February 26, 2021

Submitted via FACTS on 2/26/2021

Attn: Mr. Jon Kenning
Montana Department of Environmental Quality
Water Protection Bureau
PO Box 200901
Helena, MT 59620-0901

RE: City of Bozeman Small MS4 2020 Annual Report (MTR040002)

Mr. Jon Kenning,

The City of Bozeman (City) is pleased to submit its 2020 Phase II Small MS4 General Permit Annual Report, updated Stormwater Management Plan (SWMP), and various requested attachments for your review.

The past year proved to be challenging due to the impacts of COVID-19 on our community; however, the City successfully maintained its forward momentum in developing a robust Stormwater Management Program. Two exciting projects are ongoing and will have significant and positive impacts from water quality and MS4 Permit compliance standpoints. They include new Engineering Standards and an update to the City's Stormwater Facilities Plan.

One administrative note. Jeff Mihelich was hired as the City's Principal Executive Officer in 2020. I have reviewed MDEQ's website and have not identified a Permit Transfer Notification form or protocol applicable to the MS4 Program. Please advise if this written notification is sufficient or if there is an additional form required to ensure the City's records are in good standing with MDEQ.

The City looks forward to further implementing its Stormwater Management Program in 2021. Please do not hesitate to contact me with any questions.

Regards,

Kayla Mehrens

Kayla Mehrens, Stormwater Program Coordinator

Cc:

- Project File
- ERF

Attachments:

- 2020 MS4 Annual Report Form
- The City of Bozeman and Montana State University Stormwater Management Plan
- Attachment A: Post-Construction Facility Inventory
- Attachment B: MS4 Inventory
- Attachment C: City of Bozeman Engineering Standards
- Attachment D: Good Housekeeping Program Documents

Agency Use

MTR04_____

Date Rec'd:

Amount Rec'd:

Check No.:

Rec'd By:

WATER PROTECTION BUREAU

MPDES Storm Water Small MS4 Annual Report Form

FORM

MS4-AR

Reporting period is for the calendar year, January 1st through December 31st.
Check one. Annual Report is due by March 1st of the following year.

☐2017 ☐2018 ☐2019 ☐2020 ☐2021

Instructions: This Annual Report Form is to be completed by each permittee and co-permittee authorized to discharge storm water under the General Permit for Storm Water Discharges Associated with Small Municipal Separate Storm Water Sewer Systems (MS4s). All authorized permittees and co-permittees are required to complete this Annual Report Form for each calendar year reporting period. For co-permittees authorized under one permit authorization or for co-permittees with multiple authorizations, you are required to complete this form and submit separate required documents/information exclusively for your respective regulated Small MS4 area(s). This completed Annual Report Form must be electronically submitted to the Montana Department of Environmental Quality, Water Protection Bureau. Electronic submission is required through the web-based tool: NetDMR. Additional information is located on DEQ's website: http://deq.mt.gov/Water/WQINFO/ctss/netdmr.

Small MS4 Authorization Number: MTR04_____

Small MS4 Classification ☐**Traditional** ☐**Non-Traditional**

Small MS4 Name: City of Bozeman

Small MS4 Mailing Address: P.O. Box 1230

City, State, and Zip Code: Bozeman, MT 59771

Small MS4 Contact Person (and Title): Kayla Mehrens, Stormwater Program Coordinator

Mailing Address: P.O. Box 1230

City, State, and Zip Code: Bozeman, MT 59771

Phone Number: ( ) **E-mail address:**

406-582-2270
6002 Ber-1S@bozeman.net

Storm Water Management Team: Attach an organizational chart identifying a primary SWMP coordinator and the positions responsible for implementing each minimum measure.

Requested above chart: ☐ Attached ☐ Not Attached

See SWMP Section 1.5

Has the permittee established and executed a formalized mechanism for regular communication between storm water management team members? ☐ Yes ☐ No

See SWMP Section 1.5

Permittee's SWMP Resources:
How many FTEs does the permittee designate to the MS4 permit? 8.5 FTE If needed, provide an explanation.

If more space is needed, submit on an additional page with corresponding reference or on a data storage device.

Answer the following five (5) questions on an additional page with corresponding reference or on a data storage device.

(1) What are the source(s) of funding for implementation of the MS4 permit and the estimated percentage of the total budget allocated from each source listed?

See SWMP Section 1.3

(2) Specific to the annual reporting calendar year, how did the permittee justify commitment of resources or budget allocations to the implementation of the MS4 permit to decision-makers and the public? Provide a summary of meetings and outcomes held with decision-makers and the public.

See SWMP Section 1.3

(3) Has the permittee demonstrated program effectiveness to obtain budget allocations for this annual reporting calendar year or previous years? Why or why not? If so, what program effectiveness metrics were presented?

See SWMP Section 1.3

(4) How was this annual reporting calendar year's approach to allocate resources different than the previous year's approach?

See SWMP Section 1.3

(5) Was the permittee successful in their request for budget allocations? Describe the outcome and factors that affected or resulted in that outcome.

See SWMP Section 1.3

Illicit Discharge Detection & Elimination:
Per the IDDE MCM requirement (Part II (3)(c.i)), has the permittee reviewed, and updated if needed, the storm sewer map during the calendar year? ☐ Yes ☐ No

See SWMP Section 4.8

Per the IDDE MCM requirement (Part II (3)(e.i)), has the permittee dry weather inspected and screened outfalls during the calendar year? ☐ Yes ☐ No

See SWMP Section 4.7

Fill in the blanks with numbers. The permittee has inspected 113 outfalls during this calendar year. Since authorization under the 2017 General Permit, the permittee has inspected 221 total outfalls out of the 463 total MS4 outfalls.

See SWMP Section 4.7

Per the Illicit Discharge Detection & Elimination MCM (Part II (3)(e.i)), the permittee will complete the requirement to inspect and screen all outfalls during dry weather by the end of the permit cycle. ☐ Yes ☐ No See SWMP Section 4.7

Construction Site Storm Water Management: During the calendar year, how many construction storm water management plan reviews were completed (Part II (4)(b))? 36 See SWMP Section 5.5

During the calendar year, how many construction projects were inspected for their storm water management controls (Part II (4)(c))? 15 See SWMP Section 5.5

Pollution Prevention/Good Housekeeping for Permittee Operations:

Has the permittee reviewed, and updated if needed, the inventory of permittee-owned/operated facilities and activities (Part II (6)(a.i))? ☐ Yes ☐ No See SWMP Section 7.0

Has the permittee reviewed, and updated if needed, the map that identifies the locations of facilities and known locations of activities (Part II (6)(a.ii))? ☐ Yes ☐ No See SWMP Section 7.0

Has the permittee conducted annual storm water pollution prevention training for permittee staff during the next permit year after development of each standard operating procedure (Part II (6)(a.v))? ☐ Yes ☐ No See SWMP Section 7.0

Not applicable during calendar year 2017, 2018, and 2019. Check "No" during these years.

Training: According to Part II (B) Training requirements, has the permittee conducted applicable training during the 1st and 4th calendar years? ☐ Yes ☐ No See SWMP Section 7.0

Not required during calendar year 2018, 2019, and 2021. Check "No" during these years.

According to Part II (B) Training requirements, has the permittee conducted applicable new employee training within 90 days of the hire date? ☐ Yes ☐ No

Special Conditions: Per **Pre-TMDL Approval (Part III.A) requirements**, attach the required information regarding identification of all outfalls that discharge to impaired waterbodies, the impaired waterbodies, and the associated pollutants of impairments. Summarize the BMPs implemented over the reporting period and a schedule of BMPs planned for the following year.

☐Attached ☐ Not Attached ☐ Not Applicable

Special Conditions: Approved TMDLs (Part III.B) requirements per calendar year below.

Calendar Year 2017: The permittee has attached a Sampling Plan that includes strategy rationale, monitoring frequency, monitoring parameters, and monitoring locations.

☐Attached ☐ Not Attached ☐ Not Applicable

Calendar Year 2017: The permittee has attached all outfalls that discharge to impaired waterbodies and the associated pollutants of impairment.

☐Attached ☐ Not Attached ☐ Not Applicable

Calendar Year 2018: The permittee has attached all outfalls that discharge to impaired waterbodies and the associated pollutants of impairment.

☐Attached ☐ Not Attached ☐ Not Applicable

Calendar Year 2019: The permittee has attached all outfalls that discharge to impaired waterbodies and the associated pollutants of impairment.

☐Attached ☐ Not Attached ☐ Not Applicable

Calendar Year 2020: The permittee has attached all outfalls that discharge to impaired waterbodies and the associated pollutants of impairment.

☐Attached ☐ Not Attached ☐ Not Applicable Attached

Calendar Year 2020: The permittee has attached the TMDL section of the SWMP that identifies the measures and BMPs it plans to implement, describes the MS4's impairment priorities and long term strategy, and outlines interim milestones for controlling the discharge of the pollutants of concern and making progress towards meeting the TMDL.

☐Attached ☐ Not Attached ☐ Not Applicable See SWMP Section 2.2

Calendar Year 2021: The permittee has attached all outfalls that discharge to impaired waterbodies and the associated pollutants of impairment.

☐Attached ☐ Not Attached ☐ Not Applicable

Calendar Year 2021: The permittee has evaluated the TMDL section of the SWMP based on monitoring results. The section has been revised, if needed, and is attached.

☐Attached ☐ Not Attached ☐ Not Applicable

Monitoring: Per requirements in Part IV (B), has the permittee attached monitoring results, calculations, and evaluations?

☐Attached ☐ Not Attached ☐ Not Applicable See SWMP Section 8.0

INSTRUCTIONS: The permittee will only fill out the Annual Report Attachments section below that corresponds to the calendar in which an Annual Report is being submitted for. Attach the requested documents/information.

2017 Annual Report Attachments (1st Calendar Year)

Public Education and Outreach:

Per requirements a.i in the referenced MCM, attach the required information regarding key target audiences and associated pollutants.

☐Attached ☐ Not Attached

Public Involvement and Participation:

Per requirements a.i in the referenced MCM, attach the required information regarding the public involvement approach and schedule of each key audience.

☐Attached ☐ Not Attached

Illicit Discharge Detection & Elimination:

Per requirements a.i in the referenced MCM, attach the required information regarding categories of non-storm water discharges or flows, associated pollutants, and local controls or conditions.

☐Attached ☐ Not Attached

Per requirements b.i in the referenced MCM, attach the required information regarding occasional non-storm water discharges or flows, associated pollutants, and local controls or conditions.

☐Attached ☐ Not Attached

Per requirements f.i in the referenced MCM, attach the required Illicit Discharge Investigation and Corrective Action Plan and any associated documents.

☐Attached ☐ Not Attached

Construction Site Storm Water Management:

Per requirements a.iii in the referenced MCM, attach progress towards an Enforcement Response Plan and associated documents.

☐Attached ☐ Not Attached

Specific to Traditional MS4s and per requirements b.i in the referenced MCM, attach the construction storm water management plan review checklist.

☐Attached ☐ Not Attached ☐ Not applicable

Specific to Non-Traditional MS4s and per requirements b.iii in the referenced MCM, attach the construction storm water management plan review checklist.

☐Attached ☐ Not Attached ☐ Not applicable

Specific to Traditional MS4s and per requirements c.i in the referenced MCM, attach the construction storm water management inspection form or checklist.

☐Attached ☐ Not Attached ☐ Not applicable

Specific to Non-Traditional MS4s and per requirements c.ii in the referenced MCM, attach the construction storm water management inspection form or checklist.

☐Attached ☐ Not Attached ☐ Not applicable

Post-Construction Site Storm Water Management in New and Redevelopment

Specific to Traditional MS4s and per requirements b.i in the referenced MCM, attach the post-construction storm water management plan review checklist.

☐Attached ☐ Not Attached ☐ Not applicable

Specific to Non-Traditional MS4s and per requirements b.ii in the referenced MCM, attach the post-construction storm water management plan review checklist.

☐Attached ☐ Not Attached ☐ Not applicable

Per requirements in b.iii in the referenced MCM, attach the performance standards and associated documents.

☐Attached ☐ Not Attached

2018 Annual Report Attachments (2nd Calendar Year)

Public Education and Outreach:

Per requirements b.i in the referenced MCM, attach the required information regarding outreach messages.

☐Attached ☐ Not Attached

Per requirements c.i in the referenced MCM, attach the required information regarding a description of formats, distribution channels and schedule for key target audiences.

☐Attached ☐ Not Attached

Public Involvement and Participation:

Per requirements a.ii in the referenced MCM, attach the required information regarding participation and key target audience feedback on approaches.

☐Attached ☐ Not Attached

Illicit Discharge Detection & Elimination:

Per requirements a.i in the referenced MCM, attach the required information regarding categories of non-storm water discharges or flows, associated pollutants, and local controls or conditions.

☐Attached ☐ Not Attached

Per requirements b.i in the referenced MCM, attach the required information regarding occasional non-storm water discharges or flows, associated pollutants, and local controls or conditions.

☐Attached ☐ Not Attached

Specific to Traditional MS4s and per requirements d.i in the referenced MCM, attach the adopted ordinance or other regulatory mechanism to prohibit illicit discharges.

☐Attached ☐ Not Attached ☐ Not applicable

Specific to Non-Traditional MS4s and per requirements d.ii in the referenced MCM, attach the summary of legal authority to prohibit illicit discharges.

☐Attached ☐ Not Attached ☐ Not applicable

Per requirements d.iii in the referenced MCM, attach the required summary of the cooperative agreements.

☐Attached ☐ Not Attached

Per requirements d.iv in referenced MCM, attach the Enforcement Response Plan and associated documents.

☐Attached ☐ Not Attached

Per requirements e.ii in referenced MCM, attach the list of high priority outfalls.

☐Attached ☐ Not Attached

Specific to Traditional MS4s and per requirements f.iii in the referenced MCM, attach the summary of investigations conducted and corrective actions taken per the required Illicit Discharge Investigation and Corrective Action Plan and any associated documents.

☐Attached ☐ Not Attached ☐ Not applicable

Specific to Non-Traditional MS4s and per requirements f.iv in the referenced MCM, attach the summary of investigations conducted and corrective actions taken per the required Illicit Discharge Investigation and Corrective Action Plan and any associated documents.

☐Attached ☐ Not Attached ☐ Not applicable

Post-Construction Site Storm Water Management in New and Redevelopment

Specific to Traditional MS4s and per requirements c.i in the referenced MCM, attach the post-construction storm water management inspection form or checklist.

☐Attached ☐ Not Attached ☐ Not applicable

Specific to Non-Traditional MS4s and per requirements c.ii in the referenced MCM, attach the post-construction storm water management inspection form or checklist.

☐Attached ☐ Not Attached ☐ Not applicable

Per requirements in c.iii in the referenced MCM, attach the inventory of all new permittee-owned and private post-construction storm water management controls.

☐Attached ☐ Not Attached

Per requirements in c.vi in the referenced MCM, attach an inspection frequency protocol.

☐Attached ☐ Not Attached

Specific to Traditional MS4s and per requirements c.vii, attach the developed inspection program.

☐Attached ☐ Not Attached ☐ Not applicable

Pollution Prevention/Good Housekeeping for Permittee Operations

Per requirements in a.iii in the referenced MCM, attach completed Standard Operating Procedures.

☐Attached ☐ Not Attached

2019 Annual Report Attachments (3rd Calendar Year)

Public Education and Outreach:

Per requirements c.ii in the referenced MCM, attach the required information regarding outreach materials distributions.

☐Attached ☐ Not Attached

Public Involvement and Participation:

Per requirements a.ii in the referenced MCM, attach the required information regarding participation and key target audience feedback on approaches.

☐Attached ☐ Not Attached

Illicit Discharge Detection & Elimination:

Per requirements a.i in the referenced MCM, attach the required information regarding categories of non-storm water discharges or flows, associated pollutants, and local controls or conditions.

☐Attached ☐ Not Attached

Per requirements b.i in the referenced MCM, attach the required information regarding occasional non-storm water discharges or flows, associated pollutants, and local controls or conditions.

☐Attached ☐ Not Attached

Per requirements e.ii in referenced MCM, attach the list of high priority outfalls.

☐Attached ☐ Not Attached

Per requirements e.iii in referenced MCM, attach the required summary of screening results.

☐Attached ☐ Not Attached

Specific to Traditional MS4s and per requirements f.iii in the referenced MCM, attach the summary of investigations conducted and corrective actions taken per the required Illicit Discharge Investigation and Corrective Action Plan and any associated documents.

☐Attached ☐ Not Attached ☐ Not applicable

Specific to Non-Traditional MS4s and per requirements f.iv in the referenced MCM, attach the summary of investigations conducted and corrective actions taken per the required Illicit Discharge Investigation and Corrective Action Plan and any associated documents.

☐Attached ☐ Not Attached ☐ Not applicable

Construction Site Storm Water Management:

Specific to Traditional MS4s and per requirements a.i in the referenced MCM, attach the adopted ordinance or other regulatory mechanism to require construction storm water controls.

☐Attached ☐ Not Attached ☐ Not applicable

Specific to Non-Traditional MS4s and per requirements a.ii in the referenced MCM, attach the legal authority summary.

☐Attached ☐ Not Attached ☐ Not applicable

Per requirements a.iii in the referenced MCM, attach the adopted Enforcement Response Plan and associated documents.

☐Attached ☐ Not Attached

Post-Construction Site Storm Water Management in New and Redevelopment

Per requirements in c.viii in the referenced MCM, attach findings and compliance actions regarding inspections of high priority post-construction storm water management controls.

☐Attached ☐ Not Attached

Specific to Traditional MS4s and per requirements c.ix, attach the findings and resulting actions regarding inspections of high priority privately-owned post-construction storm water management controls.

☐Attached ☐ Not Attached ☐ Not applicable

Pollution Prevention/Good Housekeeping for Permittee Operations

Per requirements in a.iii in the referenced MCM, attach the completed Standard Operating Procedures.

☐Attached ☐ Not Attached

2020 Annual Report Attachments (4th Calendar Year)

Public Education and Outreach:

Per requirements c.ii in the referenced MCM, attach the required information regarding outreach materials distributions.

☐Attached ☐ Not Attached

See SWMP Section 3.0

Public Involvement and Participation:

Per requirements a.ii in the referenced MCM, attach the required information regarding participation and key target audience feedback on approaches.

☐Attached ☐ Not Attached

See SWMP Section 3.0

Illicit Discharge Detection & Elimination:

Per requirements a.i in the referenced MCM, attach the required information regarding categories of non-storm water discharges or flows, associated pollutants, and local controls or conditions.

☐Attached ☐ Not Attached

See SWMP Section 4.6

Per requirements b.i in the referenced MCM, attach the required information regarding occasional non-storm water discharges or flows, associated pollutants, and local controls or conditions.

☐Attached ☐ Not Attached

See SWMP Section 4.6

Per requirements e.ii in referenced MCM, attach the list of high priority outfalls.

☐Attached ☐ Not Attached

See SWMP Section 4.7

Per requirements e.iii in referenced MCM, attach the required summary of screening results.

☐Attached ☐ Not Attached

See SWMP Section 4.7

Specific to Traditional MS4s and per requirements f.iii in the referenced MCM, attach the summary of investigations conducted and corrective actions taken per the required Illicit Discharge Investigation and Corrective Action Plan and any associated documents.

☐Attached ☐ Not Attached ☐ Not applicable

See SWMP Section 4.0

Specific to Non-Traditional MS4s and per requirements f.iv in the referenced MCM, attach the summary of investigations conducted and corrective actions taken per the required Illicit Discharge

Investigation and Corrective Action Plan and any associated documents.

☐Attached ☐ Not Attached ☐ Not applicable

Post-Construction Site Storm Water Management in New and Redevelopment

Specific to Traditional MS4s and per requirements a.i in the referenced MCM, attach the adopted ordinance or other regulatory mechanism to require post-construction storm water controls. Attached

☐Attached ☐ Not Attached ☐ Not applicable

Specific to Non-Traditional MS4s and per requirements a.ii in the referenced MCM, attach the legal authority summary.

☐Attached ☐ Not Attached ☐ Not applicable

Per requirements in a.iii in the referenced MCM, attach the Enforcement Response Plan and associated documents. See SWMP Section 6.7

☐Attached ☐ Not Attached

Per requirements in c.viii in the referenced MCM, attach findings and compliance actions regarding inspections of high priority post-construction storm water management controls. See SWMP Section 6.6

☐Attached ☐ Not Attached

Specific to Traditional MS4s and per requirements c.ix, attach the findings and resulting actions regarding inspections of high priority privately-owned post-construction storm water management controls. See SWMP Section 6.6

☐Attached ☐ Not Attached ☐ Not applicable

Per requirements in d.i in the referenced MCM, attach a summary of the discussion outcomes. See SWMP Section 6.9

☐Attached ☐ Not Attached

Pollution Prevention/Good Housekeeping for Permittee Operations

Per requirements in a.iii in the referenced MCM, attach the completed Standard Operating Procedures. Attached

☐Attached ☐ Not Attached

2021 Annual Report Attachments (5th Calendar Year)

Public Education and Outreach:

Per requirements c.ii in the referenced MCM, attach the required information regarding outreach materials distributions.

☐Attached ☐ Not Attached

Public Involvement and Participation:

Per requirements a.ii in the referenced MCM, attach the required information regarding participation and key target audience feedback on approaches.

☐Attached ☐ Not Attached

Illicit Discharge Detection & Elimination:

Per requirements a.i in the referenced MCM, attach the required information regarding categories of non-storm water discharges or flows, associated pollutants, and local controls or conditions.

☐Attached ☐ Not Attached

Per requirements b.i in the referenced MCM, attach the required information regarding occasional non-storm water discharges or flows, associated pollutants, and local controls or conditions.

☐Attached ☐ Not Attached

Per requirements e.ii in referenced MCM, attach the list of high priority outfalls.

☐Attached ☐ Not Attached

Per requirements e.iii in referenced MCM, attach the required summary of screening results.

☐Attached ☐ Not Attached

Specific to Traditional MS4s and per requirements f.iii in the referenced MCM, attach the summary of investigations conducted and corrective actions taken per the required Illicit Discharge Investigation and Corrective Action Plan and any associated documents.

☐Attached ☐ Not Attached ☐ Not applicable

Specific to Non-Traditional MS4s and per requirements f.iv in the referenced MCM, attach the summary of investigations conducted and corrective actions taken per the required Illicit Discharge Investigation and Corrective Action Plan and any associated documents.

☐Attached ☐ Not Attached ☐ Not applicable

Post-Construction Site Storm Water Management in New and Redevelopment

Per requirements in c.viii in the referenced MCM, attach findings and compliance actions regarding inspections of high priority post-construction storm water management controls.

☐Attached ☐ Not Attached

Specific to Traditional MS4s and per requirements c.ix, attach the findings and resulting actions regarding inspections of high priority privately-owned post-construction storm water management controls.

☐Attached ☐ Not Attached ☐ Not applicable

Pollution Prevention/Good Housekeeping for Permittee Operations

Per requirements in a.iii in the referenced MCM, attach completed Standard Operating Procedures.

☐Attached ☐ Not Attached

Attach any updates, changes, or improvements to the Small MS4 Storm Water Management Program per requirements in Part IV (E).

☐Attached ☐ Not Attached ☐ Not applicable

Annual Report Form Signature

This Annual Report Form must be completed, signed, and certified as follows:

- **For a corporation, by a principal officer of at least the level of vice president;**
- **For a partnership or sole proprietorship, by a general partner or the proprietor, respectively; or**

For a municipality, state, federal, or other public facility, by either a principal executive officer or ranki elected official.

All Permittees Must Complete the Following Certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information; including the possibility of fine and imprisonment for knowing violations. [75-5-633, MCA].

Certification of this form indicates conformance with the 2017 General Permit for Storm Water Discharge Associated with Small Municipal Separate Storm Sewer Systems and the required Annual Reporting upon receipt of permit coverage.

