least 3 days in advance of the time of the meeting. A representative of the geogrid supplier shall be available on an "as needed" basis during construction.

308.08 Construction Platform Design

Construction platform design shall be performed under supervision of and signed by a Professional Engineer registered in the State of Colorado. The recommended procedure shall be derived by the Giroud-Han, Method (ASCE, August 2004).

Appropriate partial safety factors shall be applied to results obtained using geogrids having properties or characteristics outside the range of rigorous model validation (Giroud and Han, 2004). This method has been endorsed by numerous Departments of Transportation and Government Agencies such as the Federal Highway Administration and Army Corps of Engineers.

For general guidance purposes only, Table 308.08-1 and 308.08-2 present a guide for estimating subgrade soil strength and minimum construction platform recommendations based on a range of subgrade strengths, respectively. A piping ratio analysis(D15fill/D85subgrade) shall be performed to determine the need of a separation fabric. If the piping ratio is less than 5 then no separation fabric is required. If the piping ratio is greater than 5 then a separation fabric is required below the geogrid. Final determination of construction platform shall be approved by the engineer.

Table 308.08-1

Guide for Estimating Subgrade Soil Strengths (Fine Grained Soils)

Estimate Consistency by:		Test by:				Correlates to:			
Feel	Equipment/Visual	Standard Penetration Test (blows/ft)	Dynamic Cone Penetrometer (mm/blow)			Shear Strength c_u		R Value	CBR
			SC, SM, SP	CL	CH	(kPa)	(tsf)		
Very Soft	Man standing sinks > 3"	< 2	—	—	—	< 12	< 0.125	—	< 0.4
Soft	Man walking sinks ≈ 2 - 3"	2 - 4	—	—	—	12 - 24	0.125 - 0.25	< 0.36	0.4 - 0.8
Medium	Man walking sinks ≈ 1"	4 - 8	—	> 66	—	24 - 48	0.25 - 0.50	0.36 - 2.5	0.8 - 1.6
Stiff	Pickup truck ruts ≈ 1/2 - 1"	8 - 15	> 100	66 - 46	—	48 - 96	0.50 - 1.0	2.5 - 6.8	1.6 - 3.2
Very Stiff	Loaded dump truck ruts ≈ 1 - 3"	15 - 30	100 - 56	46 - 33	> 109	96 - 193	1.0 - 2.0	6.8 - 15.5	3.2 - 6.4
Hard	Insignificant rutting by loaded dump truck	> 30	56 - 27	33 - 23	109 - 54	> 193	> 2.0	> 15.5	> 6.4

References: After Portland Cement Association, E.I. Dupont Literature and McCarthy, David F., "Essentials of Soil Mechanics and Foundations," 1977, and Tensar 1998. Webster, Personal Communication 2001, "DCP vrs. CBR Correlations". AASHTO, "1993 Guide for Design of Pavement Structures," Van Till et. al. NCHRP 128.

Table 308.08-2

Recommended Aggregate Fill Thickness Feel / CBR Value with Geogrid Mechanical Reinforcement				
Soil Strength ¹	CBR	Aggregate Fill Thickness (in.) ²		
Feel	approx.	Type 1 Geogrid ³	Type 2 Geogrid ³	Unreinforced
Very Soft	< 0.4	37"	34"	52"
Soft	0.6	30"	26"	42"
Medium	1.2	20"	16"	29"
Stiff	2.5	14"	9"	22"
Very Stiff	4	12"	6"	20"

Notes:

1. Soil Strength is based in Table 308.08-1. The soil strength used is general for these purposes.
2. Results of aggregate fill thickness were derived using the published Giroud-Han (2004) Methodology. Average values for fill thickness are used. Aggregate fill was assumed to have a minimum R-value of 30.
3. Type 1 and Type 2 geogrid structural properties used were a minimum as derived from Table 308.04-1.

308.09 Payment. Payment shall be made at the contract unit price per square yard based upon plan quantities for the stabilization. The price shall be full compensation for furnishing all material and for all preparation of the subgrade, delivering, installation, and incidentals necessary to complete this item. Paving platform found deficient shall be removed and replaced. At the option of the TOWN, the

pavement structural section shall be adjusted to compensate for any deficiency in the paving platform thickness and strength at the CONTRACTOR's expense as noted in Item 308.06F. Granular fill will be paid for at the contract unit price per cubic yard. Unit price will be held constant regardless of deviation from actual quantities.

308.10 Wicking Geotextile

A. Submittals. Submit the following:

1. Certification: The contractor shall provide to the Engineer a certificate stating the name of the manufacturer, product name, style number, and chemical composition of the filaments or yarns and other pertinent information to fully describe the geotextile. The Certification shall state that the furnished geotextile meets MARV requirements of the specification as evaluated under the Manufacturer's quality control program. The Certification shall be attested to by a person having legal authority to bind the Manufacturer. Certifications from Private Label distributors will not be accepted.
2. If an alternate product is submitted full scale performance testing performed by an Independent testing Town shall be completed.
3. Coefficient of Interaction (C_i) test results performed by a lab with GRI accreditation should be provided to confirm conformance to the specified value.
4. Manufacturer's installation Guidelines shall be provided.
5. One 1' x 1' sample shall be provided.
6. Quality Standards: The contractor shall provide to the Engineer the Manufacturer's Quality Control Plan along with their current GAI-LAP and ISO 9001:2015 certificates.
7. Alternate products must be submitted to the Town 15 days prior to bid date and should include information on five similar projects in size and scope.

B. Quality Assurance

Manufacturer Qualifications:

1. The geotextile Manufacturer shall have all the following credentials:
 - a. ISO 9001:2015 Quality Management System
 - b. Geosynthetic Accreditation Institute (GAI) Laboratory Accreditation Program (LAP)
2. The geotextile Manufacturer shall have a GAI-LAP accredited laboratory at the location of production capable of performing the ASTM tests as outlined in the specification.

C. Delivery, Storage, and Handling

1. Geotextile labeling, shipment, and storage shall follow ASTM D4873. Product labels shall be color-coded to specifically identify each product and clearly show the Manufacturer's name, style name, and roll number.
2. Each geotextile roll shall be wrapped with a material that will protect the geotextile from

damage due to shipment, water, sunlight, and contaminants.