Name (Type or Print)	
Jeff Mihelich	
Title (Type or Print)	**Phone Number**
City Manager	(406)582-2324
Signature	**Date Signed**
Jeff Mihelich	2-23-2021

Graphic: Surcharging storm sewer utility structure

Graphic: Stormwater treatment unit installation

Blank Page

Table of Contents

Program Administration	**Section 1.0**
Capital Project Program	**Section 2.0**
Public Education Program	**Section 3.0**
Illicit Discharge Detection and Elimination Program	**Section 4.0**
Construction Site Management Program	**Section 5.0**
Post-Construction Program	**Section 6.0**
Good Housekeeping Program	**Section 7.0**
Sampling and Evaluation Program	**Section 8.0**
Stormwater Management Plan Updates	**Section 9.0**

Blank Page

Section 1.0
Program Administration

Graphic 1.0.1: Street-flooding resulting from clogged infrastructure

Graphic 1.0.2: Failed stormwater pipe

Blank Page

1.1 Introduction

This Stormwater Management Plan (SWMP) describes the City of Bozeman (City) and Montana State University's (University), collectively known as the MS4, structural and administrative Best Management Practices (BMPs) engineered, implemented, maintained, and enforced to meet the following objectives:

- Protect public safety;
- Improve water quality; and
- Comply with environmental regulations.

This SWMP is an iterative and evolving document with updates occurring annually. The MS4 tracks updates in SWMP Section 9.0. SWMP Section 1.0 details the following components necessary to administer the MS4's Program, including:

- Background Information (1.2)
- City Program Framework (1.3)
- University Program Framework (1.4)
- Stormwater Management Team (1.5)
- MS4 Coordination (1.6)
- Collaborative Organizations (1.7
- Additional Regulatory Responsibilities (1.8)
- Annual Report (1.9)
- Public Comments (1.10)

1.2 Background Information

The MS4 is an incorporated town located in Gallatin County, Montana, and has a population of 61,953 as of 2016 (*City population 45,250, University population 16,703*). The MS4's primary land-use type is residential and commercial, with isolated industrial areas. Other notable geographical details include:

- Elevation: 4820 ft.
- Climate: Cold continental, with warm and dry summers, cold and dry winters
- Average Temperature: 44.6 ˚F
- Average Precipitation: 18.4 inches (*University rain gauge*)

The MS4 is located at the headwaters of the Upper Missouri Watershed and possesses relatively pristine surface water quality that supports several beneficial uses, including aquatic life, drinking water, agriculture, and recreation. Numerous waterways originate within and pass through the MS4.

The MS4's most notable waterway is Bozeman Creek (aka Sourdough Creek), which originates in the Gallatin Mountains south of its jurisdictional boundary. Flowing north, Bozeman Creek enters the MS4 at its southeastern border and continues until its confluence with the E. Gallatin River. The Montana Department of Environmental Quality (MDEQ) determined that Bozeman Creek has various impairments from natural and anthropogenic sources when developing its 2013 Lower Gallatin Planning Area Total Maximum Daily Load Report (TMDL).

The second most notable waterway is Mandeville Creek, a small spring feed watercourse that originates south of Bozeman. Flowing north, Mandeville Creek enters the MS4 at its south-central boundary and continues until its confluence with the E. Gallatin River. The MDEQ determined that Mandeville Creek also has various impairments from natural and anthropogenic sources when developing its TMDL.

Numerous perennial and intermittent spring creeks flow through the MS4 in a web of channels, irrigation ditches, and pipes. The MDEQ has not completed an assessment of these waterways.

The MS4's water resources represent a significant community value and are the backbone of its tourism, recreation, and neighboring agricultural industries. A growing threat to these invaluable resources is stormwater runoff, which occurs when rainfall and snowmelt flow over developed surfaces, such as yards, roadways, parking lots, and rooftops. Stormwater picks up pollutants before entering storm sewers, such as drains, pipes, and ditches, and eventually discharges into the MS4's waterways. Stormwater runoff can result in property damage, public health threats, and environmental degradation if not proactively managed. Specific pollutants of concern include:

- Sediment: Sourced from barren ground, construction sites, road sand, unpaved roads and trails, gravel parking lots, windblown dust, and vehicle grime, resulting in suffocated aquatic habitat and alterations to stream channel morphology.
- Nitrogen and Phosphorous: Sourced from improper lawn fertilizer application, grass clippings, and yard debris, resulting in oxygen-depleting algae blooms.
- E.coli: Sourced from substandard septic systems and pet waste, resulting in toxic conditions for the public and wildlife.
- Floatables: Sourced from littering, overfilled garbage cans, and unsecured loads, resulting in clogged infrastructure, impaired aesthetic value, and endangered wildlife.
- Oil, Grease, Metals, and Detergents: Sourced from improper vehicle maintenance, car spills, and car washing, resulting in toxic conditions for humans and wildlife.
- Temperature: Sourced from extensive and continuous impervious areas, resulting in harmful impacts to coldwater fisheries.

To counter stormwater runoff's impact, the United States Congress established the National Pollutant Discharge Elimination System (NPDES) as a part of the Clean Water Act (CWA) in 1972 to preserve and restore the health of the United States' Waters. The U.S. Environmental Protection Agency (EPA) is the lead organization tasked with the implementation and oversight of the CWA. In Montana, the MDEQ has primacy, allowing for further state-scale interpretation, enactment, and enforcement.

The NDPES program regulates water pollution through a series of permits focused on point sources, such as industrial facilities, wastewater plants, and stormwater discharges. The driving permit behind the development and implementation of this SWMP is the MDEQ's Phase 2 General Permit for Stormwater Discharges Associated with Small Municipal Separate Storm Sewer Systems (MS4 Permit), which requires the City and University to implement a variety of programs to mitigate polluted discharges to waterways.

The MDEQ designates the City as a traditional permittee and the University as a non-traditional permittee. Both parties are co-permittees because their storm sewers are connected, and they work together on various administrative programs. The MDEQ requires the MS4 to complete the following:

- Prepare and submit individual Notices of Intent (NOI).
- Receive authorizations to discharge from MDEQ by January 1, 2017.
- Prepare and submit individual Annual Reports.
- Develop, implement, and update this SWMP throughout the MS4 Permit term.

Also, the MDEQ requires the MS4 to administer a program that works to accomplish the following:

- Educate the public (SWMP Section 3.0)
- Engage citizens through involvement and participation (SWMP Section 3.0)
- Detect and eliminate illicit discharges and connections (SWMP Section 4.0)
- Regulate construction sites (SWMP Section 5.0)

- Regulate stormwater facilities constructed with new and re-development (SWMP Section 6.0)
- Mitigate polluted discharges from municipal facilities and operations (SWMP Section 7.0)
- Collect and analyze water quality and stormwater runoff data (SWMP Section 8.0)

The following sections of this SWMP outline the MS4's work within each of these programs.

1.3 City Program Framework

On June 25, 2012, the City adopted Ordinance 1831, creating a Stormwater Utility, providing revenue collection for the operation and maintenance of the City's stormwater system. Funding was initially allocated to inventory, map, and assess the condition of the City's storm sewer. This effort was in response to findings identified during a 2011 MDEQ MS4 Permit audit, which included one violation, 16 program deficiencies, and 23 improvement recommendations.

On March 3, 2014, the City presented the results of their inventory, mapping, and assessment effort to City Commissioners. The City inventoried over ten thousand individual assets, many of which were clogged, cracked, buried, or in disrepair. Also, a program administration review identified significant shortfalls. Commissioners directed the City to develop options for addressing known issues.

On April 21, 2014, the City presented three levels of service, differing primarily on the timeline required to address issues and the annual funding level. Commissioners decided to implement a program that included a funding level of $1.2 million annually for operations, treatment, and deferred maintenance.

On February 23, 2015, the City adopted a new level of service and a rate model to collect service fees based on individual property's impact on the stormwater system.

On December 1, 2015, the City implemented the final piece of the new rate model allowing a fully funded and functional Stormwater Utility for the first time in its history. The City's utility rate model includes the following components:

- Flat Charge: Charged evenly across the service area. Properties with a water meter receive a flat monthly charge per meter. Properties that have impervious area, but do not have a water meter also receive a flat charge. The funding pays for deferred maintenance projects.
- Variable Charge: Charged proportional to the amount of impervious area individual properties have. Impervious area does not allow water to soak into the ground during rain events creating stormwater runoff. Larger areas result in more impact on public storm sewers and waterways.
- Utility Credit: Properties that have installed quantity and quality-based stormwater infrastructure controls receive a billing credit as these properties impact the stormwater system less than those without stormwater infrastructure.

The City's utility rate model includes the following funding allocations:

- Approximately $450,000 annually for deferred maintenance, which includes costs associated with the replacement and cleaning of storm sewer assets.
- Approximately $550,000 annually for operations and maintenance, which includes expenses related to personnel, reoccurring system maintenance, supplies, and equipment.
- Approximately $200,000 annually for system enhancements, which includes costs associated with stormwater treatment projects to remove pollutants before discharging to waterways.

The Stormwater, Building, Strategic Services, and Finance Divisions work collaboratively to update the rate model regularly as new development occurs. The workflow includes:

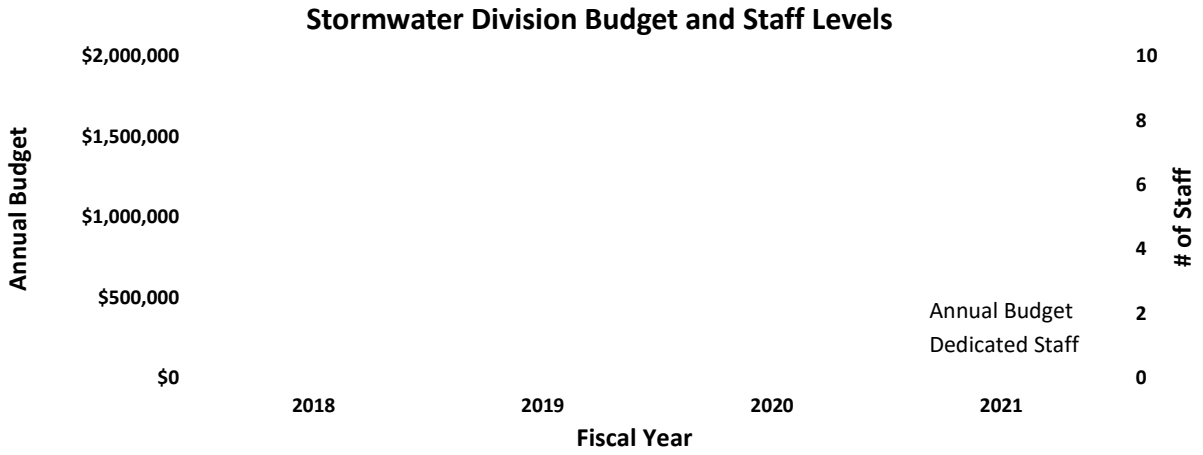
1. Developers submit site plans to the Building Division through electronic permit software.
2. Staff reviews and uploads site plans to a shared group folder on the City's internal drive.

3. Strategic Services Staff checks the folder regularly, imports site plans into GIS, digitizes impervious area, and updates the polygon's Equivalent Residential Unity (ERU) attribute.
4. Finance sends water meter notice to Staff when a project is nearing completion.
5. Stormwater Staff review impervious area data based on the address information provided by Finance and calculates an ERU total, including percentage credit, if applicable.
6. Stormwater Staff provides Finance Staff with an ERU value and credit value.
7. Finance Staff updates software and generates a bill for customers.

Table 1.3.1 shows impervious area additions per year (single-family units and public roads excluded):

Calendar Year	Impervious Area (Acres)	Site Plans
2017	75	86
2018	73	100
2019	68	98
2020	66	97
2021	-	-

Budget creation and approval occurs annually to allocate collected funds, including the following details:



Graphic 1.3.2: Stormwater Division Budget and Staff Levels Graph

- Fiscal Year 2018 Budget (July 1, 2017 - June 30, 2018)
  - Percent Allocation: 100%
  - Resource Justification: Budget approval process completed June 26, 2017.
  - Program Effectiveness: See SWMP Sections 2.0 - 8.0.
  - Resource Variation: Proposed addition of one FTE (Stormwater Specialist), approved.
  - Success Determination: See SWMP Sections 2.0 - 8.0.
  - Staff: 6.5 FTEs

Fiscal Year	Budget
Salaries and Benefits	$451,548
Operating	$161,466
Capital	$650,000
Debt Service	$225,346
Transfers	$0.00
Total Budget:	$1,488,360

- Fiscal Year 2019 Budget (July 1, 2018 - June 30, 2019)
  - Percent Allocation: 100%
  - Resource Justification: Budget approval process completed June 25, 2018.
  - Program Effectiveness: See SWMP Sections 2.0 - 8.0.
  - Resource Variation: Proposed addition of one FTE (Project Manager), approved.
  - Success Determination: See SWMP Sections 2.0 - 8.0.
  - Staff: 6.5 FTEs

Fiscal Year	Budget
Salaries and Benefits	$408,583
Operating	$240,373
Capital	$635,000
Debt Service	$160,346
Transfers	$0.00
Total Budget:	$1,444,302

- Fiscal Year 2020 Budget (July 1, 2019 - June 30, 2020)
  - Percent Allocation: 100%
  - Resource Justification: Public budget approval process completed June 24, 2019.
  - Program Effectiveness: See SWMP Sections 2.0 - 8.0.
  - Resource Variation: 4% rate increase to pay for new FTE and inflation.
  - Success Determination: See SWMP Sections 2.0 - 8.0.
  - Staff: 7.5 FTEs

Fiscal Year	Budget
Salaries and Benefits	$580,938
Operating	$268,372
Capital	$650,000
Debt Service	$161,211
Transfers	$0.00
Total Budget:	$1,660,521

- Fiscal Year 2021 Budget (July 1, 2020 - June 30, 2021)
  - Percent Allocation: 100% dedicated to stormwater programs and projects.
  - Resource Justification: Public budget approval process completed in June 2020. Staff gave a public presentation regarding past, current, and future work, and answered questions.
  - Program Effectiveness: See performance measures in SWMP Sections 2.0 - 8.0.
  - Resource Variation: 4% rate increase to pay for inflation, increased capital needs/cost, and to fund a new position. No significant changes have occurred from the FY20 budget cycle.
  - Success Determination: The City was successful in receiving requested resources. See SWMP Sections 2.0 - 8.0 for more information regarding ongoing and planned programs and projects.
  - Staff: 8.5 FTEs

Fiscal Year	Budget
Salaries and Benefits	$640,866
Operating	$317,907
Capital	$700,000
Debt Service	$194,735
Transfers	$0.00
Total Budget:	$1,853,508

1.4 University Program Framework

In the current permit cycle, the University has managed six projects of an acre or larger, which have influenced stormwater quantity and quality. Those projects are:

- American Indian Hall: Over One Acre, Active, 2021 Planned Completion
- Romney Oval Renovation Project: Over One Acre, Active, 2021 Planned Completion
- Romney Hall Renovation project: Under One Acre, Active, 2021 Planned Completion
- Norm Asbjornson Hall Construction: Over One Acre Project, Complete 2020
- Hyalite Hall: Over One Acre Project, Complete 2020
- Montana Hall Elevator and Renovation project: Under One Acre, Complete 2020
- Lambert Field Renovations: Over One Acre, Complete 2019
- Rendezvous Dining Hall Construction: Over One Acre, Complete 2019
- College and 11th Treatment Unit: Under One Acre, Complete 2019

In 2020, the University has devoted approximately 640 hours to stormwater maintenance, management, and improvements and tracks work activities and labor using a work order system. Under the general guidance of the Engineering and Utilities Manager, the Environmental Service Manager coordinates and ensures MS4 Permit compliance.

1. Current Staff:
    - Engineering and Utility Manager: Directional and political support (*40 hours per year*)
    - Director - Facilities Services: Overall program coordination. Administers and supports environmental compliance programs; manages support personnel; identifies and advocates for infrastructure projects; conducts sampling, training, inspections, permit reviews, data collection, and reporting; manages reoccurring infrastructure maintenance, structural inspections, repairs, and replacements *(300 hours/year)*
    - Support Staff and Contracted Services: Groundskeepers, laborers, plumbers, and street sweeping (300 hours/year)

The following representatives make up the University's stormwater management team. Regular communication occurs, allowing for the exchange of necessary information:

1. Megan Sterl, Engineering and Utility Manager
    - Program Administration
2. EJ Hook, Director, Facilities Services *(Primary SWMP Coordinator)*
    - Public Education Program (SWMP Section 3.0)
    - Illicit Discharge Detection and Elimination Program (SWMP Section 4.0)
    - Construction Site Management Program (SWMP Section 5.0)
    - Post Construction Program (SWMP Section 6.0)
    - Good Housekeeping Program (SWMP Section 7.0)

Current funding is not a line item but included in the general campus maintenance operations budget for Facilities Services. As allowable and necessary funds from Facilities Services General Operating budget are allocated to specific stormwater improvement projects.

- Fiscal Year 2018 Approved Budget (July 1, 2017 - June 30, 2018)
  - Percent Allocation: 100%
  - Resource Justification: Budget approval process completed June 29, 2017
  - Program Effectiveness: See SWMP Sections 2.0 - 8.0.
  - Resource Allocation Variation: $25,000 for College and 11th improvement project design
  - Success Determination: See SWMP Sections 2.0 - 8.0.
  - Staff: 0.3 FTEs

Fiscal Year	Budget
Operating	$124,000
Capital	-
Total Budget:	$124,000

- Fiscal Year 2019 Approved Budget (July 1, 2018 - June 30, 2019)
  - Percent Allocation: 100%
  - Resource Justification: Budget approval process completed June 29, 2018
  - Program Effectiveness: See SWMP Sections 2.0 - 8.0.
  - Resource Allocation Variation: $150,000 for College and 11th improvement project installation
  - Success Determination: See SWMP Sections 2.0 - 8.0.
  - Staff: 0.3 FTEs

Fiscal Year	Budget
Operating	$124,000
Capital	$150,000
Total Budget:	$274,000

- Fiscal Year 2020 Approved Budget (July 1, 2019 - June 30, 2020)
  - Percent Allocation: 100%
  - Resource Justification: Budget approval process completed June 29, 2019
  - Program Effectiveness: See SWMP Sections 2.0 - 8.0.
  - Resource Allocation Variation: None
  - Success Determination: See SWMP Sections 2.0 - 8.0.
  - Staff: 0.3 FTEs

Fiscal Year	Budget
Operating	$126,500
Capital	-
Total Budget:	$126,500

- Fiscal Year 2021 Approved Budget (July 1, 2020 - June 30, 2021)

- Percent Allocation: 100%
- Resource Justification: Budget approval process completed June 29, 2019
- Program Effectiveness: See SWMP Sections 2.0 - 8.0.
- Resource Allocation Variation: None
- Success Determination: See SWMP Sections 2.0 - 8.0.
- Staff: 0.3 FTEs

Fiscal Year	Budget
Operating	$126,500
Capital	-
Total Budget:	$126,500

1.5 Stormwater Management Team

The MS4 has three Stormwater Management Teams described in Graphic 1.5.1 and the following section.

Graphic 1.5.1: Organization Chart

SWMP Team: Meets weekly and is comprised of the following positions:

1. Stormwater Program Coordinator: SWMP Coordinator and Bozeman Municipal Code (BMC) Section 40 Article 4 Enforcement Agent. Leads the SWMP Team, SWMP Subject Matter Experts, and coordination with SWMP Support Divisions. The Coordinator develops and manages the

implementation of SWMP and MS4 Permit compliance activities, administers environmental compliance programs, manages personnel, prepares budgets, develops policies, coordinates infrastructure projects, and maintains the rate model. Primary permit responsibilities include:

- Program Administration (SWMP Section 1.0)
- Capital Project Program (SWMP Section 2.0)
- Public Education Program (SWMP Section 3.0)
- Illicit Discharge Detection and Elimination Program (SWMP Section 4.0)
- Construction Site Management Program (SWMP Section 5.0)
- Post Construction Program (SWMP Section 6.0)
- Good Housekeeping Program (SWMP Section 7.0)
- Sampling and Evaluation Program (SWMP Section 8.0)

2. Stormwater Program Specialist: Develops and implements water quality monitoring, BMP effectiveness research, and data analysis. Primary permit responsibilities include:

   - Public Education Program (SWMP Section 3.0)
   - Illicit Discharge Detection and Elimination Program (SWMP Section 4.0)
   - Good Housekeeping Program (SWMP Section 7.0)
   - Sampling and Evaluation Program (SWMP Section 8.0)

3. Stormwater Project Manager: Plans and manages stormwater conveyance, flood control, and treatment capital projects, implements the City's asset maintenance efforts, and regulates drainage infrastructure. Primary permit responsibilities include:

   - Capital Project Program (SWMP Section 2.0)
   - Post Construction Program (SWMP Section 6.0)
   - Good Housekeeping Program (SWMP Section 7.0)

4. Two Stormwater Program Technicians: Perform permit reviews, site inspections, and reporting tasks. Primary permit responsibilities include:

   - Construction Site Management Program (SWMP Section 5.0)

The SWMP Team tracks phone call and email questions, requests, and complaints received from the public to gauge programmatic needs and workloads, including:

Correspondence Type	Count				
	2018	2019	2020	2021	Total
Resident: Flooding Inquiry or Report	7	15	2	-	24
Resident: Construction Inquiry or Report	22	19	9	-	50
Resident: Water Quality Inquiry or Report	2	2	2	-	6
Resident: Pollution Inquiry or Report	14	6	3	-	23
Resident: Basin Inquiry or Report	14	12	10	-	36
Resident: Outreach Inquiry or Report	2	12	2	-	16
Resident: Rate Model Inquiry	4	6	5	-	15
Professional: Post-Const. Program	47	60	52	-	159
Professional: Pollution Program	4	18	7	-	29
Professional: Const. Program	112	295	465	-	872
Professional: Project Management	16	181	72	-	269
Professional: Education Program	14	57	32	-	103
Professional: Division Administration	9	36	43	-	88
Professional: Water Quality Program	11	8	16	-	35
Professional: Service or Product Solicitation	17	19	9	-	45
Referral to other division	5	6	4	-	15
Total:	300	752	733	-	1,785

SWMP Subject Matter Experts (SME): The SME group meets as necessary to discuss programmatic issues and is comprised of the following positions:

1. Engineering Division: Team of three positions that review and regulate new and redevelopment projects utilizing established engineering standards. The positions include the Development Review Manager and a variety of staff engineers. Primary permit responsibilities include:
   - Post Construction Program (SWMP Section 6.0)
2. Operations and Maintenance: Team of five positions that operate and maintain the public storm sewer network, including the inspection, maintenance, and repair of infrastructure. This group also inspects underground pipes to identify illicit discharges and illegal connections. This team includes a Superintendent, Assistant Superintendent, Foreman, and two Operators. Primary permit responsibilities include:
   - Illicit Discharge Detection and Elimination Program (SWMP Section 4.0)
   - Good Housekeeping Program (SWMP Section 7.0)
3. Streets Division: Numerous positions that operate the City's street sweeping, spring and fall cleanups, and surface inlet grate obstruction removal and replacement activities. This team includes a Superintendent, Assistant Superintendent, and numerous Operators. Primary permit responsibilities include:
   - Good Housekeeping Program (SWMP Section 7.0)

SWMP Support Divisions: Group engaged by the SWMP Team as needs arise. Support Divisions do not typically participate in reoccurring meetings unless invited to discuss a particular topic.

1.6 MS4 Coordination

The MS4s works collaboratively on various programs, including:

- Participation in monthly meetings.
- University payment of City stormwater fees, rate model update to occur during Q1 of each calendar year and an updated total should be in place by July 1.
- Performance tracking and reporting.
- Infrastructure project development and implementation.
- Inspection forms, training, methodologies, and program documentation sharing.
- Pollution event response and resolution, as requested.
- Stormwater treatment unit maintenance: The City removes debris collected by University stormwater mechanical treatment units and incorporates totals into SWMP Section 8.0 annually, including:
  - University Field House Downstream Defender Mechanical Separation Unit
  - 11th and College Contech CDS Mechanical Separation Unit
- Water Sampling and Analysis Program: The City manages the University's portion of this program, including purchasing equipment, collecting samples/data, and analyzing results for the following:
  - Urban Runoff Monitoring
  - In-Stream Wet Weather Monitoring
  - Sediment Reduction Monitoring
  - Long-Term Trend Monitoring
- Post Construction Program: The City completes six high-priority stormwater facility inspections on MSU property annually, and provides completed reports.
- The City provides the University an updated SWMP by February 1 of each calendar year.

1.7 Collaborative Organizations

The MS4 collaborates with a variety of organizations, including:

- Montana Stormwater Committee (MSC): An organization formed in 2016 comprised of public and private stormwater industry representatives that provides a unified voice for state scale policy changes, rules, issues, and initiatives. The MSC meets monthly to discuss relevant topics. Their most recent accomplishment includes the development of Montana's first American Society of Civil Engineers Stormwater Report Card, resulting in a statewide score of D.
- National Municipal Stormwater Alliance (NMSA): An organization formed in 2015 comprised of stormwater industry professionals that provides a unified voice for national scale policy changes, rules, issues, and initiatives.
- Montana Department of Environmental Quality (MDEQ): A state agency that administers and enforces the Montana Clean Water Act. MDEQ provides compliance training, conferences, and enforcement in cases where the MS4's resources become exhausted.
- Gallatin Local Water Quality District (GLWQD): A Gallatin County public agency that conducts water quality sampling and community education.
- Montana State Extension Water Quality: A University Extension agency that provides water quality sampling and community education.
- Montana Water Environment Association (MWEA): A Montana organization that represents water, wastewater, and stormwater professionals. MWEA is a member of the Water Environment Federation (WEF), which has over 34,000 members worldwide. WEF is working to raise knowledge regarding stormwater infrastructure, policy, and science at the national level.
- Gallatin Watershed Council (GWC): An education-based nonprofit organization that works to improve waterway health by implementing the Gallatin Watershed Restoration Plan.

1.8 Additional Regulatory Responsibilities

The following MPDES permits also fall under the purview of the MS4:

- General Permit for Stormwater Discharges Associated with Construction Activity (MTR100000): Construction projects that disturb one acre or more of land must obtain a stormwater discharge authorization from the MDEQ. The MS4 implements a Construction Management Program detailed in SWMP Section 5.0
- Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity (MTR000000): The MS4's Water Reclamation Facility (WRF) and Landfill obtain authorizations to discharge stormwater from their facilities. MS4 Staff assist WRF and Landfill personnel with required inspections, BMP development, training, reporting, and records keeping.

1.9 Annual Report

The MS4 submits individual Annual Report Forms, an updated SWMP, and relevant documents to the MDEQ by March 1 of each year.

1.10 Public Comments

The MS4 considers and responds to all public comment related to the SWMP. To facilitate, a public comment form exists on the MS4's website and is available year round. Also, the MS4 publically notices the SWMP after making annual updates in the Bozeman Daily Chronicle the second and third Sundays of March during each calendar year. Dates include:

- 2019: March 17th and 24th
- 2020: March 15th and 22nd
- 2021: March 14th and 21st

The MS4 has received the following comments:

#	Date	Participant	Comment	MS4 Response
1	2019	Adopt-A-Drain Participant	I look at the City in an entirely different way now. Whenever I look at the street, I see the headwaters of a creek (In person feedback).	Noted comment and will request their participation in the 2020 Adopt-A-Drain Program.
2	7/23/19	Adopt-A-Drain Participant	I cannot believe the debris-filled the whole bucket! You are right how much more aware I have become about the drains and my street surroundings. I even found a pair of swimming goggles near the drain, kind of weird and ironic, who was swimming in the drains!?".	Noted comment and will request their participation in the 2020 Adopt-A-Drain Program.
3	7/23/19	Adopt-A-Drain Participant	Thank you, I will put the bucket on the front porch! And yes please share my email. And to add to the email...with this new Storm Drain awareness and understanding, I feel like I should be cleaning all the drains that I see that are filled with debris and to let others know how important it is to keep them free of debris. I have always been a big supporter of clean waterways and trying to do my part for the environment	Noted comment and will request their participation in the 2020 Adopt-A-Drain Program.

			but actually being involved in a community program like Adopt A Drain makes it more real and more personal. Thank you so much for being the architect of this great program!! One more note, the drain on the corner of 3rd and Short does look pretty congested inside not sure though.	
4	9/27/19	Adopt-A-Drain Participant	Of the 563.7 pounds, 563.4 was construction debris!	Noted comment and will request their participation in the 2020 Adopt-A-Drain Program.
5	1/2/20	Adopt-A-Drain Participant	Thank you for the update! Sorry I fell off the map. The last bit of debris that I removed, I accidentally threw away. I was amazed at how once you clean the drain there is not much that needs to be done until the Fall. Also the drain looked amazing after you guys cleaned the insides out. It is an amazing program! Thank you for doing it and keeping our drains clean. I look forward to doing it again this year.	Noted comment and will request their participation in the 2020 Adopt-A-Drain Program.
6	1/3/20	Adopt-A-Drain Participant	Frank! Thanks so much for the update on how much we all saved from going down the drain! I still have a full bucket of debris; what should I do with it? And should I continue cleaning my drain? Bravo to you and the others for a great experiment!	Noted comment and will request their participation in the 2020 Adopt-A-Drain Program.
7	1/3/20	Adopt-A-Drain Participant	My only feedback is that I forget to check/clean “my” drain. I’ll create reminders in my calendar. I’ll also create a reminder and post a photo and comment about my drain on NextDoor every now and then. What’s your goal for 2020? Let’s blow the lid off!!	Noted comment and will request their participation in the 2020 Adopt-A-Drain Program.
8	1/10/20	Adopt-A-Drain Participant	Thanks for the update – that is a lot of debris. Our only problem is that the compostable bags are hard to make stay up and open in the buckets. We are glad that compostable bags are being used – I wonder if there is some kid of giant rubber band that could be put around the bag to hold it up.	Noted comment and will request their participation in the 2020 Adopt-A-Drain Program.
9	5/27/20	Adopt-A-Drain Participant	Thank you so much for your email Frank! We hope you are doing well. I would love to volunteer again this year, count me in! I do have all the equipment from last year, I am pretty sure. If I don't I will let you know. I have noticed that quite a few drains around town have been Spring cleaned by the city, which is great!! Thank you again for doing this wonderful program!	Noted comment and will request their participation in the 2021 Adopt-A-Drain Program.

10	10/1/20	General Comment	Deer droppings, leaves, and lawn clippings can be prevented from going into stormwater drains by collecting this material and placing it in an area where it is unlikely to wash into gutters during a rain or while snow is melting. Ever since I began living in my single-family home in Bozeman, I have placed lawn clippings, deer droppings, and some leaves into a compost pile in my large vinyl lidded compost bin in the back yard. Other leaves I have either used as mulch around flowers and vegetables in the garden or else placed in a plastic garbage bin for green-clippings pickup by the city sanitation services once or twice a year. Composting has enabled my family to divert a large amount of kitchen waste and green clippings waste from the landfill and instead transform it into fertilizing compost with the aid of earthworms and microorganisms. This compost spurs soil fertility and makes flowers and veggies more healthy. It is a good alternative to chemical fertilizer such as ammonium nitrate, which can kill or "burn" plants if applied in too heavy a concentration, and which can discourage earthworms' aeration and enrichment of the soil.	Responded to the resident and noted the comment on 10/13/2020.
11	9/1/20 to 12/1/20	General Comments	Stormwater survey sent to 16,000 utility account holders.	Review the survey results and integrate collected information into future decision-making.

Section 2.0
Capital Project Program

Graphic 2.0.1: Stormwater treatment unit installation

Graphic 2.0.2: Permeable pavers installed at City Hall

Blank Page

2.1 Introduction

The MS4's Capital Project Program works to:

- Increase storm sewer capacity;
- Preserve the integrity of underground pipes and surface conveyances;
- Replace failed or failing infrastructure assets; and
- Meet water quality requirements set by the MDEQ.

SWMP Section 2.0 details the following components necessary to administer the MS4's Capital Project Program, including:

- Total Maximum Daily Load Action Plan (2.2)
- Planned Projects (2.3)
- Ongoing or Completed Projects (2.4)
- Pollutant Reduction Totals (2.5)
- Performance Measures (2.6)

2.2 Total Maximum Daily Load Action Plan

The MS4 works to reduce stormwater impacts on local waterways, prioritizing the following:

Bozeman Creek due to its total stormwater discharge points and impairments identified in the 2013 Lower Gallatin Planning Area TMDLs & Framework Water Quality Improvements Plan (TMDL), including:

- Total Suspended Solids (TSS): Contributions from the MS4 require a 37% or 81 tons/year reduction. The TMDL does not hold the MS4 to numeric TSS load limits. Instead, the TMDL states that the MS4 will meet its Waste Load Allocation (WLA) by "adhering to the (MS4) permit requirements to minimize pollutant loads." The MS4 implements the following BMPs to reduce TSS, including:
    - Stormwater Management Program implementation (SWMP Sections 1.0 - 8.0)
    - Mechanical separation unit installation at select direct discharge outfalls that drain large urban basins and lack treatment (SWMP Sections 2.3, 2.4, and 2.5).
    - Public Education Program implementation (SWMP Section 3.0), including, but not limited to, the Adopt-A-Drain Program (SWMP Section 3.4.1), Construction Training (SWMP Section 3.4.8), and Lawn Care Targeted Outreach (SWMP Section 3.4.12).
    - Construction Site Management Program implementation (SWMP Section 5.0), including the prioritization and elevated inspection rates for construction-sites within the Bozeman Creek Watershed (SWMP Section 5.4).
    - Post-Construction Program implementation (SWMP Section 6.2), including the enforcement of water quality and flood control standards for new and redevelopment projects (SWMP Section 6.2).
    - Good Housekeeping Program implementation (SWMP Section 7.0), including regular municipal storm sewer cleaning, spring/fall cleanups, and street sweeping (SWMP Sections 2.5 and 7.2), Facility Stormwater Pollution Prevention Plan execution, and Activity Stormwater Pollution Plan training.
    - Sampling and Evaluation Program implementation (SWMP Section 8.0), including the collection and analysis of stormwater runoff, in-stream water quality, BMP effectiveness, and long-term monitoring data (SWMP Section 8.0).

- Total Nitrogen: Contributions from the MS4 require a 0% reduction. The TMDL does not hold the MS4 to numeric Total Nitrogen load limits. Instead, the TMDL states that the MS4 will meet its WLA by "adhering to the (MS4) permit requirements." The MS4 implements the following BMPs to reduce Total Nitrogen, including:
    - Stormwater Management Program implementation (SWMP Sections 1.0 - 8.0).
    - Mechanical separation unit installation at select direct discharge outfalls that drain large urban basins and lack treatment (SWMP Sections 2.3, 2.4, and 2.5).
    - Public Education Program implementation (SWMP Section 3.0), including, but not limited to, the Adopt-A-Drain Program (SWMP Section 3.4.1), Construction Training (SWMP Section 3.4.8), and Lawn Care Targeted Outreach (SWMP Section 3.4.12).
    - Illicit Discharge Detection and Elimination Program implementation (SWMP Section 4.0), including the identification and resolution of illegal discharges (SWMP Sections 4.3, 4.4, and 4.5), and the investigation of outfalls (SWMP Section 4.7).
    - Construction Site Management Program implementation (SWMP Section 5.0), including the prioritization and elevated inspection rates for construction-sites within the Bozeman Creek watershed (SWMP Section 5.4).
    - Post-Construction Program implementation (SWMP Section 6.2), including the enforcement of water quality and flood control standards for new and redevelopment projects (SWMP Section 6.2).
    - Good Housekeeping Program implementation (SWMP Section 7.0), including regular municipal storm sewer cleaning, storm sewer inspection (CCTV), spring/fall cleanups, and street sweeping (SWMP Sections 2.5 and 7.2), Facility Stormwater Pollution Prevention Plan execution, and Activity Stormwater Pollution Plan training.
    - Sampling and Evaluation Program implementation (SWMP Section 8.0), including the collection and analysis of stormwater runoff, in-stream water quality, BMP effectiveness, and long-term monitoring data (SWMP Section 8.0).
- E. coli: Contributions from the MS4 require a 0% reduction. The TMDL does not hold the MS4 to numeric E. coli load limits. Instead, the TMDL states that the MS4 will meet its WLA by "adhering to the (MS4) permit requirements." The MS4 implements the following BMPs to reduce E. coli, including:
    - Stormwater Management Program implementation (SWMP Sections 1.0 - 8.0).
    - Public Education Program implementation (SWMP Section 3.0), including, but not limited to, the Dog Waste Campaign (SWMP Section 3.4.4).
    - Illicit Discharge Detection and Elimination Program implementation (SWMP Section 4.0), including the identification and resolution of illegal discharges (SWMP Sections 4.3, 4.4, and 4.5), and the investigation of outfalls (SWMP Section 4.7).
    - Good Housekeeping Program implementation (SWMP Section 7.0), including regular storm sewer inspection (CCTV), Facility Stormwater Pollution Prevention Plan execution, and Activity Stormwater Pollution Plan training.

Mandeville Creek due to its total stormwater discharge points and impairments identified in the TMDL, including:

- Total Nitrogen and Total Phosphorous: Contributions from the MS4 require a 0% reduction. The TMDL does not hold the MS4 to numeric Total Nitrogen and Total Phosphorous load limits. Instead, the TMDL states that the MS4 will meet its WLA by "adhering to the (MS4) permit requirements." The MS4 implements the following BMPs to reduce Total Nitrogen and Total Phosphorous, including:

- Stormwater Management Program implementation (SWMP Sections 1.0 - 8.0).
- Mechanical separation unit installation at select direct discharge outfalls that drain large urban basins and lack treatment (SWMP Sections 2.3, 2.4, and 2.5).
- Public Education Program implementation (SWMP Section 3.0), including, but not limited to, the Adopt-A-Drain Program (SWMP Section 3.4.1), Construction Training (SWMP Section 3.4.8), and Lawn Care Targeted Outreach (SWMP Section 3.4.12).
- Illicit Discharge Detection and Elimination Program implementation (SWMP Section 4.0), including the identification and resolution of illegal discharges (SWMP Sections 4.3, 4.4, and 4.5), and the investigation of outfalls (SWMP Section 4.7).
- Post-Construction Program implementation (SWMP Section 6.2), including the enforcement of water quality and flood control standards for new and redevelopment projects (SWMP Section 6.2).
- Good Housekeeping Program implementation (SWMP Section 7.0), including regular municipal storm sewer cleaning, storm sewer inspection (CCTV), spring/fall cleanups, and street sweeping (SWMP Sections 2.5 and 7.2), and Activity Stormwater Pollution Plan training.
- Sampling and Evaluation Program implementation (SWMP Section 8.0), including the collection and analysis of stormwater runoff, in-stream water quality, BMP effectiveness, and long-term monitoring data (SWMP Sections 8.4, 8.5, 8.6, and 8.7).

The East Gallatin due to its impairments identified in the TMDL, including:

- Total Nitrogen and Total Phosphorous: Contributions from the MS4 require a 0% reduction. The TMDL does not hold the MS4 to numeric Total Nitrogen and Total Phosphorous load limits. Instead, the TMDL states that the MS4 will meet its WLA by "adhering to the (MS4) permit requirements." The MS4 implements the following BMPs to reduce Total Nitrogen and Total Phosphorous, including:

    - Stormwater Management Program implementation (SWMP Sections 1.0 - 8.0).
    - Mechanical separation unit installation at select direct discharge outfalls that drain large urban basins and lack treatment (SWMP Sections 2.3, 2.4, and 2.5).
    - Public Education Program implementation (SWMP Section 3.0), including, but not limited to, the Adopt-A-Drain Program (SWMP Section 3.4.1), Construction Training (SWMP Section 3.4.8), and Lawn Care Targeted Outreach (SWMP Section 3.4.12).
    - Illicit Discharge Detection and Elimination Program implementation (SWMP Section 4.0), including the identification and resolution of illegal discharges (SWMP Sections 4.3, 4.4, and 4.5), and the investigation of outfalls (SWMP Section 4.7).
    - Post-Construction Program implementation (SWMP Section 6.2), including the enforcement of water quality and flood control standards for new and redevelopment projects (SWMP Section 6.2).
    - Good Housekeeping Program implementation (SWMP Section 7.0), including regular municipal storm sewer cleaning, storm sewer inspection (CCTV), spring/fall cleanups, and street sweeping (SWMP Sections 2.5 and 7.2), Facility Stormwater Pollution Prevention Plan execution, and Activity Stormwater Pollution Plan training.
    - Sampling and Evaluation Program implementation (SWMP Section 8.0), including the collection and analysis of stormwater runoff, in-stream water quality, BMP effectiveness, and long-term monitoring data (SWMP Sections 8.4, 8.5, 8.6, and 8.7).

Bridger Creek due to its impairments identified in the TMDL, including:

- Nitrate: Contributions from the MS4 require a 0% reduction. The TMDL does not hold the MS4 to numeric Nitrate load limits. Instead, the TMDL states that the MS4 will meet its WLA by "adhering to the (MS4) permit requirements." The MS4 implements the following BMPs to reduce Nitrate, including:
    - Stormwater Management Program implementation (SWMP Sections 1.0 - 8.0).
    - Public Education Program implementation (SWMP Section 3.0), including, but not limited to, the Adopt-A-Drain Program (SWMP Section 3.4.1), Construction Training (SWMP Section 3.4.8), and Lawn Care Targeted Outreach (SWMP Section 3.4.12).
    - Illicit Discharge Detection and Elimination Program implementation (SWMP Section 4.0), including the identification and resolution of illegal discharges (SWMP Sections 4.3, 4.4, and 4.5), and the investigation of outfalls (SWMP Section 4.7).
    - Post-Construction Program implementation (SWMP Section 6.2), including the enforcement of water quality and flood control standards for new and redevelopment projects (SWMP Section 6.2).
    - Good Housekeeping Program implementation (SWMP Section 7.0), including regular municipal storm sewer cleaning, storm sewer inspection (CCTV), spring/fall cleanups, and street sweeping (SWMP Sections 2.5 and 7.2), Facility Stormwater Pollution Prevention Plan execution, and Activity Stormwater Pollution Plan training.
    - Sampling and Evaluation Program implementation (SWMP Section 8.0), including the collection and analysis of stormwater runoff, in-stream water quality, BMP effectiveness, and long-term monitoring data (SWMP Sections 8.4, 8.5, 8.6, and 8.7).

Other Notable Waterways: Numerous unassessed waterways exist that receive protections from the MS4's broad programmatic efforts. These waterways include, but are not limited to, Cattail Creek, Catron Creek, Baxter Creek, Nash Spring Creek, Flat Creek, Mathew Bird Creek, Figgins Creek, and Aajker Creek.

2.3 Planned Projects

The MS4 prepares a five-year Capital Improvement Plan (CIP) that outlines future infrastructure projects annually. The CIP process is open for public comment, approved by the City Commission, and incorporated into the applicable fiscal year's budget. The MS4 accounts for the following when preparing CIPs:

- Urban Waterway/Watershed Priority
- Development and Land Use
- Infrastructure Condition Analysis
- Programmatic Goals
- Available Budget
- Project Coordination

The MS4 maintains the following performance metrics to track Capital Project Program progress and identify future needs:

Pollutant Reduction Program: Comply with the MS4's stormwater permit and improve water quality by preventing the discharge of 81 tons of TSS into the Bozeman Creek watershed annually.

- Benefit: Reduced permit noncompliance risk, improved public safety, and a healthier environment.
- Driving Policy: Bronze Level of Service, approximately $200,000 per year
- Risk: Permit requirements subject to change.

Type	2017	2018	2019	2020	2021
Pollutant Reduction	20%	57%	56%	51%	-

Pipe Rehabilitation Program: Replace 13.9 miles of structurally deficient and undersized historical storm sewer infrastructure throughout the downtown core.

- Benefit: Reduced urban flooding and improved public safety
- Driving Policy: Bronze Level of Service, approximately $450,000 per year
- Risk: Increasing construction costs

Type	2017	2018	2019	2020	2021
Pipe Rehabilitation	3%	4%	34%	40%	-

Utility Operation Program: Maintain 20% (+/-2.5%) of city-owned storm sewer assets annually (excludes MSU). Totals include inlet maintenance, manhole maintenance, pipe maintenance, and pipe inspection.

- Benefit: Reduced urban flooding, extended infrastructure lifecycles, and improved environmental health.
- Driving Policy: Bronze Level of Service
- Risk: Rapid Growth

Type	2017	2018	2019	2020	2021
Utility Operation	-	21%	17%	19%	-

The MS4 plans to complete the following projects:

Pipe Rehabilitation Program: Historic Pipe Replacement Program

- ID: STDM04
- Year: FY22, FY23, FY24, FY25, and FY26
- Budget: $280,000.00, $310,000.00, $530,000.00, $735,000.00, and $767,115.00
- Description: Rehabilitation of 100-year-old vitrified clay storm sewer, which has exceeded its life cycle, does not meet modern capacity standards, and includes many structural failures.
- Alternatives Considered: The infrastructure is a critical component of the City's storm sewer network. Delay will increase chances of collapse, road failure, and flooding.

- Advantages of Approval: This project is preventative and targets pipes prone to failure and surcharging. Rehabilitation will reduce risks by addressing structural and capacity deficiencies.
- Additional Operating Cost in the Future: Stormwater Personnel will complete maintenance on a reoccurring schedule, including flushing, vacuuming, and inspection.

Pipe Rehabilitation Program: Annual Unplanned Pipe Rehabilitation and Drainage Projects

- ID: STDM05
- Year: FY22, FY23, FY24, FY25, and FY26
- Budget: $45,000.00, $47,250.00, $49,612.00, $52,093.00, and $54,697.00
- Description: An annual program that provides funding for the design and construction of unplanned pipe, drainage, and treatment projects.
- Alternatives Considered: Use of internal crews and equipment to complete work. Staff determined the workload required would reduce capacity applied towards critical services.
- Advantages of Approval: Unplanned funds allows staff to be responsive to essential needs, increasing customer service, improving system efficiency, and reducing City liability.
- Additional Operating Cost in the Future: Stormwater personnel will complete the maintenance of rehabilitated, repaired, or new infrastructure concurrently with existing public assets.

Pollutant Reduction Program: Downtown Mechanical Stormwater Treatment (Phase 3)

- ID: STRH01
- Year: FY22
- Budget: $300,000
- Description: Installation of two stormwater treatment units near the intersections of N. Rouse Ave. and E. Peach St., and N. Rouse Ave. and E. Tamarack St.
- Alternatives Considered: Staff has not identified an alternative treatment approach with comparable maintenance ease, construction footprint, or pollutant removal efficiency.
- Advantages of Approval: The units will collect over 20-tons of pollutants annually from 138-acres. They will improve public safety, Bozeman Creek's habitat, and MDEQ permit standing.
- Additional Operating Cost in the Future: Staff will complete maintenance annually using existing vacuuming equipment and drying beds. Debris will eventually be tested and disposed at the landfill.

Utility Operation Program: Street Sweeper (#01)

- ID: STOP05
- Year: FY22
- Budget: $250,000
- Description: Replacement of a mechanical street sweeper purchased in 2015. The sweeper has been in operation for seven years.
- Alternatives Considered: Use the existing street sweeper, resulting in increased downtime and maintenance. Industry guidance recommends replacing municipal sweepers every five years.
- Advantages of Approval: Street sweeping protects air quality, improves waterway health, improves MDEQ stormwater permit standing, and reduces slip hazards.
- Additional Operating Cost in the Future: The Stormwater Division will fund operation and maintenance costs. The sweeper supplements the street sweeping program led by the Streets Division.