3. During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, excess temperatures, and any other environmental conditions that may damage the physical property values of the geotextile.

D. Products

1. The geotextile shall be woven from super high-tenacity polypropylene yarns in conjunction with wicking yarns with a weave pattern to maximize strength, water flow, soil interaction, wicking capabilities and soil retention. The yarns shall be from high-tenacity long-chain synthetic polymers composed of at least 95 percent by weight of polyolefins or polyamids. They shall form a stable network such that the filaments or yarns retain their dimensional stability relative to each other, including selvages.
2. Geosynthetic must be able to directionally draw water via capillary action.
3. The geotextile shall meet the requirements of Table 1. All numeric values in Table 1 except AOS represent MARV in the specified direction. Values for AOS represent maximum measured opening size.

TABLE 308.10 – SOIL STABILIZATION AND WICKING GEOTEXTILE

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Wide Width Tensile Strength	ASTM D4595	lbs/ft (kN/m)	5280 (77.0)	5280 (77.0)
Wide Width Tensile Strength @ 2% strain	ASTM D4595	lbs/ft (kN/m)	480 (7.0)	1080 (15.8)
			Maximum Opening Size	
Apparent Opening Size (AOS)	ASTM D4751	U.S. Sieve (mm)	40 (0.425)	
			Minimum Roll Value	
Permittivity	ASTM D4491	sec ⁻¹	0.4	
Flow Rate	ASTM D4491	gal/min/ft ² (l/min/m ²)	30 (1222)	
			Minimum Test Value	
Pore Size (050)	ASTM D6767	microns	85	
Pore Size (095)	ASTM D6767	microns	195	
Wet Front Movement ¹ (24 minutes)	ASTM C1559 ²	inches	6.0 Vertical direction	
Wet Front Movement ¹ (983 minutes) Zero Gradient	ASTM C1559 ²	inches	73.3 Horizontal direction	

¹ 'STP': Standard Temperature and Pressure, Tested Value

² Modified

When sewn, seams are required, refer to Manufacturer's Installation Guidelines for overlap / seam requirements.

E. Quality Control

1. Manufacturing Quality Control: Testing shall be performed at an on-site laboratory accredited by GAI-LAP for tests required for the geotextile, at frequency meeting or exceeding ASTM D4354.
2. Manufacturer's certifications and testing of quality assurance samples obtained using Procedure B of ASTM D4354. A lot size for conformance or quality assurance sampling shall be the shipment quantity of the given product or a truckload of the given product, whichever is smaller.

F. Execution. See Manufacturer's Installation guidelines provided in the submittal.

SECTION 309 FULL DEPTH RECLAMATION

ADD Section 309 Full Depth Reclamation to these specifications.

ADD the following:

DESCRIPTION

309.01 This work consists of pulverizing the existing asphalt mat and mixing the pulverized asphalt mat with the existing base course, to the specified depth, and grading and compacting the mixed material in accordance with, and at locations as shown in the Contract.

CONSTRUCTION REQUIREMENTS

309.02 The Contractor shall develop a written method to maintain the centerline geometry, profile elevations, and cross slope of the existing roadway. The plan shall be submitted to the Engineer for approval a minimum of two weeks prior to starting work. The plan shall include, but is not limited to, the following:

1. Mobilization of equipment to haul and place material
2. The estimated length of roadway (both travel lanes) that can have existing pavement structure removed, embankment cut to new elevation, and placement of Aggregate Base Course material so that the difference in elevation between lanes is 1 inch or less at the end of the work shift
3. Contractor's plan to address stabilization of soft spots
4. Contractor's method to keep the road open for two-way traffic after the pavement and/or base is removed, and before or during a major precipitation event
5. Method of Handling Traffic to be used during the operation
6. Contractor's implementation of Revision of Section 104.04 - Maintaining Traffic

Reclamation of the existing asphalt pavement shall not commence until the Contractor has an approved design mix for Hot Mix Asphalt.

The existing asphalt mat shall be cut at neat lines as shown in the plans by the use of a cutting wheel attached to a blade or by another approved method. The existing asphalt mat shall be pulverized and mixed with the existing base course to a specified depth or as directed by the Engineer, with a self-propelled rotary type mixing machine. *Optimal speed for the reclaimer shall be 11.5 feet per minute, and it shall be the responsibility of the Contractor to assure the Town this rate is not exceeded.* Deviations must be made by the Engineer in the field.

The mixing machine shall make as many passes as required to uniformly mix the asphalt and existing base course to the required thickness. Mixing of the different materials shall create a homogenous mixture. The particle size of the pulverized asphalt mat shall be a minimum of 99 percent passing the 1-1/4 inch sieve. When the addition of water is necessary for initial compaction purposes it shall be added through the mixing machine with the capability to uniformly distribute water through the mixed materials.

When proper mixing has been accomplished, the mixture shall then be bladed, shaped, wetted or dried, and rolled to meet a minimum of 95 percent of the maximum wet density determined in accordance with AASHTO T-180 Method D. The soils moisture-density curve will be developed using wet densities and the percent compaction will be calculated using wet density.

The maximum depth to be compacted in one lift is 8 inches. If the depth of the reclaimed material exceeds 8 inches, the Contractor shall remove the material in excess of 8 inches and compact the material in layers not exceeding 8 inches. Thickness will be determined in the field with the Engineer at the beginning of work.

Grading equipment used to establish the final surface elevations shall have automatic controls for transverse slope. The transverse slope controls shall be capable of maintaining the final surface within 0.1 percent of the specified slope. Variations from the subgrade plane shall not be more than ¼ inch. The work shall be maintained and tested for conformance to these requirements immediately prior to placing additional pavement layers.

The minimum quantity for acceptance testing will be based on a random schedule of 1/1000 square yards of reclaimed material. Every 5,000 square yards a verification point will be tested to confirm the accuracy of the moisture-density curve.

The maximum time a portion of the roadway will be unpaved is ten (10) working days unless otherwise specified. The exposed longitudinal joint between the existing asphalt mat and the processed mat shall not remain in place for more than one day unless approved by the Engineer. When additional aggregate base course is imported and placed before processing begins, the full width of the roadway shall be completed daily. Joint construction and maintenance shall conform to subsection 401.16.