Utility Operation Program: Sediment Disposal Facility Asphalt Repair

- ID: STOS01
- Year: FY22
- Budget: $50,000
- Description: Preventative maintenance of the asphalt surface located at the Sediment Disposal Facility used for stormwater waste disposal generated from infrastructure operation.
- Alternatives Considered: Prolong asphalt maintenance risking degradation of drivable surfaces and increased deferred expense.
- Advantages of Approval: The project will ensure the facility remains operational and safe.
- Additional Operating Cost in the Future: None

Utility Operation Program: Administrative Vehicle (#01)

- ID: STOP03
- Year: FY22
- Budget: $35,000
- Description: Replacement of staff's 2000 Dodge Dakota. The truck has been in operation for 22 years and served numerous divisions. Significant maintenance and safety issues exist.
- Alternatives Considered: The Stormwater Division has four administrative employees that share two dedicated vehicles. Not replacing would result in impacts to daily operations of the Division.
- Advantages of Approval: Provides for a reliable and safe vehicle for staff to complete daily activities, such as pollution mitigation, equipment transport, flood response, and field inspections.
- Additional Operating Cost in the Future: The Stormwater Division will fund operation and maintenance costs.

Pollutant Reduction Program: Downtown Mechanical Stormwater Treatment (Phase 4)

- ID: STRH02
- Year: FY23
- Budget: $250,000
- Description: Installation of two stormwater treatment units near the intersections of S. Black Ave. and E. Cleveland St., and S. Bozeman Ave. and E. Cleveland St.
- Alternatives Considered: Staff has not identified an alternative treatment approach with comparable maintenance ease, construction footprint, or pollutant removal efficiency.
- Advantages of Approval: The units will collect over 27-tons of pollutants annually from 193-acres. They will improve public safety, Bozeman Creek's habitat, and MDEQ permit standing.
- Additional Operating Cost in the Future: Staff will complete maintenance semi-annually using existing vacuuming equipment and drying beds. Debris will eventually be disposed at the landfill.

Pipe Rehabilitation Program: North 9th Avenue Ditch Rehabilitation

- ID: STDM06
- Year: FY23
- Budget: $125,000
- Description: Rehabilitation of 900 feet of conveyance ditch located near N. 9th Ave. from W. Villard St. to Durston Rd., which has sediment buildup, overgrown vegetation, and bank erosion
- Alternatives Considered: The infrastructure is a critical component of the City's storm sewer network. Delay will result in an increased chance of adjacent property flooding.

- Advantages of Approval: The targeted ditch is increasingly prone to backups and flooding. Rehabilitation will reduce risks by addressing structural and capacity deficiencies.
- Additional Operating Cost in the Future: Stormwater Personnel will complete maintenance on a reoccurring schedule, including inspection and clearing.

9. Pipe Rehabilitation Program: Middle Creek Ditch Rehabilitation

   - ID: STDM09
   - Year: FY24
   - Budget: $175,000
   - Description: Rehabilitation of 1,500 feet of conveyance ditch located near N. 15th Ave. from W. Main St. to W. Beall St., which has sediment buildup, overgrown vegetation, and bank erosion
   - Alternatives Considered: The infrastructure is a critical component of the City's storm sewer network. Delay will result in an increased chance of adjacent property flooding.
   - Advantages of Approval: The targeted ditch is increasingly prone to backups and flooding. Rehabilitation will reduce risks by addressing structural and capacity deficiencies.
   - Additional Operating Cost in the Future: Stormwater Personnel will complete maintenance on a reoccurring schedule, including inspection and clearing.

10. Utility Operation Program: Pipe Inspection Van (#01)

    - ID: STOP04
    - Year: FY25
    - Budget: $290,000
    - Description: Replacement of the pipe inspection van purchased in 2001 and refurbished in 2015. The vehicle's chassis is heavily worn and the onboard computer system is aged.
    - Alternatives Considered: Continue to use the existing vehicle, which could result in downtime and increasingly costly maintenance.
    - Advantages of Approval: The vehicle facilitates the City's pipe inspection program, which identifies maintenance needs, locates structural deficiencies, and detects illegal connections.
    - Additional Operating Cost in the Future: The Stormwater Division will fund operation and maintenance costs.

11. Utility Operation Program: Vacuum and Jetting Truck (#01)

    - ID: STOP08
    - Year: FY26
    - Budget: $527,000
    - Description: Replacement of the Division's vacuum and jetting truck purchased in 2015.
    - Alternatives Considered: Continue to use the existing vehicle, which will result in downtime and increasingly costly maintenance.
    - Advantages of Approval: The vehicle facilitates infrastructure maintenance, pollution event cleanup, and vacuum excavation for pipe repairs.
    - Additional Operating Cost in the Future: The Stormwater Division will fund operation and maintenance costs.

2.4 Ongoing or Completed Projects

The MS4 has or is in the process of completing the following projects:

Pipe Rehabilitation Program: 2020 Storm Improvements

- Purpose: Three drainage repairs to fix localized flooding issues (S. 20th Ave., O'Connell Dr., and Spruce Dr.)
- Type: Inlets, pipes, and concrete structures
- Treatment Efficiency: n/a
- Treatment Area: n/a
- Discharge Location: Varied
- Date of Completion: Winter 2020
- Co-Benefit(s): Reduced erosion, improved public safety

Utility Operation Program: Stormwater Utility Cost of Service and Rate Study

- Purpose: Cost of service and financial rate study to guide the future rate structure.
- Type: Planning document
- Expected Treatment Efficiency: n/a
- Treatment Area: n/a
- Discharge Location: n/a
- Date of Completion: Mid-2021
- Co-Benefit(s): n/a

Utility Operation Program: Stormwater Facility Plan Update

- Purpose: Update the City's 2008 Stormwater Facilities Plan to provide modern policy, programmatic, and infrastructure recommendations for future implementation.
- Type: Planning document
- Treatment Efficiency: n/a
- Treatment Area: n/a
- Discharge Location: n/a
- Date of Completion: Mid-2021
- Co-Benefit(s): n/a

Pipe Rehabilitation Program: Downtown Trunk Line Rehabilitation

- Purpose: Rehabilitate a historical storm sewer trunk line (Tracy to Rouse)
- Type: CIPP liner

- Treatment Efficiency: n/a
- Treatment Area: n/a
- Discharge Location: Bozeman Creek
- Date of Completion: Mid-2021
- Co-Benefit(s): Improved public safety

Pipe Rehabilitation Program: Manley Ditch Rehabilitation

- Purpose: Rehabilitate a historical irrigation drainage ditch and convey drainage from a 58-acre urban area to the Cherry Creek Fishing Access property.
- Type: Ditch rehabilitation, bio-retention treatment areas, and flood control weirs
- Treatment Efficiency: n/a
- Treatment Area: n/a
- Discharge Location: Cherry Creek
- Date of Completion: Mid-2021
- Co-Benefit(s): Improved public safety, enhanced water quality

Pollutant Reduction Program: Mechanical Separation Unit (Westridge)

- Purpose: Reduced pollutant loading
- Type: 5' Contech CDS
- Treatment Efficiency: 50% TSS reduction
- Treatment Area: ≈28 Acres
- Discharge Location: Bozeman Creek tributary
- Date of Completion: Winter 2020
- Co-Benefit(s): Improved public safety

Pollutant Reduction Program: Rouse Stormwater Upgrades (Rouse - Main to Oak, MDT)

- Purpose: Flood control, reduced pollutant loading
- Type: Five Contech CDS units, various sizes
- Treatment Efficiency: 50% TSS Reduction
- Treatment Area: ≈94 Acres
- Discharge Location: Bozeman Creek
- Date of Completion: Fall 2020
- Co-Benefit(s): Improved public safety, reduced erosion

Utility Operation Program: Administrative Vehicle Purchase

- Purpose: Transportation for Administrative Staff
- Type: 2019 Dodge Ram
- Expected Treatment Efficiency: n/a
- Treatment Area: n/a
- Discharge Location: n/a
- Date of Completion: Spring 2019
- Co-Benefit(s): n/a

Pipe Rehabilitation Program: BMX Park Storm Improvements (Peach and 4th)

- Purpose: Flood control
- Type: 244' of 30" RCP Pipe, three 72" manhole structures
- Expected Treatment Efficiency: n/a
- Treatment Area: n/a

- Discharge Location: East Gallatin River
- Date of Completion: Spring 2019
- Co-Benefit(s): Reduced erosion

10. Pollutant Reduction Program: Mechanical Separation Unit (Church and Main)

- Purpose: Reduced pollutant loading
- Type: 6' Contech CDS
- Expected Treatment Efficiency: 50% TSS Reduction
- Treatment Area: ≈35 Acres
- Discharge Location: Bozeman Creek
- Date of Completion: Fall 2019
- Co-Benefit(s): Improved public safety

11. Pollutant Reduction Program: Mechanical Separation Unit (Black and Main)

- Purpose: Reduce sediment loads
- Type: Contech CDS (6' Diameter)
- Expected Treatment Efficiency: 50% TSS Reduction
- Treatment Area: ≈28 Acres
- Discharge Location: Bozeman Creek
- Date of Completion: Spring 2019
- Co-Benefits: Progress towards Bozeman Creek TSS WLA

12. Pollutant Reduction Program: Mechanical Separation Unit (Bozeman and Main)

- Purpose: Reduce sediment loads
- Type: Contech CDS (6' Diameter)
- Expected Treatment Efficiency: 50% TSS Reduction
- Treatment Area: ≈29 Acres
- Discharge Location: Bozeman Creek
- Date of Completion: Spring 2019
- Co-Benefits: Progress towards Bozeman Creek TSS WLA

13. Pollutant Reduction Program: Rouse Stormwater Upgrades (Oak to Story Mill , Phase 1, MDT)

- Purpose: Flood control, reduced pollutant loading
- Type: Inlets, manholes, pipes, and three mechanical treatment units
- Expected Treatment Efficiency: 50% TSS
- Treatment Area: n/a
- Discharge Location: Bozeman Creek
- Date of Completion: Spring 2019
- Co-Benefits: Flood control and water quality

14. Pollutant Reduction Program: Boulevard Infiltration Structure (Mason and Tracy)

- Purpose: Reduce sediment loads and flood mitigation
- Type: Rain Garden
- Expected Treatment Efficiency: 100% TSS Reduction
- Treatment Area: ≈2 Acres
- Discharge Location: Matthew Bird Creek (a tributary of Bozeman Creek)
- Date of Completion: Summer 2019
- Co-Benefits: Progress towards Bozeman Creek TSS WLA and flow reduction.

15. Pollutant Reduction Program: Mechanical Separation Unit (11th and College)

    - Purpose: Reduce sediment loads
    - Type: Contech CDS (8' Diameter)
    - Expected Treatment Efficiency: 50% TSS Reduction
    - Treatment Area: ≈60 Acres
    - Discharge Location: Mandeville Creek
    - Date of Completion: Summer 2019
    - Co-Benefits: n/a

16. Pollutant Reduction Program: Tracy Stormwater Upgrades (College to Babcock)

    - Purpose: Flood control
    - Type: Inlets, manholes, and 2,850 ft. of pipe
    - Expected Treatment Efficiency: n/a
    - Treatment Area: n/a
    - Discharge Location: Bozeman Creek
    - Date of Completion: Summer 2018 and 2019
    - Co-Benefits: n/a

17. Pollutant Reduction Program: Mechanical Separation Unit (3rd and Main)

    - Purpose: Reduce sediment load to Bozeman Creek
    - Type: Contech CDS (6' Diameter)
    - Expected Treatment Efficiency: 50% TSS Reduction
    - Treatment Area: ≈94 Acres
    - Discharge Location: Bozeman Creek
    - Date of Completion: Spring 2018
    - Co-Benefits: Progress towards Bozeman Creek TSS WLA

18. Pollutant Reduction Program: Mechanical Separation Unit (Grand and Main)

    - Purpose: Reduce sediment load to Bozeman Creek
    - Type: Contech CDS (6' Diameter)
    - Expected Treatment Efficiency: 50% TSS Reduction
    - Treatment Area: ≈58 Acres
    - Discharge Location: Bozeman Creek
    - Date of Completion: Spring 2018
    - Co-Benefits: Progress towards Bozeman Creek TSS WLA

19. Pollutant Reduction Program: Mechanical Separation Unit (Tracy and Main)

    - Purpose: Reduce sediment load to Bozeman Creek
    - Type: Contech CDS (6' Diameter)
    - Expected Treatment Efficiency: 50% TSS Reduction
    - Treatment Area: ≈32 Acres
    - Discharge Location: Bozeman Creek
    - Date of Completion: Spring 2018
    - Co-Benefits: Progress towards Bozeman Creek TSS WLA

20. Pollutant Reduction Program: Permeable Streetscape Project (7th and Peach)

    - Purpose: Pilot permeable paver use
    - Type: Basalite Pavers

- Expected Treatment Efficiency: 100% TSS Reduction
- Treatment Area: .1 Acres
- Discharge Location: East Gallatin
- Date of Completion: Spring 2018
- Co-Benefits: Flood control and water quality

21. Pipe Rehabilitation Program: Baxter Lane Stormwater Upgrades

    - Purpose: Improve drainage for 7th and Baxter
    - Type: Inlets, manholes, and mains
    - Expected Treatment Efficiency: n/a
    - Treatment Area: n/a
    - Discharge Location: Mandeville Creek
    - Date of Completion: Summer 2018
    - Co-Benefits: Flood control and water quality

22. Utility Operation Program: Bozeman Creek Stream Gage Installation

    - Purpose: Data collection
    - Type: DNRC Stream Gage
    - Expected Treatment Efficiency: n/a
    - Treatment Area: n/a
    - Discharge Location: n/a
    - Date of Completion: Summer 2018
    - Co-Benefits: Includes port for turbidity monitoring device

23. Pipe Rehabilitation Program: East Olive Street Stormwater Upgrades

    - Purpose: Improve drainage for East Olive Street
    - Type: Inlets, manholes, and mains
    - Expected Treatment Efficiency: n/a
    - Treatment Area: n/a
    - Discharge Location: Bozeman Creek
    - Date of Completion: Fall 2017
    - Co-Benefits: Flood control and water quality

24. Pollutant Reduction Program: City Hall Patio Permeable Paver Project

    - Purpose: LID/Green infrastructure pilot project and community education
    - Type: Pave Drain Permeable Pavers
    - Expected Treatment Efficiency: 100% TSS Reduction
    - Treatment Area: ≈1,000 square feet
    - Discharge Location: Bozeman Creek
    - Date of Completion: Summer 2017
    - Co-Benefits: Progress towards Bozeman Creek TSS WLA and flood control

25. Pipe Rehabilitation Program: Inlet Replacements

    - Purpose: Reduce sediment to Bozeman Creek and flood control
    - Type: Standard inlet with 9” sump
    - Expected Treatment Efficiency: Unknown
    - Treatment Area: 23 inlets
    - Discharge Location: Bozeman Creek

- Date of Completion: Fall 2017
- Co-Benefits: Progress towards Bozeman Creek TSS WLA

Pipe Rehabilitation Program: Pipe Replacements (Black and Bozeman)

- Purpose: Flood control
- Type: 15" SDR
- Expected Treatment Efficiency: n/a
- Treatment Area: 600'
- Discharge Location: Bozeman Creek
- Date of Completion: Fall 2017
- Co-Benefits: n/a

Pollutant Reduction Program: Mechanical Separation Unit Installation (Rouse and Griffin)

- Purpose: Reduce sediment load to Bozeman Creek
- Type: Contech CDS (6' Diameter)
- Expected Treatment Efficiency: 50% TSS Reduction
- Treatment Area: ≈ 14 Acres
- Discharge Location: Bozeman Creek
- Date of Completion: Fall 2017
- Co-Benefits: Progress towards Bozeman Creek TSS WLA

Pollutant Reduction Program: Mechanical Separation Unit Installation (Rouse and Bridger Center)

- Purpose: Reduce sediment load to the East Gallatin River
- Type: Contech CDS (5' Diameter)
- Expected Treatment Efficiency: 50% TSS Reduction
- Treatment Area: ≈12 Acres
- Discharge Location: Bozeman Creek
- Date of Completion: Fall 2017
- Co-Benefits: Progress towards WLA

Pollutant Reduction Program: Mechanical Separation Unit Installation (Rouse and Olive)

- Purpose: Reduce sediment load to Bozeman Creek
- Type: Contech CDS (5' Diameter)
- Expected Treatment Efficiency: 50% TSS Reduction
- Treatment Area: ≈9 Acres
- Discharge Location: Bozeman Creek
- Date of Completion: Fall 2017
- Co-Benefits: Progress towards Bozeman Creek TSS WLA

Pollutant Reduction Program: Mechanical Separation Unit Installation (Perkins and Peach)

- Purpose: Reduce sediment load to Bozeman Creek
- Type: Contech CDS (4' Diameter)
- Expected Treatment Efficiency: 50% TSS Reduction
- Treatment Area: ≈ 22 Acres
- Discharge Location: Bozeman Creek
- Date of Completion: Fall 2017
- Co-Benefits: Progress towards Bozeman Creek TSS WLA

Utility Operation Program: Stormwater Operations Disposal Facility

- Purpose: Sediment dewatering and storage
- Type: Asphalt pad with ecology block bays
- Expected Treatment Efficiency: n/a
- Treatment Area: n/a
- Discharge Location: Lined wastewater pond
- Date of Completion: Fall 2017
- Co-Benefits: Facilitates pollutant reduction totals

Pollutant Reduction Program: Mechanical Separation Unit Installation - S. Rouse and E. Lincoln

- Purpose: Reduce sediment load to Bozeman Creek
- Type: Contech CDS (5' Diameter)
- Expected Treatment Efficiency: 50% TSS Reduction
- Treatment Area: ≈32 Acres
- Discharge Location: Bozeman Creek
- Date of Completion: Fall 2016
- Co-Benefits: Progress towards Bozeman Creek TSS WLA

Pollutant Reduction Program: Mechanical Separation Unit Installation - N. 11th and W. Lamme

- Purpose: Reduce sediment load to Mandeville Creek
- Type: Contech CDS (4' Diameter)
- Expected Treatment Efficiency: 50% TSS Reduction
- Treatment Area: ≈7 Acres
- Discharge Location: Mandeville Creek
- Date of Completion: Fall 2016
- Co-Benefits: Located adjacent to High School

Pollutant Reduction Program: Mechanical Separation Unit, Underground Infiltration Basin, Wash Pad, and Paving Project – Shops Complex

- Purpose: Reduce sediment load to Bozeman Creek
- Type: Contech CDS (4' Diameter), ADS StormTech, and Inlet Sumps
- Expected Treatment Efficiency: 50% TSS Reduction for Mechanical Separation Unit and 100% for Underground Infiltration Basin
- Treatment Area: ≈2 Acres
- Discharge Location: Bozeman Creek
- Date of Completion: Fall 2016
- Co-Benefits: Progress towards Bozeman Creek TSS WLA

Pollutant Reduction Program: Mechanical Separation Unit Installation – N. Wallace and E. Tamarack

- Purpose: Reduce sediment load to Bozeman Creek
- Type: Contech CDS (8' Diameter)
- Expected Treatment Efficiency: 50% TSS Reduction
- Treatment Area: ≈100 Acres
- Discharge Location: Bozeman Creek
- Date of Completion: November 2016
- Co-Benefits: Progress towards Bozeman Creek TSS WLA

Pollutant Reduction Program: Underground Infiltration Basin – N. 7th and Baxter

- Purpose: Reduce localized flooding; reduce sediment load to Mandeville Creek
- Type: Perforated gravity main embedded in aggregate for storage
- Expected Treatment Efficiency: 100% TSS Reduction
- Treatment Area: ≈9 Acres
- Discharge Location: Mandeville Creek
- Date of Completion: Summer 2016
- Co-Benefits: Joint Water Conservation and Stormwater LID pilot project.

37. Pollutant Reduction Program: Underground Infiltration Basin – Plum and Avocado

- Purpose: Reduce localized flooding; reduce sediment load to East Gallatin;
- Type: ADS StormTech
- Expected Treatment Efficiency: 100% TSS Reduction
- Treatment Area: ≈14 Acres
- Discharge Location: Subsurface
- Date of Completion: Fall 2016
- Co-Benefits: Resolved localized flooding issue

38. Pollutant Reduction Program: Backwater Slough – Story Mill Park

- Purpose: Reduce sediment load in Bozeman Creek
- Type: Constructed wetland
- Expected Treatment Efficiency: 100% TSS Reduction
- Treatment Area: Entire Bozeman Creek Watershed
- Discharge Location: Bozeman Creek
- Date of Completion: Summer 2015
- Co-Benefits: Nutrient uptake, flood mitigation, and wetland restoration

39. Pollutant Reduction Program: Bozeman Creek Meander Construction – Bogert Park

- Purpose: Stream restoration; improve streamside vegetative cover; reduce sediment load due to streambank erosion; flood control
- Type: Excavated meander and pool addition; inset floodplain construction
- Expected Treatment Efficiency: Unknown
- Treatment Area: Entire Bozeman Creek Watershed
- Discharge Location: Bozeman Creek
- Date of Completion: Spring 2017
- Co-Benefits: Education, fish habitat, stream bank stabilization, and flood control

40. Pollutant Reduction Program: Meander the Mandeville Construction – Bozeman High School

- Purpose: Stream restoration; improve streamside vegetative cover; flood control
- Type: Construction of meanders, riffles, and pools
- Expected Treatment Efficiency: Unknown
- Treatment Area: Entire Mandeville Creek Watershed
- Discharge Location: Mandeville Creek
- Date of Completion: 2016
- Co-Benefits: Education, fish habitat, stream bank stabilization, and flood control

41. Pollutant Reduction Program: LID Infiltration Galleries – University Field House

- Purpose: Reduce sediment load to Mandeville Creek
- Type: LID Infiltration Galleries

- Expected Treatment Efficiency: 100% TSS Reduction
- Treatment Area: 2.4 Acres
- Discharge Location: Mandeville Creek
- Date of Completion: 2016

42. Pollutant Reduction Program: Mechanical Separation Unit Installation – University Field House

- Purpose: Reduce sediment load to Mandeville Creek
- Type: Hydro International Downstream Defender and Sediment Separator
- Expected Treatment Efficiency: 50% TSS Reduction
- Treatment Area: 3 Acres
- Discharge Location: Mandeville Creek
- Date of Completion: Fall 2015

43. Pollutant Reduction Program: Underground Infiltration – Jabs and Wilson Halls

- Purpose: Reduce sediment load to Mandeville Creek
- Type: Underground Infiltration Gallery
- Expected Treatment Efficiency: 100% TSS Reduction
- Treatment Area: 3.9 Acres
- Discharge Location: Subsurface
- Date of Completion: 2016

44. Pipe Rehabilitation Program: Gravity Main Install – 15th and Babcock

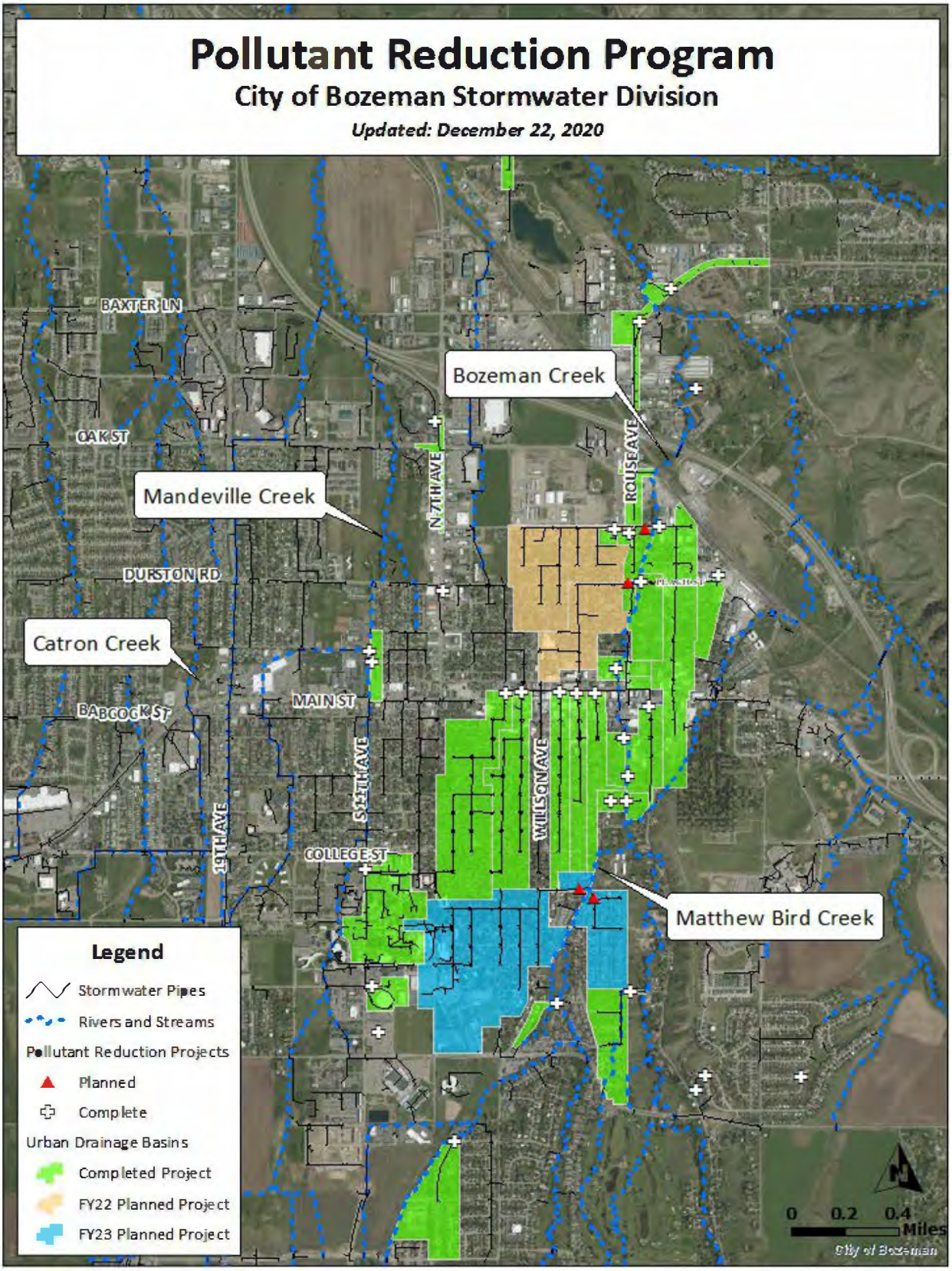
- Purpose: Eliminate localized flooding issue
- Type: Construction of underground stormwater main
- Expected Treatment Efficiency: None
- Treatment Area: None
- Discharge Location: Mandeville Creek
- Date of Completion: Fall 2015

45. Pipe Rehabilitation Program: Wallace Reconstruction and Stormwater System Improvements

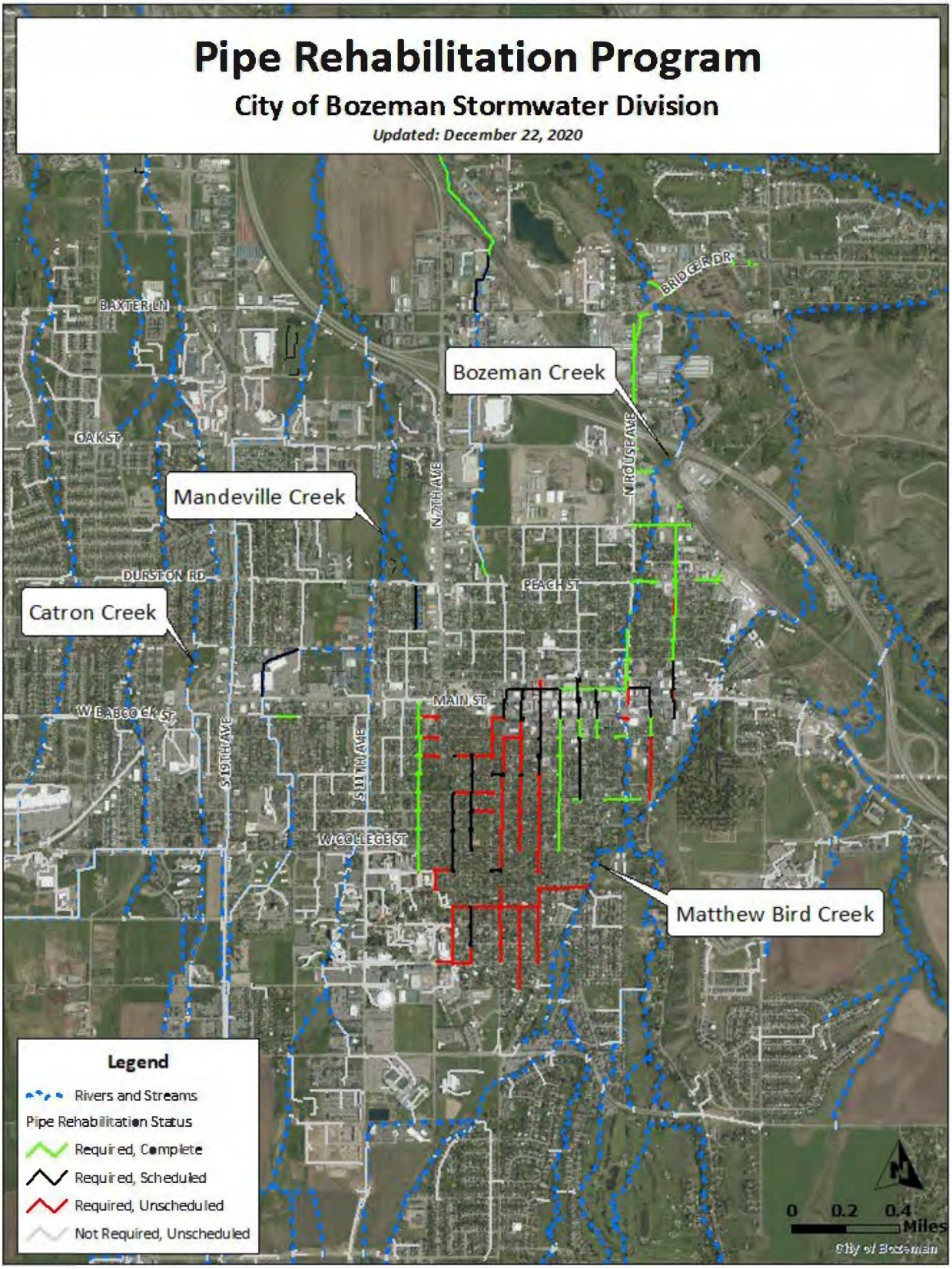
- Purpose: Eliminate localized flooding issue and provide treatment
- Type: Construction of 3,000 feet of underground stormwater mains and new inlets
- Expected Treatment Efficiency: None
- Treatment Area: None
- Discharge Location: Bozeman Creek
- Date of Completion: 2016

46. Pipe Rehabilitation Program: Story Street Reconstruction and Stormwater System Improvements

- Purpose: Eliminate localized flooding issue and provide treatment
- Type: Construction of underground stormwater mains, new inlets, and oil/sand separators
- Expected Treatment Efficiency: Unknown
- Treatment Area: 10 Acres
- Discharge Location: Bozeman Creek
- Date of Completion: 2015



Graphic 2.4.2: Planned and completed pollutant reduction projects



Graphic 2.4.3: Planned and complete pipe rehabilitation projects

2.5 Pollutant Reduction Totals

The MS4 tracks pollutant reduction totals using a variety of data tracking mechanisms:

- Total Suspended Solids (TSS)
  - Treatment Unit Maintenance: The MS4 calculates tonnage totals by measuring the depth of debris within each unit before cleaning. The MS4 subtracts a top of debris depth measurement from a total unit depth measurement, calculates a volume of debris (cubic feet) using dimension information for each unit, and converts the volume to tons by using an assumed sand weight ratio of .056 tons = 1 cubic foot of sand.

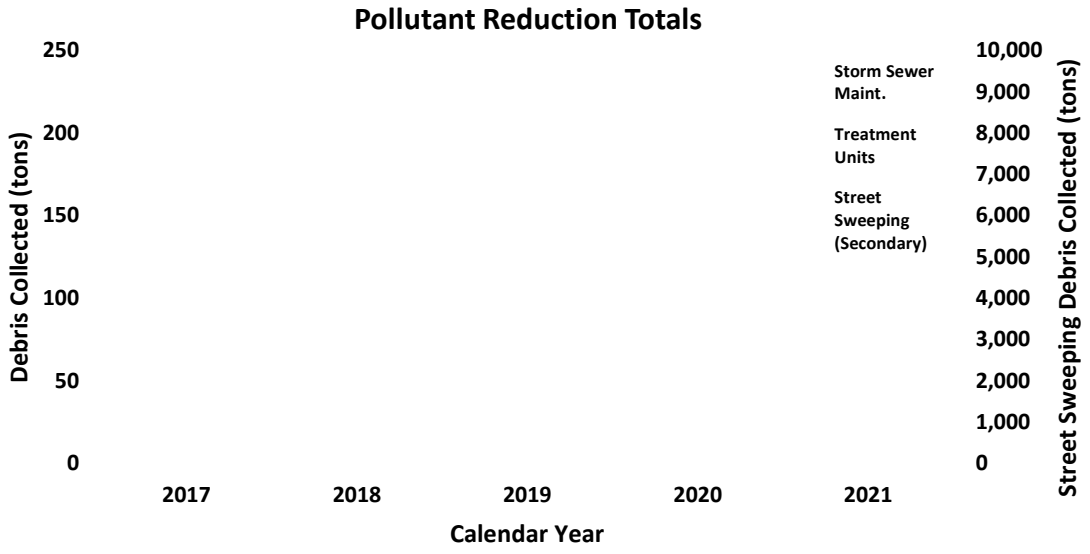
Watershed	2017	2018	2019	2020	2021
Bozeman Creek	16 Tons	45 Tons	45 Tons	41 Tons	-
Mandeville Creek	5 Tons	1 Ton	6 Tons	8 Tons	-
East Gallatin River	1 Ton	4 Tons	6 Tons	6 Tons	-
Total:	22 Tons	50 Tons	57 Tons	55 Tons	-

  - Storm Sewer Maintenance: The MS4 calculates tonnage totals by calculating the depth of debris vacuumed out of manholes and inlets before cleaning. The MS4 multiplies the area of each assets sump by an assumed 1/2 full depth measurement, multiplies the volume by the total assets maintained for that year, and converts the volume to tons by using an assumed sand weight ratio of .056 tons = 1 cubic foot.

Entity	2017	2018	2019	2020	2021
City of Bozeman	118 Tons	99 Tons	111 Tons	131 Tons	-
Montana State University	47 Tons	46 Tons	48 Tons	38 Tons	-
Total:	165 Tons	145 Tons	159 Tons	169 Tons	-

  - Street Sweeping: The MS4 calculates tonnage totals for year-round and spring/fall cleanup street sweeping operations. The Streets Division tracks cubic yard totals for each of the activities, which is then stored in Cityworks and reported. The MS4 converts yards to tons using an assumed weight ratio of 1.5 tons = 1 cubic yard of sand for reoccurring and spring street sweeping and converts yards to tons using an assumed weight ratio of .18 tons = 1 cubic yard of leaves for fall street sweeping.

Entity	2017	2018	2019	2020	2021
City of Bozeman	6,108 Tons	6,022 Tons	5,502 Tons	5,127 Tons	-
Montana State University	124 Tons	224 Tons	206 Tons	195 Tons	-
Total:	6,232 Tons	6,246 Tons	5,708 Tons	5,322 Tons	-



Graphic 2.5.4: Pollutant Reduction Totals Chart

2.6 Performance Measures

The MS4 utilizes performance measures to evaluate programmatic strategies with the goal of optimizing limited resources, increasing efficiencies, and balancing annual workloads.

Stormwater Report Card: Final Grade generated by the MS4 that provides a consistent and communicable method for tracking stream health improvement and permit compliance risk. The MS4's target level of service is to facilitate an upward trend annually, which is calculated using the methods described in SWMP Section 8.0.

Calendar Year	Score (%)	Score (Grade)
2018	61%	D
2019	54%	F
2020	65%	D
2021	-	-

Community Safety and Urban Flood Risk: Tracking mechanism utilized by the MS4 that provides a consistent and communicable method for tracking community safety and urban flood risk. The MS4's target level of service is to have zero insurance claims filed annually as a result of public storm sewer deficiencies.

Calendar Year	Filed Insurance Claims
2018	0
2019	0
2020	0
2021	-

Blank Page

Section 3.0

Public Education Program

Graphic 3.0.1: Construction field academy

Graphic 3.0.2: Dog waste station with educational signage

Blank Page

3.1 Introduction

The MS4 strives to improve waterway health, protect public safety, and comply with its MS4 Permit through the education of the public by:

- Passively engaging residents through the consistent supply of educational information; and
- Actively engaging residents, providing them tools to take direct action.

SWMP Section 3.0 details the following components necessary to administer the MS4's Public Education Program, including:

- Education Protocol (3.2)
- Key Audiences (3.3)
- Ongoing Initiatives (3.4)
- Future and Deferred Opportunities (3.5)

3.2 Education Protocol

The MS4 educates audiences on stormwater-related issues to reduce the public's contribution of pollutants to waterbodies using the following strategies:

Passive Engagement (Education): Creation and distribution of educational messages, targeting pollutant-generating activities and behaviors distributed via the following platforms:

- Website
- Utility bill inserts
- Internet and radio advertisements
- Brochures
- Magazine articles
- Educational signage
- Vehicle wraps
- Surveys

Active Engagement (Involvement and Enforcement): Customized interpersonal interactions with various audiences, targeting pollutant-generating activities and behaviors distributed via the following activities:

- Presentations/Meetings
- Trainings
- Tours
- Activities
- Events
- Penalties

3.3 Key Audiences

The MS4 targets key audiences since they conduct activities that result in stormwater pollution, including:

Targeted Audience	Pollutants(s)	Activity	Rationale	Engagement Type	Initiatives
Residents	Nutrients, E. coli, TSS	Yard Maintenance	SWMP Sec. 8.9	Passive/Active	SWMP Sec. 3.4
Construction Industry	TSS	Construction	SWMP Sec. 5.6	Passive/Active	SWMP Sec. 3.4
Youth/MSU Students	Nutrients, E. coli, TSS	Education and class projects	Paradigm shift, trickle up impact	Active	SWMP Sec. 3.4
HOAs - Home Owner Associations	Nutrients, E. coli, TSS	Facility Maintenance	SWMP Sec. 6.8	Passive/Active	SWMP Sec. 3.4
Carpet Cleaning Firms	Wash Waste	Dumping	SWMP Sec. 4.4	Active	SWMP Sec. 3.4
Pet Owners	E.coli	Dog waste	SWMP Sec. 8.2	Active/Passive	SWMP Sec. 3.4

3.4 Ongoing Initiatives

The MS4 completes initiatives to engage, educate, and promote sustainable behavior of its key target audiences. Ongoing initiatives include:

Adopt-a-Drain: A program that actively engages watershed champions and supplies them with a tool to make a measurable difference in their neighborhoods by periodically cleaning debris from adopted storm sewer inlets. The program also passively engages residents by creating an environment where stormwater-related issues can be discussed and acted upon at a neighborhood level, rather than the City acting as the sole information provider.

- Key Audience: Residents
- Strategy: Active and Passive Engagement
- Treatment Area: Citywide
- Distribution Channels: Recruitment, training, troubleshooting, and engagement
- Performance Measure: Total weight of debris collected annually

Year	Task	Task Outcome	Goal	Goal Outcome	Notes
2019	Implement pilot program	Complete	Collect 250 lbs.	Met 773 lbs.	Time intensive but effective program, 11 Residents cared for 21 inlets.
2020	Implement program, retain majority of the recruited residents, explore expansion	Complete	Collect 500 lbs.	Met 1,362 lbs.	Covid-19 affected ability to engage residents, many participants started strong but tapered in their efforts mid-year, 14 residents cared for 30 inlets.
2021	Implement program, retain majority of the recruited residents, develop expansion plan	-	Collect 750 lbs.	-	-

Educational Stormwater Video: Seven-minute video that describes the MS4's Program, the context for why stormwater is important, and ways residents/property owners can make a difference. Residents view the video on the City's website.

- Key Audience: Residents
- Strategy: Passive Engagement
- Treatment Area: Citywide
- Distribution Channels: MS4 website and email signature attachment
- Performance Measure: Total views, watch time, and average view duration tracked annually

Year	Task	Task Outcome	Goal	Goal Outcome	Notes
2017	Maintain video	Complete	n/a	n/a 179 Views	12 hours watch time, 4:02 average duration
2018	Maintain video	Complete	Repeat 2017 Views	Met 502 Views	31 hours watch time, 3:42 average view duration
2019	Maintain video, add to City Channel	Not Complete	Repeat 2018 Views	Not Met 214 Views	14.1 hours watch time, 3:57 average view duration

2020	Maintain video, add to City Channel, promote using Facebook	Not Complete	Repeat 2019 Views	Not Met 167 Views	Moved video to different viewing service in September, shifted training platform that no longer uses YouTube and results in views
2021	Maintain video, add to City Channel	-	Repeat 2020 Views	-	-

Dog-Waste Campaign: Campaign devoted to educating residents about the importance of dog waste collection and disposal. The campaign includes the deployment and maintenance of educational signage and dog waste stations in numerous parks and trail corridors.

- Key Audience: Residents
- Strategy: Passive and Active Engagement
- Treatment Area: Citywide
- Distribution Channels: Strategic signage and waste stations placed in high use areas.
- Performance Measure: Tonnage tracked annually by calculating the total amount of dog waste collected at all waste stations. The MS4 derives the total by multiplying the total waste station bags collected by 10 lbs., which is the assumed weight of each bag.

Year	Task	Task Outcome	Goal	Goal Outcome	Notes
2017	Maintain stations	Complete	n/a	n/a 19.5 Tons	n/a
2018	Maintain stations	Complete	Repeat 2017 Total	Met 20.6 Tons	n/a
2019	Maintain stations, add urban specific signs in 4 locations	Not Complete	Repeat 2018 Total	Not Met 18.2 Tons	27% drop in visits from 2018, meaning bags likely filled up more and replaced less often due to staffing shortages
2020	Maintain stations	Complete	Repeat 2019 Total	Not Met 17.6 Tons	Increased cleanout visitation by Park's Staff; however, COVID-19 impacts.
2021	Maintain stations	-	Repeat 2020 Total	-	-

Vehicle Decal Wraps: Educational signage installed on the MS4's Vactor truck and street sweeper that visually displays the connection between urban areas and waterways.

- Key Audience: Residents
- Targeted Pollutant(s): E.coli, nutrients, oil, grease, floatables, and sediment
- Strategy: Passive Engagement
- Treatment Area: Citywide
- Distribution Channel: Vehicle use
- Performance Measure: Stormwater operator hours

Year	Task	Task Outcome	Goal	Goal Outcome	Notes
2017	Maintain decals	Complete	n/a	n/a 4,300 Hours	n/a
2018	Maintain decals	Complete	Repeat 2017 Hours	Met 5,400 Hours	n/a

2019	Maintain decals	Complete	Repeat 2018 Hours	Not Met 4,100 Hours	Staffing shortages prevalent through 2019.
2020	Maintain decals	Complete	Repeat 2019 Hours	Not Met 3,400 Hours	Staffing shortages prevalent through 2020.
2021	Maintain decals	-	Repeat 2020 Hours	-	-

Website: Website that includes a variety of information, spanning from what stormwater is, how to report a pollution event, construction stormwater permits, rate model information, post-construction design standards, and more. Address: www.bozeman.net/government/stormwater.

- Key Audience: Residents, Home Owner Associations, and Contractors
- Strategy: Passive Engagement
- Treatment Area: Citywide
- Distribution Channels: Available to the public via the internet
- Performance Measure: Total unique page views tracked by Google Analytics.

Year	Task	Task Outcome	Goal	Goal Outcome	Notes
2017	Maintain website	Complete	n/a	n/a 677 Views	
2018	Maintain website	Complete	Repeat 2017 Views	Met 1,225 Views	
2019	Maintain website	Complete	Repeat 2018 Views	Met 2,408 Views	Most Visitations: Homepage, Construction, and Contact Us
2020	Maintain website, update periodically	Complete	Repeat 2019 Views	Met 4,700 Views	Most Visitations: Homepage, Construction, and Contact Us
2021	Maintain website, update periodically	-	Repeat 2020 Views	-	-

General Outreach: Information developed by the MS4 and applied in various settings focused on providing general stormwater information and soliciting public participation.

- Key Audience: Residents
- Strategy: Active Engagement
- Treatment Area: Citywide
- Distribution Channels: Presentations, conferences, community events, and advertisements
- Performance Measure: Total events
    - 2017: 10 (Green Drinks Event, MSU Class Presentations, GLWQD Board Presentation, (2) MSAWWA Conference Presentation, SWMBIA Home Show Booth, Environment Summit Community Event, Water Works Art Initiative, Gallatin Watershed Sourcebook, Breaking Ground Advertisement)
    - 2018: 15 (Montana DNRC Water Summit Presentation, MDEQ Stormwater Conference Presentation, MDEQ Stormwater Conference Tour, Parade of Homes Garden Tour, Gallatin College Presentation, MSU Landscape School Presentation, Stream Team Training, City Commission Emergency Ordinance Presentation, City Commission Capital and Budget Presentation, Gallatin Watershed Sourcebook Creation and Distribution, Water and Society Class Presentation, Horticulture 201

Stormwater Design Project, (2) Student-Led Campus Cleanup Events: Loose Litter and Cigarettes, Campus Cleanup Event)

- 2019: 17 (City of Bozeman Planning Board Presentation, Lives and Landscapes Article, Raccoon Facebook Post, Arbor Day Event, Mountain Outlaw Article, S. Church Traffic Calming, MSU Teacher Tour, Water School Presentation, MSU EENG 341 Class Presentation, Active Aging Week Presentation, Eagle Scout Stenciling Project, Montana Stormwater Committee Webinar, Water and Society Class Presentation, Water Hydrology Class Presentation, Hort. 201 Stormwater Design Project, Health Advancement Butt Clean Up-Day, and Campus Clean Up Event)
- 2020: 12 (CATs Project #2, CATs Project #3, Grass Clippings Mailer, City of Bozeman Climate Action Plan, MSU HORT 440 Class Project Review, Commission Budget Presentation, City Clerk Training, Water and Society Class Presentation, Water Hydrology Class Presentation, Hort 201 Stormwater Design Project, Campus Clean-Up Event, Arbor Day Plantings along Mandeville Creek)

Construction Training: Trainings that educate contractors on proper selection and use of best management practices (BMPs) and permit preperation. The MS4 holds training tailored to various education levels, construction activities, and inspection procedures. Further, the MS4 maintains a Construction Program that includes permits and materials for this group (SWMP Section 5.0).

- Key Audience: Contractors and Engineers
- Strategy: Active and Passive Engagement
- Treatment Area: Citywide
- Distribution Channels: BMP Manual, annual training, and lunch and learns
- Performance Measure: Annual construction-site audit earned score (see SWMP Section 5.4)

Year	Task	Task Outcome	Goal	Goal Outcome	Notes
2018	Hold trainings	Complete	n/a	n/a, 33%	
2019	Hold trainings	Complete	Improve the 2018 Score	Not Met, 28%	Most Visitations: Homepage, Construction, and Contact Us
2020	Hold trainings	Not Complete	Improve the 2019 Score	Met, 34%	Scheduled classes cancelled due to Covid-19 meeting regulations.
2021	Hold trainings	-	Improve the 2020 Score	-	-

Project WET Curriculum: Class exercises taught by 4th, 5th, and 6th-grade teachers in Bozeman School District (BSD) classrooms, educating students on stormwater-related issues, utilizing customized, and location-specific lesson plans and activities. The City's Park's Division also uses the lesson plans for their summer camps.