METHOD OF MEASUREMENT

309.03 Full Depth Reclamation of Hot Mix Asphalt Pavement will be measured by the square yard of roadway treated, completed and accepted.

BASIS OF PAYMENT

309.04 The accepted quantities of Full Depth Reclamation of Hot Mix Asphalt Pavement will be paid for at the contract unit price per square yard for Full Depth Reclamation of Hot Mix Asphalt Pavement, for the depth shown in the project plans. The depth shown in the plans is based on cores obtained from the existing pavement, and the Contractor should be aware that the depth will vary and, in some locations, will be either less or more than the depth range shown in the plans. The pay item shown in the plans shall be that used for the entire project, regardless of variations discovered during construction.

Pay Item		Pay Unit
Full Depth Reclamation of Hot Mix Asphalt Pavement	SY	Square Yard

Payment for Full Depth Reclamation of Hot Mix Asphalt Pavement will be full compensation for all work necessary to complete the item including cutting of the existing asphalt mat, pulverizing the existing asphalt mat, mixing the pulverized asphalt mat into the existing base course, moving the pulverized material and existing base course, wetting and compacting the mixed pulverized asphalt mat and base course, blading, shaping, haul, water, and maintenance of the riding surface.

DIVISION 400 PAVEMENTS

SECTION 401 PLANT MIX PAVEMENTS - GENERAL

401.07 RETAIN the first paragraph and Table 401-3. DELETE the remainder of Section 401.07 and REPLACE with the following:

“Temporary asphalt ramps shall be placed at all vertical milled edges greater than 1”. The Contractor shall maintain the temporary asphalt throughout the project. Distress in milled surfaces which affects the ride, safety, or serviceability of the road shall receive a temporary asphalt layer. Asphalt shall not be placed between November 1st and April 30th. When emergency work requires asphalt placement between November and April the asphalt will be considered temporary and shall be replaced the following year after May 1st.”

401.08 ADD the following sentence to the end of paragraph one:

“Asphalt mixing and storage plant operations shall comply with ASTM D995 for materials storage, control, mixing, and for plant equipment and operation.”

401.11 DELETE AND REPLACE with: “A tack coat shall be applied between pavement courses, at vertical edges of pavement, and at all vertical faces of concrete abutting the pavement at a rate of 0.05 to 0.15 gal/sq. yd. and paid for in accordance with Section 407. A prime coat at the subgrade shall not be required.”

401.12 ADD the following: “All manholes and valve boxes shall be set to ½ inch below final grade prior to paving of streets.”

401.17 Add the following to the end of paragraph one:

“After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Asphalt surface temperature shall be below 160 degrees.

Erect barricade to protect paving from traffic until mixture has cooled and attained its maximum degree of hardness.”

DELETE all references to compaction pavement test section (CTS). ADD the following: “Compaction pavement test section not required. Unless specified by the Contract, pavement cores are only required for longitudinal joints.”

401.20 DELETE and REPLACE entire section with following:

Town representative will inspect paving operations to ensure surface smoothness. On roads below 35 mph, the Town will not inspect small deviations in smoothness. On roads above or equal to 35 mph, Town will inspect smoothness using 10 foot level and measure any deviations greater than 3/16”. Contractor will be required to grind deviations. If smoothness is excessively poor, the Town will require Contractor to mill and replacement pavement.

SECTION 403 HOT MIX ASPHALT

ADD the following Table

Table 403.01

**Minimum Materials Sampling and Testing
for Process Control and Owners Acceptance**

Test	Standard	Minimum Frequency
Sampling	AASHTO T168, ASTM D 979 and ASTM D3665	One test per day, per mix design.
Density (Nuclear Gauge)	AASHTO T 166, T 355	One test every 250 lineal feet, per lane, per mix design.
Total Thickness (Core or non destructive method)	ASTM D3549 or approved non destructive method	IF requested by the AGENCY , not to exceed one test per day.
Gradation	AASHTO T 27, T 11	One test per day, per mix design.
Binder Content	AASHTO T 308 or other methods agreed upon between Agency and Contractor. AASHTO 308	One test per day per mix design.
Maximum Theoretical Specific Gravity (Rice)	AASHTO T 209	One test per day, per mix design.

SECTION 405 HEATING AND SCARIFYING TREATMENT

RETAIN all sections.

SECTION 406 COLD ASPHALT PAVEMENT (RECYCLE)

DELETE Section 406

SECTION 407 PRIME COAT, TACK COAT, AND REJUVINATING AGENT

RETAIN all sections.

SECTION 408 JOINT AND CRACK SEALANT

RETAIN all sections.

SECTION 409 CHIP SEAL

DELETE Section 409

SECTION 410: SLURRY SEAL

DESCRIPTION

410.01 The slurry seal shall consist of a mixture of an approved emulsified asphalt, mineral aggregate, water and specific additives, proportioned, mixed and uniformly spread over a properly prepared surface in accordance with the plans and specifications. The complete slurry seal shall leave a homogeneous mat, adhere firmly to the prepared surface, and have a friction resistant surface texture throughout its service life.

MATERIALS

410.02

A. Emulsified Asphalt

The emulsified asphalt shall conform to Grade SS-1h, CSS-1h, CQS-1h as specified in ASTM D 977, D 2397, AASHTO M 140 and M 208. The cement mixing test is waived. Each load of emulsified asphalt shall be accompanied with a Certificate of Compliance.

Table 410.02-1 Emulsified Asphalt

Test	Quality	Specification
AASHTO T59	Residue after distillation	60% Min.
AASHTO T49 ¹	Penetration at 77° F (25° C)	40 to 90
AASHTO T 59	Saybolt Furol Viscosity 77° F (25° C)	15 to 90 Sec.

¹Test on Residue

B. Aggregate

The aggregate shall be manufactured 100 percent crushed stone such as granite, slag, limestone, chert, or other high quality aggregate, or combination thereof. All aggregates shall have at least two fractured faces.