- Key Audience: Residents
- Strategy: Active Engagement
- Treatment Area: Entire MS4
- Distribution Channel: Trainings for teachers who then present lessons to students
- Performance Measure: Total student participants

Year	Task	Task Outcome	Goal	Goal Outcome	Notes

2017	Coordinate Classroom Use	Complete	n/a	n/a 492 Students	-
2018	Coordinate Classroom Use	Complete	Repeat 2017 Student Count	Met 526 Students	-
2019	Coordinate Classroom and Camp Use	Not Complete	Repeat 2018 Student Count	Not Met 100 Students	Spent year incorporating into the BSD curriculum.
2020	Coordinate Classroom and Camp Use	Not Complete	Repeat 2019 Student Count	Not Met Students	Program discontinued until Covid-19 regulations lift.

Post-Construction Stormwater Program: Tailored outreach that educates HOA Boards and management representatives on the proper function and maintenance of stormwater basins. The MS4 maintains a Post-Construction Program that includes processes and materials tailored to this group further described in SWMP Section 6.0.

- Key Audience: Home Owner Associations and Property Management Companies
- Strategy: Active and Passive Engagement
- Treatment Area: Citywide
- Distribution Channels: Participation in facility tours, board meetings, annual assemblies, and development of educational information
- Performance Measure: Annual post-construction audit earned score (see SWMP Section 6.4)

Year	Task	Task Outcome	Goal	Goal Outcome	Notes
2018	Inspect Facilities and Educate Owners	Complete	n/a	n/a 25%	-
2019	Inspect Facilities and Educate Owners	Complete	Improve the 2018 Score	Met 32%	Limited capacity to complete due to other priorities.
2020	Inspect Facilities and Educate Owners	Complete	Improve the 2019 Score	Met 56%	Hired Project Manager to assist with program.
2021	Inspect Facilities and Educate Owners	-	Improve the 2020 Score	-	-

Carpet Cleaning Targeted Outreach: Educate local carpet cleaning and restoration companies on proper disposal methods and potential enforcement penalties for illicit discharges to the storm sewer system.

- Key Audience: Carpet Cleaning and Restoration Companies
- Strategy: Active Engagement
- Treatment Area: Entire MS4
- Distribution Channels: Written and verbal correspondence
- Performance Measure: Illicit discharge reports related to targeted activities

Year	Task	Task Outcome	Goal	Goal Outcome	Notes
2018	n/a	n/a	No Related Illicit Discharges	Not Met 1	-
2019	Distribute a letter to owners	Complete	No Related Illicit Discharges	Met 0	Increased engagement yielded a good result.

2020	Inspect Facilities and Educate Owners	Complete	No Related Illicit Discharges	Met 0	-
2021	Inspect Facilities and Educate Owners	-	No Related Illicit Discharges	-	-

Lawn Care Targeted Outreach: Educate residents on best practices related to lawn mowing.

- Key Audience: Residents
- Strategy: Passive Engagement
- Treatment Area: Entire MS4
- Distribution Channels: Mailer sent with a monthly utility bill.
- Performance Measure: Residential sites' TSS median concentration (SWMP Section 8.4)

Year	Task	Task Outcome	Goal	Goal Outcome	Notes
2020	Distribute a mailer to residents	Complete	One mailer in 2020	Met, sent Fall 2020	First year tracking this metric.
2021	Distribute a Mailer	-	One mailer in 2021	-	-

3.5 Future and Deferred Initiatives

The following items represent future initiatives for the MS4:

Education Video Series: Development of a multi-faceted video library that would bring to life many of the concepts presented in the MS4's static educational materials.
Adopt a Rain Garden: A program that would actively engage businesses to periodically clean and dispose debris from adopted rain gardens.
CATs Program: Collaborative program where MSU students complete projects in support of the City's goals. Projects typically span a semester and include a variety of activities.

Blank Page

Section 4.0

Illicit Discharge Detection and Elimination Program

Graphic 4.0.1: Bentonite slurry spill

Graphic 4.0.2: Illicit connection confirmation

Blank Page

4.1 Introduction

The MS4 strives to improve waterway health, protect public safety, and comply with its MS4 Permit through the identification and elimination of pollutant sources by:

- Completing dry weather screening of outfalls;
- Inspecting the storm sewer for illegal connections;
- Responding to and resolving pollution events; and
- Enforcing municipal ordinances preventing illegal dumping.

SWMP Section 4.0 details the following components necessary to administer the MS4's Illicit Discharge Detection and Elimination Program, including:

- Regulatory Framework (4.2)
- Illicit Discharge Detection and Corrective Action Plan (4.3)
- Enforcement Response Plan (4.4)
- Event Tracking (4.5)
- Non-Stormwater Discharge Evaluation (4.6)
- Outfall Reconnaissance Inventory (4.7)
- Storm Sewer Infrastructure Totals (4.8)

4.2 Regulatory Framework

Pursuant to §40.04.200 Bozeman Municipal Code (BMC), it shall be unlawful to discharge or cause to be discharged into the MS4 any materials, including, but not limited to, pollutants or waters containing any pollutants that cause or contribute to a violation of applicable water quality standards or that could cause the city to be in violation of its MPDES. It shall be unlawful to store, handle, or apply any pollutant in a manner that will cause exposure to rainfall or runoff and discharge to the MS4 and to state waters or waters of the United States.

4.3 Illicit Discharge Detection and Corrective Action Plan

The MS4 uses the following Corrective Action Plan (CAP) to determine event priority, formulate a response, and, if necessary, pursue enforcement:

Assign an Event Coordinator (EC).
Investigate to determine pollutant type and severity (site visit and correspondence). Methods for investigation include:

- Field observation (in person, CCTV, ORI).
- Sampling and analysis (grab sample, turbidimeter, multi-parameter probe (pH and temperature), and ammonia test strips).
- Infrastructure analysis (GIS, plats, and record drawings).
- Dye testing.
- Correspondence with property owners.

Determine an event tier and response based on the following thresholds:

- Tier 1 Event: Minimal impact to public safety, infrastructure, and environment. Spills with a major dimension less than six feet and non-continuous. Outfalls and illicit connections deemed potential sources of pollution. Response includes:
    - Team: MS4 Staff and Code Compliance Officer

- Timeline: Initiate response within five days
- Resolution: MS4 Operations and/or contracted restoration firm.
- Pollutant Disposal: Public, Sediment/Pollutant Disposal Facility. Private, Contracted Hauler.
- Report: Internal
- Examples: Leaking vehicles and dripping dumpsters.

- Tier 2 Event: Moderate impact to public safety, infrastructure, and environment. Spills with a major dimension greater than six feet and non-continuous, or spills with a major dimension greater than six feet, continuous, and contained. Outfalls and illicit connections deemed suspect and obvious sources of pollution. Response includes:

    - Team: MS4 Staff and Code Compliance Officer
    - Timeline: Initiate response within 24-hours
    - Resolution: MS4 Operations and/or contracted restoration firm.
    - Pollutant Disposal: Public, Sediment/Pollutant Disposal Facility. Private, Contracted Hauler.
    - Report: Internal
    - Examples: Carpet cleaning process water discharge, sanitary overflow, camper waste disposal, homeless camp cleanup, floor drain, illicit sanitary connections, and non-hazardous chemical spills.

- Tier 3 Event: Immediate threat to human health, infrastructure, and environment. Spills with a major dimension greater than 6', continuous, and not contained.

    - Team: MS4 Staff, Code Compliance Office, and Emergency Services
    - Timeline: Immediate
    - Resolution: Fire, MS4 Operations, and/or contracted restoration firm.
    - Pollutant Disposal: Public, Sediment/Pollutant Disposal Facility. Private, Contracted Hauler.
    - Reporting: Internal and MDEQ Notification
    - Example: Hazardous spills

Eliminate discharge through various mitigation measures depending on event severity. Options include:

- Absorbent
- Vaccum and disposal
- Pipe plugs or seals
- Decontamination
- Enforcement
- Infrastructure retro-fit

If applicable, notify appropriate state and federal agencies.
Complete an event report that includes:

- Event Coordinator
- Date
- Event Location
- Pollutant(s) of Concern
- Event Tier Level
- Response Staff
- Response Time
- Discharge Location
- Description
- Event Timeline
- Conclusion/Resolution
- Images

4.4 Enforcement Response Plan

Pursuant to §40.04.860 and §40.04.890 BMC, the MS4 has the authority to implement the following Enforcement Response Plan (ERP) and use the following enforcement protocols for violators of BMC, including:

Informal Response: Warning issued via email notification or verbal notice used for cases when the responsible party unknowingly commits a violation of BMC. If not dealt with in an agreed upon timeframe, or an agreement does not occur, the MS4 escalates to a Formal Response. The MS4 handles most Tier 1 events under this category.
Formal Response: Notice of Violation and Cease and Desist Order using a set compliance timeline and monetary penalties based on staff time accrued and remediation costs. The MS4 uses this approach in cases when the responsible party knowingly violates BMC or has a record of non-compliance. The MS4 handles most Tier 2 and 3 events under this category.
Judicial Response: Civil penalties, injunctive relief, or criminal penalties using the Bozeman Police Department, City Attorney, and Municipal Court. The MS4 uses this approach in cases where the responsible party repeatedly and knowingly commits violations of BMC and fails to remedy issues under a Formal Response.
Additional ERP Information:

- Staff with Enforcement Authority: Stormwater Program Technician, Stormwater Program Specialist, Stormwater Program Project Manager, Stormwater Program Coordinator have the authority to investigate events as an EC; however, the the Stormwater Coordinator is the authorized Enforcement Agent and makes determinations regarding penalties.

4.5 Event Tracking

2017 Events: 5

- Tier 1 Event: Ellis Apartments - Leaking vehicle
    - Event ID: 201701
    - Pollutant: Oil
    - Local Control: Bozeman Municipal Code *(report available upon request)*
    - Resolved: Yes, owner cleaned up oil.
    - Significant: No, less than 5-gallons, no confirmed discharge to the storm sewer
- Tier 1 Event: Crystal Bar - Illicit roof drain
    - Event ID: 201702
    - Pollutant: Wash water
    - Local Control: Bozeman Municipal Code *(report available upon request)*
    - Resolved: Yes, owner disconnected sink from the roof drain
    - Significant: Yes, over 5-gallons, confirmed discharge to the storm sewer
- Tier 2 Event: Lindley Park - Homeless camp clean up
    - Event ID: 201703
    - Pollutant: Trash, human waste, and drug paraphernalia
    - Local Control: Bozeman Municipal Code *(report available upon request)*
    - Resolved: Yes, restoration firm cleaned up debris
    - Significant: No, less than 5-gallons, no confirmed discharge to the storm sewer
- Tier 1 Event: NAC Construction Site Fueling Spill

- Event ID: 201704
- Pollutant: Diesel Fuel
- Local Control: MSU Safety and Risk Management
- Resolved: Yes, MSU Facility Services clean up
- Significant: Yes, over 5-gallons

- Tier 1 Event: Stadium Tractor Hydraulic Oil Spill
  - Event ID: 201705
  - Pollutant: Hydraulic Oil (<25 gallons)
  - Local Control: MSU Safety and Risk Management
  - Resolved: Yes, MSU Facility Services clean up
  - Significant: Yes, over 5-gallons, no confirmed discharge to the storm sewer

2018 Events: 7

- Tier 1 Event: 15th & Patrick Oil Dumping
  - Event ID: 201801
  - Location: See map 4.2.1
  - Pollutant: Used motor oil
  - Local Control: BMC Section 40.04.200 and system cleaning
  - Significant: No, less than 5-gallons, confirmed discharge to the storm sewer

- Tier 1 Event: Solid Waste Hydraulic Hose
  - Event ID: 201802
  - Location: See map 4.2.1
  - Pollutant: Hydraulic fluid
  - Local Control: Solid Waste and Streets spill response
  - Significant: No, over 5-gallons, no confirmed discharge to the storm sewer

- Tier 1 Event: Prue Clean Technologies Carpet Cleaners
  - Event ID: 201803
  - Location: See map 4.2.1
  - Pollutant: Soaps and cleaning chemicals
  - Local Control: BMC Section 40.04.200
  - Significant: Yes, over 5-gallons, confirmed discharge to the storm sewer

- Tier 1 Event: Northwestern Energy Frac-Out
  - Event ID: 201804
  - Location: See map 4.2.1
  - Pollutant: Bentonite slurry
  - Local Control: BMC Section 40.04.200
  - Significant: No, over 5-gallons, no confirmed discharge to the storm sewer

- Tier 2 Event: Sanitary Sewer Overflow
  - Event ID: 201805
  - Location: See map 4.2.1
  - Pollutant: Sediment and pathogens
  - Local Control: Sewer Department sanitary sewer overflow response and system cleanout

- Significant: Yes, over 5-gallons, confirmed discharge to the storm sewer

- Tier 1 Event: John Deer Contractor Hydraulic Hose Failure
  - Event ID: 201806
  - Location: See map 4.2.1
  - Pollutant: Hydraulic Fluid
  - Local Control: MSU Safety and Risk Spill Response (sorbent material, 55-gallon drum, disposal)
  - Significant: No, under 5-gallons, no confirmed discharge to the storm sewer

- Tier 1 Event: Barnard Holder Snow Machine Hydraulic Hose Failure
  - Event ID: 201807
  - Location: See map 4.2.1
  - Pollutant: Hydraulic Fluid
  - Local Control: MSU Safety and Risk Spill Response (sorbent material, 5-gallon buckets, disposal)
  - Significant: No, under 5-gallons, no confirmed discharge to the storm sewer

2019 Events: 4

- Tier 2 Event: Sobo Lofts Fire
  - Event ID: 201901
  - Location: See map 4.2.1
  - Pollutant: Ash, construction debris/chemicals, traction sand, and chlorinated water
  - Local Control: Emergency fire operation and system cleaning
  - Significant: Yes, 1.5 million gallons of water sprayed on the fire. The majority did not discharge to Mandeville Creek due to a degraded historical irrigation conveyance that ponded the flows until infiltration occurred.

- Tier 1 Event: Durston Oil Spill
  - Event ID: 201902
  - Location: See map 4.2.1
  - Pollutant: Motor oil
  - Local Control: BMC Section 40.04.200
  - Significant: No, immediate response and mitigation by MS4 Staff.

- Tier 2 Event: Bogert Pool Filter Backflush
  - Event ID: 201903
  - Location: See map 4.2.1
  - Pollutant: Chlorinated water, Celatom Diatomite Filter Media, and filter debris
  - Local Control: BMC Section 40.04.200
  - Significant: No, immediate response and implementation of operational controls, plugged connection soon after eliminating the chance of future discharges.

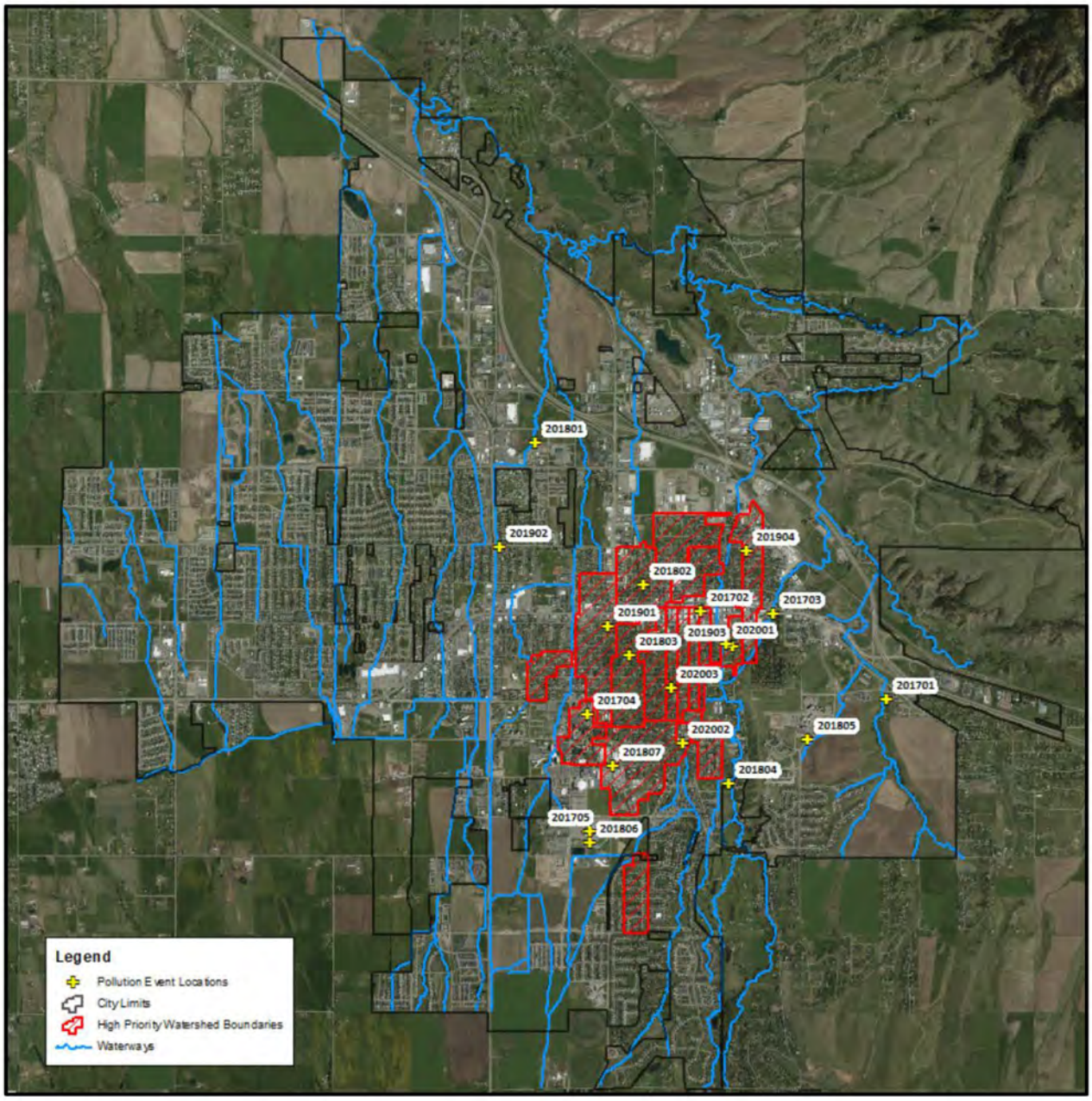
- Tier 1 Event: Karst Stage Oil Spill
  - Event ID: 201904
  - Location: See map 4.2.1
  - Pollutant: Motor oil
  - Local Control: BMC Section 40.04.200

- Significant: No, immediate response and mitigation by Karst stage staff.

2020 Events: 3

- Tier 1 Event: Bogert Pavilion
  - Event ID: 202001
  - Location: See map 4.2.1
  - Pollutant: Chlorinated wash-water
  - Significant: No, implementation of operational controls and plugged the connection eliminating the chance of future discharges.
- Tier 1 Event: Vehicle Oil Leak
  - Event ID: 202002
  - Location: See map 4.2.1
  - Pollutant: Diesel Fuel
  - Significant: No, vehicle towed and spill cleaned.
- Tier 1 Event: Willson Ave. Paint Spill
  - Event ID: 202003
  - Location: See map 4.2.1
  - Pollutant: Paint
  - Significant: No, immediate response by the Bozeman Fire Department and Streets Division.

Event Tier	2017	2018	2019	2020	2021
Tier 1	4	6	2	3	-
Tier 2	1	1	2	0	-
Tier 3	0	0	0	0	-
Total:	5	7	4	3	-



Graphic 4.5.2: Event Locations

4.6 Non-Stormwater Discharge Evaluation

The MS4 evaluates the following non-stormwater discharges to identify if they pose a waterway threat:

1. Water Line Flushing
    - Description: Chlorinated water resulting from Bac-T testing and cleaning of new water lines
    - Associated Pollutant(s): Chlorine
    - Local Control(s): Construction specifications requiring contractors to contain flush water
    - Risk: Medium, managed as Tier 2 illicit discharge
    - Illicit Discharges Reported: 0

2. Landscape Irrigation, Irrigation, Lawn Watering, and Potable Water

   - Description: Intermittent over-watering or faulty sprinklers
   - Associated Pollutant(s): Varied depending on the source (well or potable supply)
   - Local Control(s): Water Conservation landscaping audits and outreach initiatives
   - Risk: Low, not managed as an illicit discharge
   - Illicit Discharges Reported: 0

3. Rising Groundwater, Springs, and Flows from Riparian Habitats

   - Description: Flows that enters the storm sewer system when ground and surface water levels rise above the bottom elevation of the storm drain
   - Associated Pollutant(s): None
   - Local Control(s): Prohibition of sump drains that discharge to a street or other public right-of-way, a sanitary sewer line, or onto neighboring properties
   - Risk: Low, not managed as an illicit discharge
   - Illicit Discharges Reported: 0

4. Uncontaminated Groundwater Infiltration

   - Description: Water other than wastewater that enters a storm sewer system from the ground through such means as defective pipes, pipe joints, connections, or utility holes
   - Associated Pollutant(s): None
   - Local Control(s): Inspection of storm sewer pipe annually, and defective pipe repair
   - Risk: Low, not managed as an illicit discharge
   - Illicit Discharges Reported: 0

5. Uncontaminated Pumped Groundwater

   - Description: Groundwater pumped into the storm sewer system for lowering subsurface levels, particularly for construction
   - Associated Pollutant(s): None
   - Local Control(s): Discharge must originate from a well located in an undisturbed area, initial turbid first flush contained on site
   - Risk: Low, not managed as an illicit discharge
   - Illicit Discharges Reported: 0

6. Foundation Drains, Crawl Space Pumps, and Footing Drains

   - Description: Groundwater pumped or diverted from building foundations to the MS4.
   - Associated Pollutant(s): None
   - Local Control(s): Prohibition of sump drains that discharge to a street or other public right-of-way, a sanitary sewer line, or onto neighboring properties
   - Risk: Low, not managed as an illicit discharge
   - Illicit Discharges Reported: 0

7. Air Conditioning Condensation

   - Description: HVAC and refrigeration condensation discharged to the MS4
   - Associated Pollutant(s): None
   - Local Control(s): Allowed
   - Risk: Low, not managed as an illicit discharge
   - Illicit Discharges Reported: 0

8. Swimming Pool and Hot Tub Drain Water

   - Description: Dumping of swimming pool and hot tub drain water into the MS4
   - Associated Pollutant(s): Chlorine
   - Local Control(s): Infiltration or discharge to sanitary sewer
   - Risk: Medium, managed as Tier 2 illicit discharge
   - Illicit Discharges Reported: 0

9. Fire Hydrant Flushing

   - Description: Discharges resulting from regular fire hydrant flushing by MS4 operators
   - Associated Pollutant(s): Chlorine
   - Local Control(s): Water and Sewer Division fire hydrant flushing process
   - Risk: Low, not managed as an illicit discharge
   - Illicit Discharges Reported: 0

10. Non-Commercial, Individual Residential, and Charity Carwashes

    - Description: Wash-waters resulting from vehicle washing
    - Associated Pollutant(s): Soaps, oils, greases, metals, and sediment
    - Local Control(s): The City requires a public assembly permit for non-commercial and charity car washes on public property. If deemed appropriate, the MS4 can utilize this process to require specific controls.
    - Risk: Low, not managed as an illicit discharge
    - Illicit Discharges Reported: 0