Table 410.02-2 Aggregates

Test	Quality	Specification
AASHTO T176*	Sand Equivalent	55 Min.
AASHTO T104	Soundness	15% Max. using NA ₂ SO ₄ or 25% Max. using MgSO ₄
AASHTO T96	Abrasion Resistance	25% Max. Grading D

* Moisture condition sample at least 24 hours prior to running the test.

When tested in accordance to AASHTO T 27 and AASHTO T 11, the aggregate gradation (including the mineral filler) shall be within the following bands. Note: Selection of Type II or Type III shall be designated by the Town and shown on the plans.

Table 410.02-3 Aggregate Gradation

Sieve Size	Percent Passing		Job Tolerance
	Type II	Type III	
1/2"	100	100	± 0
No. 4	90 to 100	70 to 90	± 4
No. 8	65 to 90	45 to 70	± 4
No. 16	45 to 70	28 to 50	± 3
No. 30	30 to 50	19 to 34	± 3
No. 50	18 to 30	2 to 25	± 3
No. 100	10 to 21	7 to 18	± 3
No 200	5 to 15	5 to 15	± 2

The stockpile shall be accepted based on an average of five gradation tests according to AASHTO T 2. Note requirement of 26.2E.

C. Mineral Filler

Portland cement, hydrated lime, limestone dust, fly ash or other approved filler meeting the requirements of AASHTO M 17 or ASTM D 242 shall be used if required by the mix design. They shall be considered as part of the dry aggregate.

D. Water

The water shall be free of salts and contaminants and shall be tested and conform to AASHTO T 26. Potable water testing is not required.

E. Additives

Liquid additives may be used to accelerate or retard the break-set of the slurry seal, or improve the resulting finished surface. The use of liquid additives in the slurry mix (or individual materials) shall be made initially in quantities predetermined by the mix design with field adjustments if required, after approval by the Town.

410.03 Mix Design

The CONTRACTOR shall submit to the Town, for approval, a mix design prepared and signed by a Professional Engineer registered in the State of Colorado, performed by a laboratory who has experience in designing Emulsified Asphalt Slurry Seal Surfacing. Compatibility of the aggregate, emulsion, mineral filler, and other additives shall be verified by the mix design. The mix design shall be made with the same materials and gradation that the CONTRACTOR will provide on the project. After the mix design has been approved, no substitution will be permitted. Minimum requirements are as follows:

Table 410.03-1 Recommended Mix Properties

Test	Description	Specification
ISSA T106	Slurry Seal Consistency	--
ISSA TB-139 (for quick-set systems)	Wet Cohesion 30 minutes Min. (set) 4 hour Min. (traffic)	12 kg-cm Min. 20 kg-cm Min.
ISSA TB-139 (for quick- traffic systems)	Wet Cohesion 60 minutes Min	20 kg-cm Min.
ISSA TB-109	Excess Asphalt by LWT Sand Adhesion	50 g/ft ² Max.
ISSA TB-114	Wet Stripping 10 minutes boiling water	Pass (90% Min.)
ISSA TB-100	Wet Track Abrasion Loss One hour soak 6-Day soak	50 gm ² Max. 75 g/ft ² Max.
ISSA TB-113	Mix Time	*
Residual Asphalt	6.5% to 12.0%	---
Mineral Filler	0.5% to 2.0%	

*The mixing test and set time test shall be done to anticipate the highest temperatures expected during construction. This will include 180 seconds mix time at 77° F and 70 seconds mix time minimum at 100° F.

The laboratory shall also report the quantitative effects of moisture content on the unit weight of the aggregate (bulking effect). The report must clearly show the proportions of aggregate, mineral filler (minimum and maximum), water (minimum and maximum), additive(s) (usage), and asphalt emulsion based on the dry weight of the aggregate. The report shall be sealed and signed by a Professional Engineer registered in the State of Colorado.

410.04 Equipment

A. General

All equipment, tools, and machines used in performance of this work shall be maintained in satisfactory working condition at all times to ensure a high quality product.

B. Mixing Equipment

The machine shall be specifically designed and manufactured to lay slurry seal. The material shall be mixed by a self-propelled slurry seal mixing machine of either truck mounted or continuous run design. Continuous run machines are those that are equipped to self load materials while continuing to lay slurry seal. Either type machine shall be able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, control setting additive, and water to a revolving mixer and discharge the mixed product on a continuous flow basis.

The machine shall have sufficient storage capacity for aggregate, emulsified asphalt, mineral filler, control additive and water to maintain an adequate supply to the proportioning controls. If continuous run equipment is used, the machine shall be equipped to allow the operator to have full control of the forward and reverse speed during application of the slurry seal. It shall be equipped with a self-loading device, opposite side driver stations, and forward and reverse speed controls.

C. Proportioning Devices

Individual volume or weight controls for proportioning each material to be added to the mix (i.e. aggregate, mineral filler, emulsified asphalt and additive) shall be provided and property marked.

The proportioning devices are required to be in working order and shall be capable of determining the material output at any time.

D. Spreading Equipment

The mixture shall be spread uniformly by means of a conventional surfacing spreader box attached to the mixer and equipped to agitate and spread the material evenly throughout the box. A front seal shall be provided to ensure no loss of the mixture at the road contact point. The rear seal shall act as final strike-off and shall be adjustable. The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off. The spreader box shall have suitable means provided to side shift the box to compensate for variations in the pavement geometry. A burlap drag or other approved screed may be attached to the rear of the spreader box to provide a uniform, highly textured mat. The drag pulled behind the spreader box shall not be stiffened or hardened by slurry or asphalt.

E. Auxiliary Equipment

Suitable surface preparation equipment, traffic control equipment, hand tools, power brooms, sweepers, and any other support equipment shall be provided as necessary to perform the work.

Equipment shall be approved by the TOWN. All equipment and machinery shall be kept in good working order, free of leaks and properly muffled. All taxes, licenses and fees shall have been paid and proper licenses and permits shall be posted as required by law.

410.05 Calibration

Each mixing unit to be used in performance of the work shall be calibrated in the presence of the engineer prior to construction. Previous calibration documentation covering the exact materials to be used may be acceptable, provided they were made during the calendar year. A one-point calibration check may be required at the start of production. The documentation shall include an individual calibration of each material at various settings, which can be related to the machine's metering devices. No machine will be allowed to work on the project until the calibration has been completed and/or accepted.