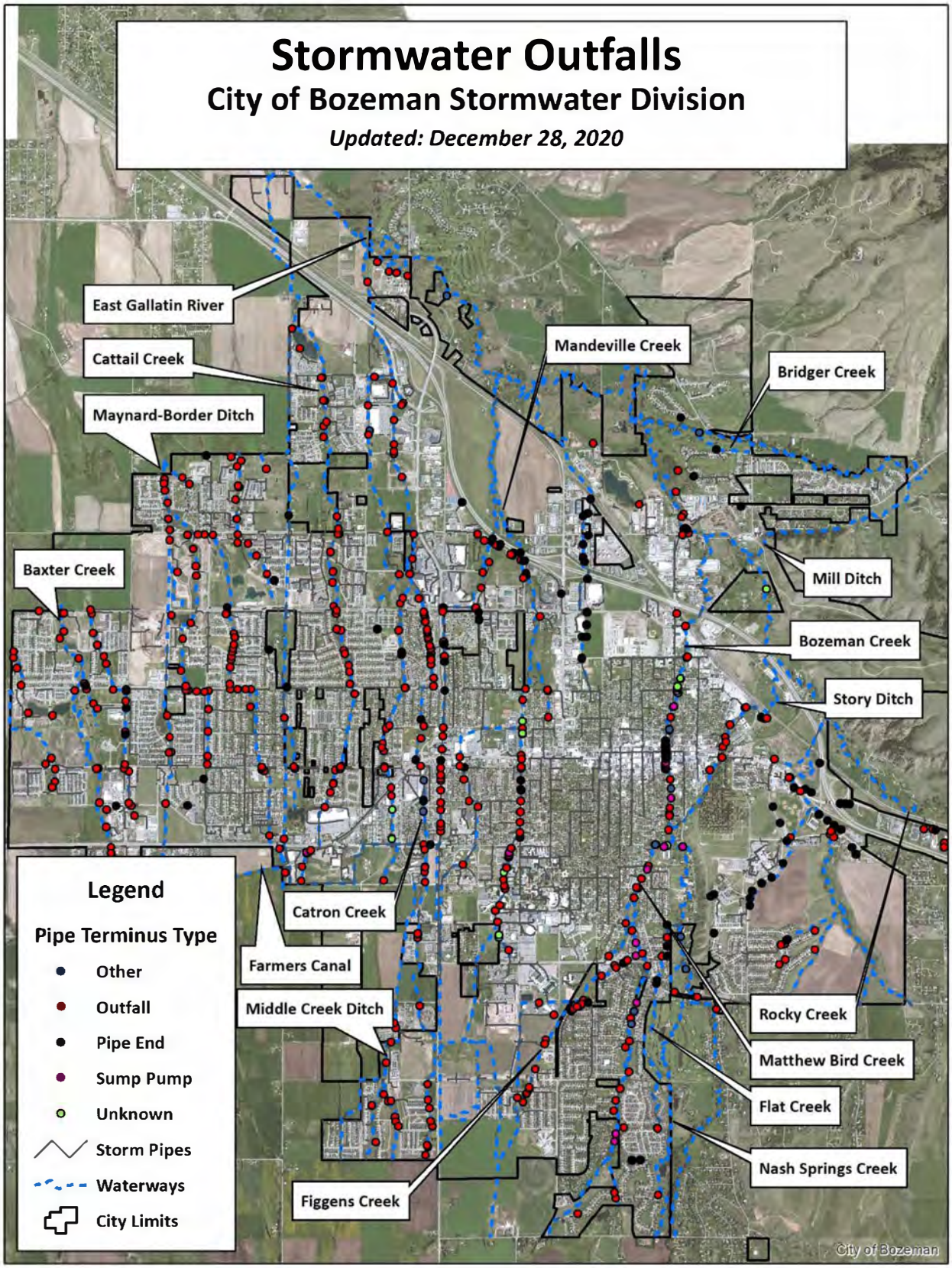
11. Street Wash Waters

    - Description: Water used to wash sidewalks, streets, parking lots, and buildings
    - Associated Pollutant(s): Sediment, oils, greases, and metals
    - Local Control(s): Allowed
    - Risk: Low, not managed as an illicit discharge
    - Illicit Discharges Reported: 0

4.7 Outfall Reconnaissance Inventory (ORI)

The MS4 has hundreds of storm sewer outfalls that discharge into numerous waterways and irrigation ditches within its boundary. Staff uses the Draft 2016 Integrated Report available at the MDEQ's Clean Water Act Information Center, TMDL, and City GIS databases (250' buffer with "outfall" terminus type) to compile the following information:

#	Waterway Name	2018 Outfalls	2019 Outfalls	2020 Outfalls	2021 Outfalls	TMDL	Impairments	MS4 Waste Load Allocation
1	Baxter Creek	14	18	17	-	No	None	None
2	Bozeman Creek	60	63	20	-	Yes	E. Coli, Nitrogen, Sediment, Chlorophyll-a, alteration in streamside cover	Sediment: 81 tons/year
3	Bridger Creek	1	1	0	-	Yes	Chlorophyll-a and Nitrate/Nitrite (Nitrite + Nitrate as N)	None
4	Catron Creek	82	83	72	-	No	None	None
5	Cattail Creek	42	44	43	-	No	None	None
6	East Gallatin River	13	22	10	-	Yes	Total Nitrogen, Total Phosphorous	None
7	Farmers Canal	46	51	40	-	No	None	None
8	Figgins Creek	23	22	22	-	No	None	None
9	Flat Creek	11	11	5	-	No	None	None
10	Mandeville Creek	48	53	50	-	Yes	Total Nitrogen, Total Phosphorous	None
11	Matthew Bird Creek	29	31	19	-	No	None	None
12	Maynard-Border Ditch	16	13	14	-	No	None	None
13	Middle Creek Ditch	26	25	35	-	No	None	None
14	Mill Ditch	0	0	0	-	No	None	None
15	Nash Spring Creek	0	1	2	-	No	None	None
16	Rocky Creek	1	3	0	-	Yes	Alteration in Streamside Cover, Anthropogenic Substrate Alterations, Physical Substrate Alterations, Sediment	None
17	Story Ditch	10	10	12	-	No	None	None
18	W. Gallatin Canal	31	30	32	-	No	None	None
19	Unnamed	167	153	70	-	No	None	None



Graphic 4.7.2: Stormwater outfall map

The MS4 prioritizes and inspect outfalls once during each MS4 Permit term using the Center for Watershed Protection protocol, including:

- Outfall Inventory: Field and GIS analysis to update existing and add new outfalls to the MS4's databases. Coordination occurs between the Stormwater and Strategic Services Divisions.
- Field Preparation: Staff utilizes waders, high visibility vest, measuring tape, multi-parameter sensor (temp and pH), ammonia test strips, turbidimeter, sample bottles, field forms, clipboard, camera, flashlight, legal pad, marker, pen, outfall maps, and nitrile gloves.
- Develop Inspection Plan: The MS4 has five maintenance districts that contain approximately 20% of the MS4's outfalls. Staff inspects one maintenance district per year, or all within a five-year permit cycle. Planning includes using GIS software to identify clusters of outfalls, property ownership, safety concerns, and accessibility to plan inspection routes.
- ORI Inspection: The MS4 visits individual outfalls and completes the following workflow:

Graphic 4.7.3: ORI Inspection Plan

- If applicable, implement Corrective Action Plan: The MS4 initiates a response as defined in SWMP Section 4.3 for any outfall classified as potential, suspect, or obvious pollution source.

The MS4 inspects outfalls deemed a high-priority annually. The MS4 considers an outfall to be high-priority if it meets the following criteria:

- 18" or more in diameter.

- Drains an urban watershed area of 25 acres or more.
- Dumps stormwater directly into an impaired receiving water (i.e., no stormwater basin).
- Obvious or suspect outfalls classified through previous years' ORI.

High-priority outfalls include:

Outfall ID: OF.G08.00035

- Discharge Location: Overbrook Dr. and Langhor Ave.
- Receiving Waterway: Figgins Creek
- Size and Material: 30" RCP

Inspection Year	Date	Flow	Characterization
2019	February 1, 2019	Yes, Trickle	Unlikely, No Indicators
2020	October 7, 2020	Yes, Trickle	Unlikely, No Indicators
2021	-	-	-

Outfall ID: OF.F06.00090

- Discharge Location: S. Bozeman Ave. and E. Cleveland St.
- Receiving Waterway: Matthew Bird Creek
- Size and Material: 20" Steel

Inspection Year	Date	Flow	Characterization
2019	July 19, 2019	No	Unlikely, No Indicators
2020	July 7, 2020	No	Unlikely, No Indicators
2021	-	-	-

Outfall ID: OF.F06.00089

- Discharge Location: S. Black Ave. and W. Cleveland St.
- Receiving Waterway: Matthew Bird Creek
- Size and Material: 19" RCP

Inspection Year	Date	Flow	Characterization
2019	July 19, 2019	No	Unlikely, No Indicators
2020	July 7, 2020	No	Unlikely, No Indicators
2021	-	-	-

Outfall ID: OF.H05.00370

- Discharge Location: N. 11th Ave. and W. College St.
- Receiving Waterway: Mandeville Creek
- Size and Material: 18" RCP

Inspection Year	Date	Flow	Characterization
2019	July 19, 2019	Yes, Moderate	Unlikely, No Indicators
2020	July 7, 2020	No	Unlikely, No Indicators
2021	-	-	-

Outfall ID: OF.H05.00384

- Discharge Location: N. 11th Ave. and W. Koch St.
- Receiving Waterway: Mandeville Creek
- Size and Material: 12" RCP

Inspection Year	Date	Flow	Characterization
2019	January 31, 2019	No	Unlikely, No Indicators
2020	July 8, 2020	No	Unlikely, No Indicators
2021	-	-	-

Outfall ID: OF.F04.00441

- Discharge Location: N. Rouse Ave. and E. Villard St.
- Receiving Waterway: Bozeman Creek
- Size and Material: 42" RCP (42" CMP replaced during Rouse Reconstruction in 2020)

Inspection Year	Date	Flow	Characterization
2019	August 8, 2019	No	Unlikely, No Indicators
2020	July 7, 2020	No	Unlikely, No Indicators
2021	-	-	-

Outfall ID: OF.G04.00398

- Discharge Location: N. 9th Ave. and W. Villard St.
- Receiving Waterway: Tributary SWWW_00053
- Size and Material: 24" RCP

Inspection Year	Date	Flow	Characterization
2019	January 19, 2019	No	Unlikely, No Indicators
2020	July 8, 2020	No	Unlikely, One Indicator
2021	-	-	-

Outfall ID: OF.F03.00446

- Discharge Location: N. Rouse Ave. and E. Peach St.
- Receiving Waterway: Bozeman Creek
- Size and Material: 43" RCP (Pipe upgraded from 27" RCP during Rouse Reconstruction)

Inspection Year	Date	Flow	Characterization
2019	January 31, 2019	No	Unlikely, No Indicators
2020	July 7, 2020	No	Unlikely, No Indicators
2021	-	-	-

Outfall ID: OF.G03.00399

- Discharge Location: N. 4th Ave. and W. Peach St.
- Receiving Waterway: Tributary SWWW_00034
- Size and Material: 30" RCP
- Note: Outfall removed in 2020 because of BMX Bike Park project. New outfall location is the jurisdictional boundary of SWWW_00034 (Manley Ditch) and the Cherry Creek Fishing Access.

Inspection Year	Date	Flow	Characterization
2019	January 31, 2019	No	Potential, Two+ Indicators
2020	-	-	-
2021	-	-	-

Outfall ID: OF.E03.00450

- Discharge Location: N. Rouse Ave. and E. Tamarack St.
- Receiving Waterway: Bozeman Creek
- Size and Material: 36" RCP

Inspection Year	Date	Flow	Characterization
2019	January 31, 2019	No	Unlikely, No Indicators
2020	July 7, 2020	No	Unlikely, One Indicator
2021	-	-	-

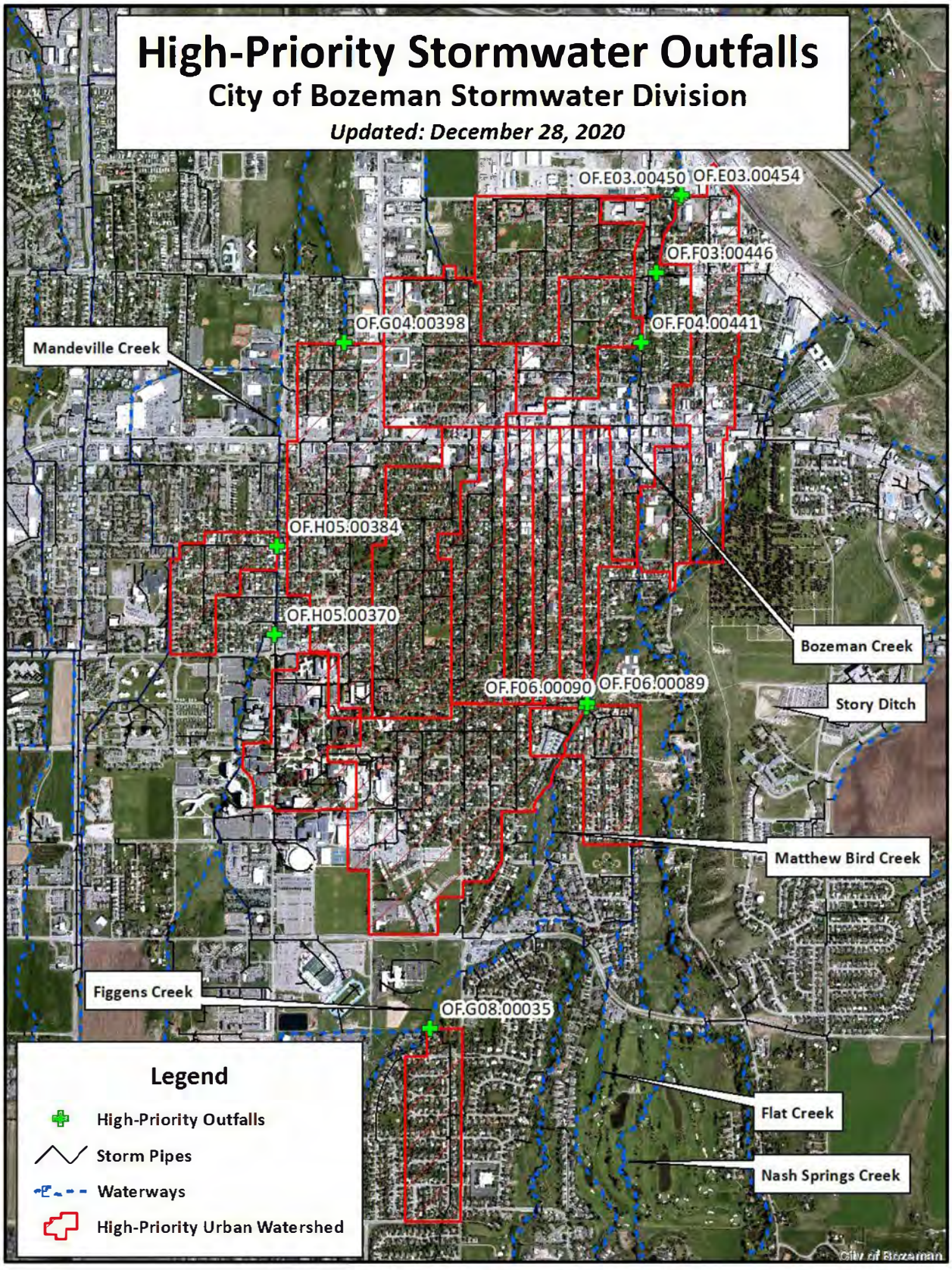
Outfall ID: OF.E03.00454

- Discharge Location: N. Rouse Ave. and E. Tamarack St.
- Receiving Waterway: Bozeman Creek
- Size and Material: 30" RCP

Inspection Year	Date	Flow	Characterization
2019	January 31, 2019	No	Unlikely, No Indicators
2020	July 7, 2020	No	Unlikely, No Indicators
2021	-	-	-

The MS4 completed the following outfall inspections:

ORI Year	Outfalls	Outfalls Inspected	High-Priority Outfalls	High-Priority Outfalls Inspected
2019	634	108 Flow: 99 No, 1 Trickle, 6 Moderate, 2 Unknown Pollution Charecterization: 104 Unlikely, 1 Potential, 1 Suspect, 2 Unknown	11	11 Flow: 9 No, 1 Trickle, 1 Moderate Pollution Charecterization: 10 Unlikley, 1 Potential
2020	463	113 Flow: 104 No, 6 Trickle, 3 Moderate Pollution Charecterization: 113 Unlikely	10	10 Flow: 8 No, 2 Trickle Pollution Charecterization: 10 Unlikley
2021	-	-	-	-



Graphic 4.7.16: High-Priority Stormwater Outfalls Map

4.8 Storm Sewer Infrastructure Totals

The MS4 collects and updates storm sewer data annually from the City's GIS. The public can view the MS4's storm sewer system at: https://gisweb.bozeman.net/Html5Viewer/?viewer=infrastructure.

Owner	2017	2018	2019	2020	2021
City of Bozeman	-	999	1,162	1,146	-
Montana State University	-	155	155	155	-
Montana Department of Transportation	-	68	67	76	-
Private or Null	-	352	398	440	-
Total:	1,484	1,574	1,782	1,817	-

Owner	2017	2018	2019	2020	2021
City of Bozeman	-	2,524	2,800	2,779	-
Montana State University	-	207	207	204	-
Montana Department of Transportation	-	187	187	187	-
Private or Null	-	661	734	840	-
Total:	3,457	3,579	3,928	4,010	-

Owner	2017	2018	2019	2020	2021
City of Bozeman	-	67 Miles	73 Miles	74 Miles	-
Montana State University	-	8 Miles	8 Miles	8 Miles	-
Montana Department of Transportation	-	4 Miles	4 Miles	4 Miles	-
Private, Other, and Null	-	30 Miles	31 Miles	31 Miles	-
Total:	89 Miles	109 Miles	116 Miles	117 Miles	-

Owner	2017	2018	2019	2020	2021
Total:	435	497	591	769	-

Owner	2017	2018	2019	2020	2021
Total:	594	622	634	463	-

Owner	2017	2018	2019	2020	2021
City of Bozeman	-	9	12	17	-
Montana State University	-	1	2	2	-
Montana Department of Transportation	-	2	2	8	-
Total:	7	12	16	27	-

Blank Page

Section 5.0

Construction Site Management Program

Graphic 5.0.1: Compliant single-family residential property

Graphic 5.0.2: Inlet sump clogged with construction debris

Blank Page

5.1 Introduction

The MS4 strives to improve waterway health, protect public safety, and comply with its MS4 Permit through the regulation of construction sites by:

Providing educational opportunities;
Administering a permitting program;
Conducting site inspections; and
Enforcing municipal and state regulations.

SWMP Section 5.0 details the following components necessary to administer the MS4's Construction Site Management Program, including:

- Regulatory Framework (5.2)
- Construction Site Permitting Program (5.3)
- Construction Site Enforcement Response Plan (5.4)
- Construction Site Inventory (5.5)
- Performance Tracking (5.6)
- Future Opportunities (5.7)
- Program Documents (5.8)

5.2 Regulatory Framework

Pursuant to §40.04.350 Bozeman Municipal Code (BMC), the MS4 requires owners/operators of construction sites to comply with the following regulations:

Article 4 Chapter 40 Bozeman Municipal Code (BMC);
75-5-101 Montana Code Annotated (MCA); and
17.30.1101, 17.30.1301 et seq., and 17.30.601 et seq Administratve Rules of Montana (ARM).

5.3 Construction Site Permitting Program

Pursuant to §40.04.350 BMC, the MS4 requires owners/operators of construction sites to submit Stormwater Pollution Prevention Plans (SWPPPs) before receiving a Building Permit or Infrastructure Project Notice to Proceed. Three permit application types exist, including:

MDEQ General Permit for Stormwater Discharges Associated with Construction Activity (Construction General Permit): The MS4 requires owners/operators to submit for construction sites that meet the Eligibility Requirments of the most current Construction General Permit. The MS4 completes one permit review for compliance with the most current Construction General Permit's Technology-Based Effluent Limitations and Stormwater Pollution Prevention Plan (SWPPP) requirements. The MS4 provides the owner/operator a Permit Review Checklist and Confirmation Letter. The MS4 does not confirm the owner/operator has corrected deficiencies through consecutive reviews. Instead, the MS4 reviews changes onsite during Stormwater Compliance Evaluation Inspections (CEI).

Construction Stormwater Permit: Sites Less than One (1) Acre: The MS4 requires owners/operators to submit for construction sites with land disturbance less than one acre and greater than 10,000 square feet. The MS4 completes numerous content and adequacy reviews of the owner/operator's submitted application and map, and provides a Construction Stormwater Permit once deemed compliant with BMC.

Construction Stormwater Permit: Single-Family Residential Projects: The MS4 requires for individual single-family and duplex home construction sites. The MS4 completes numerous

content and adequacy reviews of the owner/operator's submitted application and provides a Construction Stormwater Permit once deemed compliant with BMC.

5.4 Enforcement Response Plan

The MS4 implements the following Construction Site Enforcement Response Plan (ERP) to ensure compliant construction sites within its jurisdiction:

Image 5.4.1: ERP workflow

Inspection Type: Pursuant to §40.04.850.D BMC, the MS4 has the authority to complete CEIs at construction sites to ensure compliance with BMC and the Construction General Permit. Inspections may include: (1) Document review, including the site's NOI, SWPPP, BMP specifications, site maps, self-inspection records, and administrator certification, and (2) Site tour identifying pollutant sources, inspection of implemented BMPs, and compliance determinations with the BMC and Construction General Permit. Inspection types include:

- Unannounced: CEI resulting from a complaint or field observation. See SWMP Section 5.4.2.
- Announced: CEI resulting from reoccurring inspection efforts, which the MS4 prioritizes based on site prioritization and complaints. See SWMP Section 5.4.2.

Compliance Determination: Pursuant to §40.04.860 BMC, the MS4 has the authority to make BMC and Construction General Permit non-compliance determinations, including:

- Permit and/or Site is Complaint: No permit nor site non-compliance determinations issued. Inspection closed.
- Permit and/or Site is Not Complaint: Permit and/or site non-compliance determinations issued. See SWMP Section 5.4.3.

Enforcement Response: The MS4's enforcement response options, including:

- Verbal Warning: An informal response used when the MS4 determines the BMC and Construction General Permit non-compliance determinations are low-risk, and there are reasonable grounds that the owner/operator will correct the issues. Verbal warnings take the form of phone calls, emails, or in-person meetings. Inspection closed.
- Site Inspection Form: An informal response by the MS4 to document BMC and Construction General Permit non-compliance determinations. The MS4 emails or delivers the Site Inspection Form to the site owner/operator. See SWMP Section 5.4.4.

Enforcement Action: Pursuant to §40.04.860 and §40.04.890 BMC, the MS4 has the authority to require the owner/operator to comply with BMC and/or the Construction General Permit using the following actions:

- Follow-Up CEI: An informal action completed to ensure the site owner/operator corrects the non-compliance determinations issued in the Site Inspection Form. A Follow-Up CEI can take the form of a site visit, a conversation, or a review of submitted information. If so, inspection closed. If not, See SWMP Section 5.4.4 – Notice of Violations.
- Notice of Violations (NOV): A formal enforcement action taken when the site owner/operator does not resolve the non-compliance determinations. An NOV includes written violations of the BMC and the Construction General Permit, a Cease and Desist Order, and Stop Work Order. Both Orders apply to the site activities resulting in the issued violations and associated non-compliance determinations. NOVs require the site owner/operator to submit a written response within a set timeframe, documenting that they have resolved the violations and associated non-compliance determinations. Upon the MS4's review and approval of the written response, the inspection is closed. If existing non-compliance determinations remain or additional areas of non-complaince are identified, see SWMP Section 5.4.4 - Enforcement. In severe cases, the MS4 bypasses the Follow-Up CEI and immediately issues an NOV.
- Enforcement: A variety of formal enforcement penalties used by the MS4 when the site owner/operator does not comply with the NOV's requirements, including:
    - Building Permit Stop Work Order: Pursuant to §10.02.010.D, BMC, a Building Official may issue an order requiring any site owner/operator to immediately stop all work of any kind related to site's Building Permit. Any person who continues work after having been served with a Stop Work Order, except such work as that person is directed by the City to perform to remove a violation or unsafe condition, shall be subject to the misdemeanor penalty provision of §10.02.100 BMC. The issuance of a Stop Work Order cancels any pending inspections.
    - Withholding Issuance of a Certificate of Occupancy: Pursuant to §10.02.010.C, BMC, a Building Official of the City may withhold the issuance of a certificate of occupancy when the available evidence shows the structure and associated development does not conform with the standards of Chapter 40 BMC, a permit issued pursuant to Chapter 40 BMC, or has failed to pay costs of the abatement of stormwater violations as may be ordered by the City.
    - Misdemeanor Criminal Charge and Prosecution (Judicial): Pursuant to §40.04.910 BMC, any person, firm or corporation, their agents or servants who violate any

provision or requirement of Chapter 40 BMC or of a permit issued shall be guilty of a misdemeanor and, upon conviction thereof, shall be punished by a fine not exceeding $500.00 and in addition shall pay all costs and expenses of the case. A separate offense shall be deemed committed upon each day during or on which a violation occurs or continues.