A. Verification

Test strips will be made by each machine after calibration and prior to construction. Test strips shall be a portion of the project. Samples of the slurry seal will be taken and verification made as to mix consistency and proportioning. Verification of rate of application will also be made. Upon failure of any of these tests, additional test strips, at no cost to the TOWN, will be required until each unit is authorized to work. Any unit failing to pass the tests after the third trial, will not be permitted to work on the project. Test strips must be accepted or rejected within 24 hours after application.

410.06 Weather Limitations

The slurry seal shall not be applied if either the pavement or air temperature is below 50° F and falling, but may be applied when both pavement and air temperature are above 45° F and rising. No slurry seal shall be applied when there is danger that the finished product will freeze before 24 hours. The mixture shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.

410.07 Surface Preparation

A. General

Immediately prior to applying the slurry seal the surface shall be cleared of all loose material, oil spots, vegetation, and other objectionable material. Any standard cleaning method will be acceptable. If water is used, cracks shall be allowed to dry thoroughly before slurry surfacing.

Manholes, valve boxes, drop inlets and other service entrances shall be protected from the slurry seal by a suitable method. The TOWN shall approve the surface preparation prior to surfacing.

B. Tack Coat

If a tack coat is required it should consist of one part emulsified asphalt and three parts water. The emulsified asphalt should be the same as used in the mix. The distributor shall be capable of applying the dilution evenly at a rate of 0.05 to 0.10 gallons per square yard (0.15 to 0.35 liters per square meter). The tack coat shall be allowed to cure before application of the slurry seal.

C. Joint and Crack Sealant

Joints and crack shall be sealed in accordance with the requirements in Item 23.

410.08 Application

The slurry seal mixture shall be of proper consistency at all times so as to provide the application rate required by the surface condition. The average application rate shall be 18 to 30 pounds per square yard (8.16 to 13.6 kgs/m²).

Application rates are affected by the unit weight of the aggregate, the gradation of the aggregate and the demand of the surface to which the slurry seal is being applied.

A. General

When required by local conditions, the surface shall be pre wetted by fogging ahead of the spreader box.

The rate of application of the fog spray shall be adjusted during the day to suit temperatures, surface texture, humidity, and dryness of the pavement.

The slurry seal shall be of the desired consistency upon leaving the mixer. A sufficient amount of material shall be carried in all parts of the spreader at all times so that a complete coverage is obtained. Overloading of the spreader shall be avoided.

No lumping, balling, or unmixed aggregate shall be permitted.

No streaks, such as those caused by oversized aggregate shall be left in the finished surface. If excess oversize develops, the job will be stopped until the CONTRACTOR proves to the engineer that the situation has been corrected.

Some situations may require screening the aggregate just prior to loading it into the units going from the stockpile area to the laydown operations.

410.09 Joints

No excess buildup, uncovered areas, or unsightly appearance shall be permitted on longitudinal or transverse joints. The CONTRACTOR shall provide suitable width spreading equipment to produce a minimum number of longitudinal joints throughout the project. When possible, longitudinal joints shall be placed on lane lines. Half passes and odd width passes will be used only in minimum amounts. If half passes are used, they shall not be the last pass of any paved area. A maximum of 4 inches (152 mm) shall be allowed for overlap of longitudinal lane line joints. The paper shall be used at transverse joints to ensure a straight line.

410.10 Mix Stability

The slurry seal shall possess sufficient stability so that premature breaking of the material in the spreader box does not occur. The mixture shall be homogeneous during and following mixing and spreading. It shall be free of excess water and emulsion and free of segregation of the emulsion and aggregate fines from the coarser aggregate.

Spraying of additional water into the spreader box or addition of excess water will not be

permitted.

410.11 Hand Work

Areas which cannot be reached with slurry seal machines shall be surfaced using hand squeegees to provide complete and uniform coverage. The area to be hand worked shall be lightly dampened prior to mix placement and the slurry worked immediately. Care shall be exercised to leave no unsightly appearance from handwork. The same type finish as applied by the spreader box shall be required. Handwork shall be completed during machine applying process.

410.13 Lines

Care shall be taken to ensure straight lines along shoulders. No runoff on these areas will be permitted. Lines at intersections will be kept straight to provide good appearance.

410.14 Rolling

At the option of the TOWN, the roadway shall be rolled by a self propelled 10 ton pneumatic roller with a tire pressure of 50 psi (3.4 atms.) and equipped with a water spray system. The surfaced areas shall be subjected to a minimum of two full coverage passes by the roller.

Rolling should not commence until the slurry has cured enough so that it will not pick up on the tires of the roller.

410.15 Clean-up

All areas, such as manways, gutters and intersections, shall have the slurry seal removed as specified by the Town. The CONTRACTOR shall remove any debris associated with the performance of the work on a daily basis.

410.16 Tolerances

Tolerances for individual materials as well as the slurry seal mixture are as follows:

After the designed residual asphalt content is determined, a plus or minus one percentage point variation will be permitted.

The percentage of aggregate passing each sieve shall be within stockpile tolerance range as stated and within the master range of Table 26.2B-2.

The percentage of aggregate passing shall not go from the high end to the low end of the specified range of any two successive sieves.

The slurry consistency shall not vary more than +/-0.5 cm from the job mix formula after field adjustments.

The rate of application once determined by the engineer shall not vary more than +2 pounds per square yard, while remaining within the design application rate.

If any two successive tests fail on the stockpile material, the job shall be stopped. It is the responsibility of the CONTRACTOR, at his own expense, to prove to the TOWN that the conditions have been corrected. If any two successive tests on the mix from the same machine fail, the use of the machine shall be suspended. It will be the responsibility of the CONTRACTOR, at his own expense, to prove the TOWN that the problems have been corrected and that the machine is working properly.

410.17 Measurement

The area of slurry seal shall be measured by the square yard per plan quantities completed in place and accepted.

410.18 Testing and Inspection

Testing and inspection shall be performed in accordance with Table 410.18-1.

Table 410.18-1 Schedule for Minimum Slurry Seal Materials Sampling and Testing

Test Type	Test Standard	Minimum Frequency of Tests
Residue after distillation	AASHTO T 59	One test each 5,000 square yards of slurry seal
Extraction and Gradation	AASHTO T 164 AASHTO T 30	One test each 5,000 square yards of slurry seal
Application Rate		One test each 5,000 square yards of slurry seal

410.19 Payment

The slurry seal shall be measured and paid for by the contract unit price per square yard (SY). The price shall be full compensation for furnishing all materials and for preparation, mixing and applying these materials, and for all labor, equipment, tools, test design, clean-up and incidentals necessary to complete and warrant the job as specified herein.

SECTION 411 ASPHALT MATERIALS

DELETE Section 411.05 and REPLACE with the following: "Asphalt cement, emulsified asphalt, and other asphalt materials will not be paid separately but shall be included in the unit price for TONS of Hot Mix Asphalt or other appropriate mix."

SECTION 412 PORTLAND CEMENT CONCRETE PAVEMENT

- 412.17 REVISE as follows "Roadway smoothness will not be tested on roads with speed limits below 35 mph. On roads at or above 35 mph, Town shall use a ten foot level to measure high spots greater than 3/16". Contractor shall diamond grind areas exceeding 3/16".
- 412.21 DELETE and REPLACE with the following: "Pavement thickness shall be measured by Town measuring the depth prior to placement of pavement. Contractor shall assist with setting string lines, forms, and other methods to measure thickness. Cores shall not be used unless requested by the Engineer."

SECTION 420 GEOSYNTHETICS

- 420.02 DELETE the first sentence and replace with the following: "Geotextiles and geomembranes shall meet the applicable requirements of subsection 308."

DIVISION 500 STRUCTURES

SECTION 501 STEEL SHEET PILING

RETAIN all sections.

SECTION 502 PILING

RETAIN all sections.

SECTION 503 DRILLED SHAFTS

RETAIN all sections.

SECTION 504 WALLS

ADD the following to Section 504.01: "For stone or boulder walls, Contractor shall deliver samples of stone to the site for approval by Town. Contractor shall construct a short section of wall as a mockup for Town review and approval. If mockup does not meet requirements of contract documents, the Contractor shall removal and replace wall at their expense."

SECTION 506 RIPRAP

RETAIN all sections.

SECTION 507 SLOPE AND DITCH PAVING

RETAIN all sections.

SECTION 508 TIMBER STRUCTURES

RETAIN all sections.

SECTION 509 STEEL STRUCTURES

RETAIN all sections.

SECTION 510 STRUCTURAL PLATE STRUCTURES

RETAIN all sections.

SECTION 512 BEARING DEVICE

RETAIN all sections.

SECTION 514 PEDESTRIAN AND BIKEWAY RAILING

RETAIN all sections.

SECTION 515 WATERPROOF MEMBRANE

RETAIN all sections.

SECTION 516 DAMPPROOFING

RETAIN all sections.

SECTION 517 WATERPROOFING

RETAIN all sections.

SECTION 518 WATERSTOPS AND EXPANSION JOINTS

RETAIN all sections.

DIVISION 600
MISCELLANEOUS CONSTRUCTION

SECTION 601 STRUCTURAL CONCRETE

ADD the following to Section 601.02: "w/cm ratio for Concrete Class B,D, and P shall be 0.38 to 0.42."

SECTION 602 REINFORCING STEEL

RETAIN all sections

SECTION 603 CULVERTS AND SEWERS

ADD the following to Section 603.01: "For any sanitary sewer work, delete Section 603 in its entirety and replace with the Upper Blue Sanitation District Sewer Standards."

ADD the following to Section 603.13: "Structure excavation and backfill shall not be paid separately, but shall be included in the cost of the pipe."

SECTION 604 MANHOLES, INLETS, AND METER VAULTS

RETAIN all sections

SECTION 605 SUBSURFACE DRAINS

RETAIN all sections

SECTION 606 GUARDRAIL

RETAIN all sections

SECTION 607 FENCES

RETAIN all sections

SECTION 608 SIDEWALKS AND BIKEWAYS

ADD the following to Section 608.03: "All concrete sidewalk shall be a minimum of 5" thick. Control joints shall be placed at 6' intervals and shall be sawcut joints. Joints shall be sawcut immediately after curing. Expansion joint shall be added between new concrete sidewalk and existing concrete sidewalk"

SECTION 609 CURB AND GUTTER

RETAIN all sections

SECTION 610 MEDIAN COVER MATERIAL

RETAIN all sections

SECTION 611 CATTLE GUARDS

RETAIN all sections

SECTION 612 DELINEATORS AND REFLECTORS

RETAIN all sections

SECTION 613 LIGHTING

RETAIN all sections

SECTION 614 TRAFFIC CONTROL DEVICES

RETAIN all sections

SECTION 615 WATER CONTROL DEVICES

RETAIN all sections

SECTION 616 SIPHONS

RETAIN all sections

SECTION 618 PRESTRESSED CONCRETE

RETAIN all sections

SECTION 619 WATER LINES

DELETE and REPLACE with the following: "Water lines and appurtenances shall be constructed in accordance with the Town of Breckenridge Water Construction Standards."

SECTION 620 FIELD FACILITIES

RETAIN all sections

SECTION 622 REST AREAS AND BUILDINGS

DELETE Section 622 in its entirety.

SECTION 623 IRRIGATION SYSTEMS

RETAIN all sections

SECTION 624 DRAINAGE PIPE

624.02 ADD "High Density Polyethylene Corrugated Pipe with Smooth Interior" to the list of pipe materials under the Plastic Heading. ADD the abbreviation as HDPE.

Table 624-1. ADD ⁷ to the Table: "Plastic Pipe and fittings shall be manufactured from high density polyethylene resin which shall meet or exceed the requirements of Type III, Category 4 or 5, Grade P33 or P34, Class C per ASTM D1248. HDPE storm pipe shall be ADSN-12 WT-1B (water tight or approved equal."

SECTION 625 CONSTRUCTION SURVEYING

RETAIN all sections

SECTION 626 MOBILIZATION

RETAIN all sections

SECTION 627 PAVEMENT MARKING

RETAIN all sections

SECTION 629 SURVEY MONUMENTATION

RETAIN all sections

SECTION 630 CONSTRUCTION ZONE TRAFFIC CONTROL

ADD the following to Section 630.01:

"Construction Under Traffic

Contractor shall maintain a minimum of one lane of traffic to greatest extent possible. When one lane cannot safely be maintained, the length and duration of the full road closure shall be minimized to the extent possible and shall be approved by the Town Engineer.

Two lanes of traffic shall be reopened during evenings and weekends. Full road closures during nights and weekends shall be submitted for review and approval by Town Engineer. Access to all residences and businesses shall be maintained at all times during construction. Flaggers shall be used to assist with construction access and pedestrian traffic control.

Pedestrian traffic shall be maintained through the construction zones. Temporary curb ramps shall be installed consisting of compacted base course. Pedestrian routes shall be a minimum of 5' wide, meet ADA requirements, and be separated from traffic by approved barriers.

Flaggers shall be used to assist with construction access and pedestrian traffic control.

The Contractor shall provide to the Town a detailed phasing plan, schedule, Traffic Control Plan and MHT for each anticipated phase of construction.

Flagging

The contractor shall provide competent certified flaggers to direct traffic when work is being done in the street ROW or intersection that is open to traffic. The Contractor shall provide a minimum of one flagger while construction activities are occurring. The flaggers will be required to direct vehicular traffic and construction vehicles. Pedestrian and vehicular traffic shall be the priority of the "minimum" required flaggers. Certified flaggers, additional to the "minimum" required, may be utilized at the Contractor's discretion to assist with the Contractor construction activities. Flagging shall conform to the requirements of the MUTCD. The cost of the "minimum" flaggers and additional flaggers utilized by the Contractor shall be included in the unit price of the bid item, Traffic Control.

Traffic Control Supervisor (TCS)

When required by the Contract, the contractor shall provide a competent CCA or ATSSA certified Traffic Control Supervisor (TCS) on site for any set up, moving, reconfiguration, and removal of all traffic control devices required for the project. The TCS may be utilized as a flagger, and be recognized as one of the "minimum" required flaggers if the work is contained within a reasonable work zone length. The TCS shall monitor and make repairs and adjustments to the traffic control devices daily. The Traffic Control Supervisor shall conform to the requirements of the MUTCD, and will be included in the cost of the bid item, Traffic Control

Traffic Control Devices

The Contractor shall furnish, erect, and maintain all barricades, construction signing, lights, and other traffic control devices in conformity to the Manual of Uniform Traffic Control Devices for Streets and Highways and as called for in the plans and drawings. All signs and barricades to be paid for by the owner shall be in good condition and acceptable to the project engineer. All required traffic control devices, signs and flaggers shall be in place through the construction area prior to beginning and work.

The use of Type "A" low intensity warning lights shall be as shown in the contract and are incidental to the price of each barricade.

All construction signing shall be black on reflective orange and per MUTCD standards unless otherwise specified.

Maintenance

The Traffic Control Supervisor shall conduct daily inspections (three times per day minimum on working days) of all traffic control devices to ensure proper placement and condition of all signs, barricades and channelization devices, and shall log placement, inspection, maintenance, and replacement of all traffic control devices. Copies of the contractor's daily traffic control logs shall be given to the engineer once per week.

All construction signing, barricades, channelization devices, temporary pavement markings, and other construction traffic control devices shall be kept clean, legible, visible, and in proper position at all times. Damaged traffic control devices shall be repaired or replaced immediately.

Method of Handling Traffic (MHT)

To implement the Traffic Control Plan the Contractor will prepare and submit a Method of Handling Traffic (MHT) to the Engineer for approval at least one week prior to commencement of any demolition work. The Contractor shall implement the MHT in accordance with the plans and specifications. Any variance from those plans will require the approval of the Engineer.

The MHT shall be drawn specific to each project. The MHT shall be drawn reasonably close to scale and shall show representative project landmarks, streets and salient features. The Engineer, upon

request from the Contractor, will furnish to the Contractor base mapping for preparation of the MHT. An individual MHT shall be submitted for each phase of work.

The MHT shall include the following as a minimum:

1. Detailed diagrams showing the size and location of all proposed traffic control devices.
2. Access plan for all businesses.
3. Access plan for pedestrians.
4. Emergency vehicle access plan.
5. Supporting documentation as required.
6. Flagger number and locations.

The key elements of the Contractor's method of handling traffic (MHT) are outlined in subsection 630.10(a).

The components of the TCP for this project are included in Subsection 104.04 and Section 630 of the specifications.

Unless otherwise approved by the Engineer, the Contractor's equipment shall follow normal and legal traffic movements. The Contractor's ingress and egress of the work area shall be accomplished with as little disruption to traffic as possible. Traffic control devices shall be removed by picking up the devices in a reverse sequence to that used for installation. This may require moving backwards through the work zone. When located behind barrier or at other locations shown on approved traffic control plans, equipment may operate in a direction opposite to adjacent traffic.

SECTION 641 SHOTCRETE

RETAIN all sections

DIVISION 700

MATERIALS DETAILS

SECTION 701 HYDRAULIC CEMENT

Add the following to Section 701.02:

Fly ash or natural pozzolans shall conform to ASTM C618, for Class C, F, N, or AASHTO M321 for High Reactivity Pozzolans. Class C fly ash may only be used for Class 0 sulfate resistance and if the calcium oxychloride is determined to be less than 15g CaOXY/100g cementitious paste in accordance with AASHTO T 365.

SECTION 702 BITUMINOUS MATERIALS

RETAIN all sections

SECTION 703 AGGREGATES

703.07 DELETE and REPLACE Paragraph (a) as follows: “(a) Bed course material for curbing, sidewalks and bike/pedestrian paths shall be 6 inches of aggregate base course Class 6 unless otherwise approved by the Engineer.”

SECTION 704 MASONRY UNITS

RETAIN all sections

SECTION 705 JOINT, WATERPROOFING AND BEARING MATERIAL

705.01 ADD the following to paragraph (a) JOINT SEALANT WITH BACKER ROD:

“The following sealants are approved for sealing concrete joints:

Sika Group - Sikaflex-1c SL

Dow Corning - Dow 890-SL

Pecora Corporation - Pecora 300 SL

Tremco incorporated - Spectrem 900-SL

Sonneborn – Sonalastic SL1

The color of the joint sealant shall match the color of the concrete unless otherwise specified or approved.”

ADD the following to paragraph (b) PREFORMED JOINT FILLERS:

“Preformed joint fillers conforming to AASHTO M 153 Type IV – Polyurethane bonded recycled rubber, are approved.”

SECTION 706 CONCRETE AND CLAY PIPE

RETAIN all sections

SECTION 707 METAL PIPE

RETAIN all sections

SECTION 708 PAINTS

RETAIN all sections

SECTION 709 REINFORCING STEEL AND WIRE ROPE

RETAIN all sections

SECTION 710 FENCE AND GUARDRAIL

RETAIN all sections

SECTION 711 CONCRETE CURING MATERIALS AND ADMIXTURES

711.01 ADD the following: "Liquid membrane-forming curing compound shall be a V.O.C. compliant, dissipating resin, conforming to AASHTO M-148, Type 2 for uncolored concrete or Type 1 (clear) for colored concrete. The following curing compounds are approved:

Dayton Superior - Day-Chem White Pigmented Cure (J-10-W)

Dayton Superior - White Dissipating Cure EF

Euclid – Kurez DR VOX"

711.03 ADD the following:

"Accelerating Admixtures: Set accelerating admixtures shall be non-chloride liquid conforming the ASTM C 494 Type C. The following accelerating admixtures are approved:

BASF Chemical Company - Pozzolith NC 534

Grace Construction Products - Daraset 200, 400 or HES

Euclid Chemical Company – Eucon NCA or Eucon ACN

Evaporation Retardants. The following evaporation retardants are approved:

BASF Chemical Company - CONFILM

Dayton Superior - Sure Film J-74

Euclid Chemical Company - EucoBar

Color Additive for Colored Concrete shall be manufactured by DAVIS Colors, 3700 East Olympic Blvd., Los Angeles, CA or an approved substitute.

SECTION 712 MISCELLANEOUS

712.13 ADD paragraph (e) and include the following:

"High Density Polyethylene Corrugated Pipe with Smooth Interior for Storm Sewers, Culverts, and Drains.

- (1) ASTM F-405: Standard Specification for Corrugated Polyethylene Tubing and Fittings
- (2) ASTM F-667: Large Diameter Corrugated Polyethylene Tubing
- (3) AASHTO M 252-851: Standard Specifications for Corrugated Polyethylene Drainage Tubing
- (4) AASHTO M 294-851: Corrugated Polyethylene Pip, 12 to 24 inch Diameter
- (5) The nominal size of the pipe is based on the nominal inside diameter of the pipe.
- (6) The tolerance on the specified inside diameter shall be +3%, -1.5%, or ½ inch, whichever is less. Lengths shall be no less than 99% of stated quantity.
- (7) Pipe shall be joined by split corrugated couplings at least 7 corrugations wide and exceeding the soil tightness requirements of the AASHTO Standard Specification for Highway Bridges, Section 23 (2.23.3).

(8) Pipe Stiffness

The pipe shall have a minimum pipe stiffness at 5% deflection as follows:

Diameter (inches)	Pipe Stiffness (PSI)
12	45
15	42
18	40
24	34

Tests shall be in accordance with ASTM D2412 with a minimum one diameter sample length, a loading rate of 0.5"/min., and readings at 5% deflection.

(9) Hydraulics

The pipe shall have a minimum tested Mannings "n" value of 0.012.

(10) Perforations

Where perforated pipe is specified, the perforations shall conform to the requirements of Class 1, unless otherwise specified in the order. Class 1 perforations are for pipe intended to be used for subsurface drainage or combination storm and underdrain. The perforations shall be cleanly cut so as not to restrict the inflow of water. Pipe connected by couplings or bands may be unperforated within 4 inches (100 mm) of each end of each length of pipe.

- A. Class I Perforations: The perforations shall be approximately circular and shall have nominal diameters of not less than 3/16 inch (4.8 mm) nor greater than 3/8 inch (9.5 mm) and shall be arranged in rows parallel to the axis of the pipe.

The perforations shall be located in the external valleys with perforations in each row for each corrugation. The rows of perforations shall be arranged in two equal groups placed symmetrically on either side of the lower unperforated segment corresponding to the flow line of the pipe. The spacing of the rows shall be uniform. The distance between the center lines of the rows shall not be less than 1 inch (25 mm).

(11) Retest and Rejection

If any failure to conform to these specifications occurs, the pipe or fittings may be retested to establish conformity in accordance with agreement between the purchaser and seller. Individual results, not averages, constitute failure."

SECTION 713 TRAFFIC CONTROL MEASURES

RETAIN all sections

SECTION 714 PRESTRESSED UNIT MATERIALS

RETAIN all sections

SECTION 715 LIGHTING AND ELECTRICAL MATERIALS

ADD the following to Section 715.03:

"Light poles shall meet the following requirements:

Manufacturer: Mountain States Lighting or Approved Equal

Part#: 9SRS-3.5-NO TENON-11.50" BOLT CIRCLE-BLACK or Approved Equal

Height: 9' Pole or 12' Pole (near intersections)

Base: 44" Slipover decorative base cover, Die-Cast Aluminum Alloy 356HMLC, High Strength, Copper Free, 10" Hex, 10 3/4" Point to Point, Separate Anchor Bolt Covers

Handhole: 2" x 5" Handhole opening in base of pole

Ladder Rest: 4" OD, 3.5" ID ladder rest, black finish, per Town Details

ADD the following to Section 715.04:

Luminaires and Lamps shall be one of the following per the Contract Documents:

PROV-T3-32LED-3K-700-LDL-HSS-PCA-T (Providence or Approved Equal)

F660-GX919-40-277-T2 or T5 (Newport, Welsbach, or Approved Equal)

PRMD2-72L-335-3K7-3-BLT-FTG-TRA5D-MOD 4.5" (Promenade or Approved Equal)

SECTION 716 WATER LINE MATERIALS

DELETE Section 716 in its entirety and REPLACE with the Town of Breckenridge Water Construction Standards

SECTION 717 REST AREA AND BUILDING MATERIALS

DELETE Section 717 in its entirety.