Additional ERP Information:

- Elimination and Abatement of Illegal Construction Discharges: The MS4 uses the ERP to identify and resolve violations of BMC and/or the Construction General Permit.
- Staff with Enforcement Authority: Stormwater Program Technician, Stormwater Program Specialist, Stormwater Program Project Manager, Stormwater Program Coordinator have the authority to issue non-compliance determinations. The Stormwater Coordinator is the authorized Enforcement Agent and makes determinations regarding enforcement penalties.
- Enforcement Action Available, Escalation Process, and Schedule: The MS4's ERP is flexible and includes escalation protocols based on a owner/operator's response, while also providing options for immediate action when the Enforcement Agent identifies severe violations of BMC and/or the Construction General Permit. The MS4's ERP schedule is based on the Enforcement Agent's determination of risk (weather, capacity, waterway proximity, site size, pollutant source scale and severity, owner/operator compliance history, etc.). ERP implementation ranges from immediate action to a timeframe extending a week or more. A typical Follow-Up CEI occurs within five days. An NOV standard response timeframe is 10 days.
- Abate Damages and Prevent Reoccourences: Upon the conclusion of the NOV via the Closure Letter issuance, the MS4 maintains the authority to enact immediate enforcement action, as detailed in SWMP Section 5.4.4 - Enforcement upon the identification of any repeat violations.

Site Prioritization and Inspection Frequency Protocol:

The MS4 uses the following Construction Site Scoring Matrix to determine a site's priority level.

Criteria	3-Points	2-Points	1-Point
Site Size (Acres)	> 10-Acres	5 - 10 Acres	< 5-Acre
Proximity to Waterbody	< 1,000 ft	> 1,000 or < 2,000 ft	> 2,000 ft
Site Steepness per SWPPP	Yes	-	No
Bozeman Creek Watershed	Yes	-	No
Permit Review Checklist Score	> 50	25 - 50	< 25

Once priority is determined, the MS4 completes inspections per the frequencies outlined below.

- High-Priority Construction Sites (Over 10 Points):
    - Once at construction commencment.
    - After every .25" rain event. The MS4 interprets this standard to mean any rain event that occurs within a six-hour timeframe and uses the Bozeman International Airport NOAA Rain Gage.
    - After every snow melt event resulting in visible erosion.
    - Once at the conclusion of the project.
- Medium-Priority Construction Sites (5 - 10 Points):
    - As need basis per complaints and field observations.
- Low-Priority Construction Sites (Below 5 Points):

- As need basis per complaints and field observations.
- Less than One Acre Construction Sites
- Single-Family Residential Construction Sites

5.5 Construction Site Inventory

The following tables contain an inventory of construction site permits and inspection:

Permit Type	2018	2019	2020	2021
City Single- Family Residential Total	-	292	272	-
City Less than One Acre Total	-	63	34	-
City Greater than One Acre Total	24	29	36	-
MSU Greater than One Acre Total	2	1	1	-

Inspection Type	2018	2019	2020	2021
City Single-Family Residential Total	32	19	1	-
City Single-Family Residential Percentage (%)	17%	7%	.4%	-
City Less than One Acre Total	17	16	5	-
City Less than One Acre Percentage (%)	32%	25%	14%	-
City Greater than One Acre Total	10	6	15	-
City Greater than One Acre Percentage (%)	42%	21%	42%	-
MSU Greater than One Acre Total	2	3	2	-
MSU Greater than One Acre Percentage (%)	100%	>100%	>100%	-

High-Priority Construction Sites:

OAC18-0014 South Tracy Reconstruction: Four acre site within the Bozeman Creek watershed. The site includes the reconstruction of an existing road and underlying utilities.

- Permit Confirmation: May 29, 2018
- Initial Inspection: June 1, 2018
- Precipitation Triggered Inspections:
  - Inspection 1: June 19, 2018
  - Inspection 2: June 22, 2018
  - Inspection 3: July 2, 2018
  - Inspection 4: August 28, 2018
- Final Inspection: n/a

OAC18-0020 East Tamarack Reconstruction: Three acre site within the Bozeman Creek watershed. The site includes the reconstruction of an existing road and underlying utilities.

- Permit Confirmation: August 7, 2018
- Initial Inspection: n/a
- Precipitation Triggered Inspections:
  - Inspection 1: August 28, 2018
  - Inspection 2: September 17, 2018
  - Inspection 3: October 5, 2018

- Final Inspection: n/a

OAC19-0001 16 Willson Residential Development: One acre site within the Bozeman Creek watershed. The site includes the demolition of exisitng structures and construction of numerous row houses.

- Permit Confirmation: January 8, 2019
- Initial Inspection: n/a
- Precipitation Triggered Inspections:
    - Inspection 1: May 28, 2019
    - Inspection 2: June 10, 2019
    - Inspection 3: June 21, 2019
    - Inspection 4: July 9, 2019
    - Inspection 5: July 16, 2019
    - Inspection 6: September 9, 2019
    - Inspection 7: September 23, 2019
    - Inspection 8: June 8, 2020
    - Inspection 9: June 16-17, 2020
    - Inspection 10: July 23, 2020
    - Inspection 11: September 7, 2020
- Final Inspection: TBD

OAC19-0026 Bozeman Public Safety Center: Eight acre site within the Bozeman Creek watershed. The site includes the demolition of existing structures and construction of commercial building.

- Permit Confirmation: August 27, 2019
- Initial Inspection: n/a
- Precipitation Triggered Inspections:
    - Inspection 1: August 27, 2019
    - Inspection 2: September 23, 2019
    - Inspection 3: January 8, 2020
    - Inspection 4: June 8, 2020
    - Inspection 5: June 16-17, 2020
    - Inspection 6: July 23, 2020
    - Inspection 7: September 7, 2020
- Final Inspection: TBD

OAC20-0017 Front Street Interceptor Project: Three acre site within the Bozeman Creek watershed. The site includes the installation of a trunk sewer line.

- Permit Confirmation: August 12, 2020
- Initial Inspection: August 18, 2020
- Precipitation Triggered Inspections:
    - Inspection 1: September 7, 2020
- Final Inspection: TBD

OAC20-0043 Allision Subdivision: Fory-eight acre site within the Bozeman Creek watershed. The site includes the installation of a subdivision, including utilities, roads, and structures.

- Points: 12

- Permit Confirmation: December 17, 2020
- Initial Inspection: January 12, 2021
- Precipitation Triggered Inspections:
    - Inspection 1: TBD
- Final Inspection: TBD

5.6 Performance Tracking

The MS4 completes a Construction Site Compliance Audit in the fall, evaluating 50 random construction sites to determine their compliance with the BMC and Construction General Permit. The MS4 evaluates each construction site using the following criteria:

Implementation: BMPs present or absent.
Adequacy: Appropriate type and scale of BMPs for site conditions.
Installation: Adequate BMP installation per industry standard specifications.
Maintenance: Sufficient maintenance so that BMPs are in good working order.

After evaluation, the MS4 grades each construction site using one of the following categories:

0-Points: Not compliant with permit, high risk to infrastructure, public, and environment
1-Point: Partially compliant with permit, moderate risk to infrastructure, public, and environment
2-Points: Compliant with permit, low risk to infrastructure, public, and environment

The MS4 compiles the collected data and updates the following:

Audit Year	Audit Dates	Compliance Trend	Total Points	Earned Score	OAC Average	UAC Average	SFR Average
2018	October 24 - 26	n/a	33/100	33%	33%	37%	31%
2019	October 14 - 16	Decreasing	28/100	28%	28%	29%	28%
2020	November 6 - 13	Increasing	34/100	34%	67%	21%	27%
2021	-	-	-	-	-	-	-

2018 Discussion:

- Increased BMP use but many not adequately maintained.
- Noncompliance was mostly contained within private sites.
- Increased inspection frequency is effective at increasing compliance rates.

2019 Discussion:

- Compliance degrades back to pre-inspection levels after inspections.
- Permit applicant does not always communicate the requirements to onsite workers.
- 64% of commercial and infrastructure sites yielded a score with moderate or low risk.
- 44% of residential sites yielded a score with moderate or low risk.
- Only three sites fully complied with regulations.
- Increase inspection frequency to ensure compliance throughout project life.
- Inspect sites proportional to ratios (i.e. residential/commercial/infrastructure).
- Apply more emphasis on installation, maintenance, and records during inspections.

2020 Discussion:

- Multiple SWPPP reviews for a respective project do not result in elevated onsite compliance.
- Inspection time and constant presence equates to improved compliance onsite.

- The City's consulting engineer should create SWPPPs for public projects, not the contractor.
- More emphasis required on installation, maintenance, and records during inspections.

Graphic 5.6.2: Construction Compliance Audit Scores

5.7 Future Opportunities

Inspection Optimization Software: Develop a web-based inspection platform that will expedite documentation and communication with construction site owner/operators.

5.8 Program Documents

Single-Family Residential Sites:

- Construction Stormwater Permit: Single-Family Residential Projects
- SFR Permit Review Checklist
- Construction Stormwater Permit Confirmation
- SFR and UAC Site Inspection Form

Less than One Acre Sites:

- Construction Stormwater Permit: Sites Less than One Acre
- UAC Permit Review Checklist
- Construction Stormwater Permit Confirmation
- SFR and UAC Site Inspection Form

Greater than One Acre Sites:

- MDEQ Construction General Permit
- MDEQ Construction General Permit Notice of Intent (NOI)

- MDEQ Construction Stormwater Pollution Prevention Plan (SWPPP)
- MDEQ Construction Stormwater Permit Notice of Termination
- MDEQ Construction Stormwater Permit Transfer Notification
- OAC Permit Review Checklist
- OAC Site Inspection Form

Blank Page

Section 6.0

Post-Construction Program

Graphic 6.0.1: Overgrown stormwater basin

Graphic 6.0.2: Dredged stormwater basin

Blank Page

6.1 Introduction

The MS4 strives to improve waterway health, protect public safety, and comply with its MS4 Permit through the regulation and oversight of existing and new structural BMPs in the following ways:

Enforcing water quality and flood control standards on new and redevelopment projects; and
Completing inspections of structural BMPs.

SWMP Section 6.0 details the components necessary to administer the MS4's Post-Construction Management Program, including:

- Regulatory Framework and Applicable Documents (6.2)
- Development Review (6.3)
- Structural BMP Inventory (6.4)
- Inspection Program (6.5)
- High-Priority Structural BMPs (6.6)
- Enforcement Response Plan (6.7)
- Performance Tracking (6.8)
- Ongoing and Future Initiatives (6.9)

6.2 Regulatory Framework and Applicable Documents

The MS4 requires developers with projects over one-acre to infiltrate, evapo-transpire, or capture for reuse the first half-inch of rainfall to address stormwater runoff quality from new and redevelopment from a 24-hour storm preceded by 48-hours of no measurable precipitation using structural best management practices (BMPs). The runoff generated from the first half-inch of rainfall contains the majority of pollutants deposited on impervious area during dry periods. Structural BMPs can mitigate the loads by capturing the first flush, preventing pollutants from entering waterways.

Developers use surface and subsurface structural BMPs, which typically take the form of permeable pavers, infiltration basins, and bio-retention areas. Additionally, in Bozeman, structural BMPs must also be designed to limit runoff to the predevelopment level during a 10-year, 2-hour storm. This reduces peak runoff and helps protect waterways and property.

The MS4 also requires developers to implement non-structural BMPs that promote waterway health, including zoning and land planning, wetland regulations, waterway setbacks, and open space standards.

Various governing documents contain standards, policies, and regulations related to structural and non-structural BMPs for new and redevelopment, including:

- City of Bozeman Design Standards and Specification Policy - 2020
- City of Bozeman Modifications to Montana Public Works Standard Specifications - 6th Edition
- Montana Public Works Standard Specifications - 6th Edition
- Bozeman Municipal Code
- Montana Post-Construction Storm Water BMP Design Guidance Manual - 2017
- City of Bozeman Stormwater Facilities Plan - 2008

6.3 Development Review

The MS4 completes development review tasks related to structural BMPs as Developers submit new and redevelopment project proposals. Projects triggering the regulatory threshold covered in SWMP Section

6.2 include commercial, multi-family, and subdivision developments. In most cases, Developers utilize structural BMPs through an onsite management approach, which the MS4 defines as either on the developing parcel or at the overarching subdivision scale. The onsite management approach's primary benefits are the decentralized siting of structural BMPs, promoting green space and better integrating structural BMPs into the landscape. The disadvantage of this approach includes increased structural BMP totals throughout the MS4 and costly long-term maintenance.

An alternative to the onsite management approach is the use of an offsite management approach. This approach results in structural BMPs located at the bottom of watersheds that contain numerous subdivisions. This approach's primary benefit is that it reduces the number of structural BMPs, focusing on a select few that the MS4 can more effectively inspect and maintain. The disadvantages of this approach are that it requires significant planning, upfront MS4 investment, and an extensive payback financing mechanism. The MS4 does not utilize an offsite management approach; however, is exploring future opportunities. Graphic 6.3.1 provides a conceptual view of the varying management approaches.

The following information and Chart 6.3.2 describes the MS4's typical structural BMP review process:

The Developer completes a seasonal high-groundwater analysis and soil study to establish a baseline for the project's pre-construction site conditions.

The Developer selects a structural BMP based on site conditions, completes a design, and submits documents for review, including a drawings, drainage report, and maintenance plan.

The Engineering Division reviews the documents, ensures compliance with standards and policies, and provides comments to the Developer via a review letter. This step can repeat until the proposed design fully complies. The Stormwater Division offers review support, primarily focusing on the maintenance-related aspects of the structural BMP.

The Developer constructs the project and associated structural BMP after receiving approval. In some cases, modifications may occur at this stage in response to unforeseen site conditions.
Once complete, the Engineering Division completes an inspection to verify the Developer installed the BMP as approved. The Stormwater Division provides a secondary inspection focused on stabilization. Results from the Stormwater Division's inspection are stored in the Site Inspection Form and shared with the Developer. This step can repeat numerous times until the constructed BMP fully complies with the approved documents and Bozeman Municipal Code.
The Stormwater Division confirms that the GIS database contains the structural BMP.
The BMP goes into service and is managed by the owner indefinitely.

6.4 Structural BMP Inventory

The MS4 maintains an inventory of structural BMPs as construction occurs. The process typically includes a combination of GIS digitization and field verification to ensure adequate data capture. The tables below show the breakdown of structural stormwater BMPs based on four ownership categories, including:

Public: Contains structural BMPs located on public land, including the City, MSU, and MDT.
Private: Contains structural BMPs located on private property.
Open Space/Parkland: Contains structural BMPs located on HOA open space or parkland.
Unknown: Contains structural BMPs without known ownership.

The MS4 also categorizes and tracks the type of structural BMPs:

Surface Detention Facility: Regulated discharge to receiving waterway via an outlet structure.
Underground Detention Facility: Regulated discharge to waterway via an outlet structure.
Surface Retention Facility: No discharge to a waterway.
Underground Retention Facility: No discharge to a waterway.

The MS4 updates the inventory annually, with variations occurring as ownership determinations arise.

Type	2017	2018	2019	2020	2021
Surface Detention Facility	-	-	-	26	-
Underground Detention Facility	-	-	-	2	-
Surface Retention Facility	-	-	-	12	-
Underground Retention Facility	-	-	-	1	-
Total:	-	-	-	41	-

Type	2017	2018	2019	2020	2021
Surface Detention Facility	-	-	-	133	-
Underground Detention Facility	-	-	-	12	-
Surface Retention Facility	-	-	-	137	-
Underground Retention Facility	-	-	-	40	-
Total:	-	-	-	322	-

Type	2017	2018	2019	2020	2021
Surface Detention Facility	-	-	-	247	-
Underground Detention Facility	-	-	-	32	-
Surface Retention Facility	-	-	-	88	-
Underground Retention Facility	-	-	-	7	-
Total:	-	-	-	374	-

Type	2017	2018	2019	2020	2021
Surface Detention Facility	-	-	-	18	-
Underground Detention Facility	-	-	-	-	-
Surface Retention Facility	-	-	-	14	-
Underground Retention Facility	-	-	-	-	-
Total:	-	-	-	32	-

Land Classification	2017	2018	2019	2020	2021
Public	-	-	-	41	-
Private	-	-	-	322	-
Open Space/Parkland	-	-	-	374	-
Unknown	-	-	-	32	-
Total:	439	497	589	769	-

The MS4 also completes an analysis annually to identify high-priority structural BMPs. To complete the analysis, the MS4 completes a risk assessment in GIS using the following criteria:

- Size: Structural BMPs larger than 1,076 square feet. Analyzed using geometry data in GIS.
- Proximity: Within 500 feet of an impaired waterbody. Analyzed using a 500' buffer in GIS.
- Type: Surface detention or underground detention facility. Analyzed using GIS data.

The MS4 deems structural BMPs that meet all criteria as high-priority and manages them per the criteria detailed in SWMP Section 6.5. Table 6.4.6 includes analysis totals, and Table 6.6.1 includes specific structural BMP information.

Land Classification	2017	2018	2019	2020	2021
Public	-	-	12	13	-
Private	-	-	3	3	-
Open Space/Parkland	-	-	3	3	-
Unknown	-	-	1	1	-
Total:	-	-	19	20	-

6.5 Inspection Program

The MS4 completes inspections of typical and high-priority structural BMPs using qualitative and quantitative data collection practices. Inspection frequencies for the two types include:

- Typical: Complaint based, field observation, or as needed. No reoccurring return interval established at this time.
- High-Priority: Annual inspection per the requirements detailed in the MS4 Permit.

The MS4 receives permission from the underlying property owner to access the structural BMP. Once granted, a typical inspection involves the review of the physical characteristics, flow path, maintenance needs, and geometry of the structural BMP. The MS4 documents all notes and findings in a standard inspection form. Post-inspection, the MS4 assigns each structural BMP a maintenance priority level:

- Low: Structural BMP appears to be functioning as designed.
- Medium: Structural BMP requires minor to moderate sediment and vegetation maintenance to mitigate the risk of flooding, waterway pollution, and infrastructure failure.
- High: Structural BMP requires significant sediment dredging, vegetation removal, and/or infrastructure repairs to restore function.

The MS4 typically sends the owner a letter, inspection form, map, and maintenance guide, and requests they submit a plan to complete necessary maintenance and resolve the identified issues.

The MS4 has completed the following inspections of structural BMPs (including high-priority):

Land Type	2017		2018		2019		2020		2021	
	# Inspected	% of Total	# Inspected	% of Total	# Inspected	% of Total	# Inspected	% of Total	# Inspected	% of Total
Public	-	-	-	-	-	-	13		-	-
Private	-	-	-	-	-	-	4		-	-
OS/Parkland	-	-	-	-	-	-	30		-	-
Unknown	-	-	-	-	-	-	1		-	-
Total:	8	1.8%	15	3.0%	72	12%	48	6%	-	-

The MS4 has completed the following occupancy inspections:

Project Type	2017	2018	2019	2020	2021
Under 1 Acre	-	-	-	-	-
Over 1 Acre	-	-	-	-	-
Total:	-	-	-	-	-

Image 6.5.3: Post-Construction Program Map

6.6 High-Priority Structural BMPs

The MS4 manages the following structural BMPs as high-priority:

#	Facility ID	Owner	Area (ft^2)	Receiving Waterbody	2019 Rating	2020 Rating	2021 Rating
1	DP.H06.00026	MSU Facility 1	3,185	Mandeville Creek	Low	Low	-
2	DP.H06.00400	MSU Facility 2	7,591	Mandeville Creek	Low	Low	-
3	DP.H06.00024	MSU Facility 3	11,829	Mandeville Creek	Low	Low	-
4	DP.H06.00023	MSU Facility 4	4,667	Mandeville Creek	Low	Medium	-
5	DP.H06.00028	MSU Facility 5	1,294	Mandeville Creek	Low	Low	-
6	DP.H06.00025	MSU Facility 6	7,231	Mandeville Creek	-	Low	-
7	DP.I51.00073	City WRF 1	10,744	East Gallatin River	Low	Low	-
8	DP.I51.00075	City WRF 2	1,355	East Gallatin River	Low	Low	-
9	DP.I51.00074	City WRF 3	10,314	East Gallatin River	Low	Low	-
10	DP.E02.00006	City Vehicle Maintenance	5,577	East Gallatin River	Medium	Medium	-
11	DP.H04.00006	Bozeman School District 1	7,188	Mandeville Creek	Low	Low	-
12	TBD	Bozeman School District 2	7,000	Mandeville Creek	-	Low	-
13	DP.E01.00007	Bridger Creek HOA	22,765	East Gallatin River	High	-	-
14	DP.G02.00017	Tange's Addition	2,245	Mandeville Creek	-	Medium	-
15	DP.G02.00048	Best Western GranTree	3,464	Mandeville Creek	-	Medium	-
16	DP.H02.00001	Kenyon Noble	5,450	Mandeville Creek	-	High	-
17	DP.F01.00026	SID 674	7,354	East Gallatin River	-	High	-
18	DP.H07.00022	South University District 1	14,775	Mandeville Creek	-	Low	-
19	DP.H07.00023	South University District 2	26,987	Mandeville Creek	-	Low	-
20	DP.B05.00001	West Paw	3,967	Rocky Creek	-	Low	-

A summary of work related to each high-priority structural BMP includes:

MSU Facilities 1-6

- 2019: All inspected and reports submitted to the MSU Facilities Director other than MSU Facility 6, which was under construction.
- 2020: All inspected and reports submitted to MSU Facilities Director other than MSU Facility 6, which was under construction.

City WRF 1-3

- 2019: All inspected and reports submitted to the WRF Superintendent.
- 2020: All inspected and reports submitted to the WRF Superintendent.

City Vehicle Maintenance

- 2019: Inspected and report submitted to Public Works.
- 2020: Inspected and report submitted to the Streets Superintendent.

Bozeman School District 1-2

- 2019: Bozeman School District 1 inspected and report submitted to the BSD Facilities Director. Bozeman School District 2 not mapped or identified.
- 2020: Bozeman School District 1 and 2 inspected and reports submitted to the BSD Facilities Director.

Bridger Creek HOA

- 2019: Inspected and report submitted to the Bridger Creek Subdivision Community Association, Inc.
- 2020: Not inspected due to pending legal and policy issues.

Tanges Addition

- 2019: Not inspected.
- 2020: Inspected and report compiled; however, not sent to owner due to legal/policy issues.

Best Western GranTree

- 2019: Not inspected.
- 2020: Inspected and report submitted to the General Manager.

Kenyon Noble

- 2019: Not inspected.
- 2020: Inspected and report compiled; however, not sent to owner due to legal/policy issues.

SID 674

- 2019: Not inspected.
- 2020: Inspected and report compiled; however, not sent to owner due to legal/policy issues.

South University District 1-2

- 2019: Not inspected.
- 2020: Inspected and report compiled; however, not sent to owner due to legal/policy issues.

West Paw

- 2019: Not inspected.
- 2020: Inspected and report submitted to the General Manager.

6.7 Enforcement Response Plan

This section outlines the MS4's Enforcement Response Plan, which provides strategies and authority to ensure owners install, operate, and maintain structural BMPs.

Design: SWMP Section 6.2 references numerous documents containing regulations and requirements regarding structural BMP design. If a developer does not fully comply with regulations, the MS4 denies the site plan, making it impossible to acquire a building permit and construct their project. If a developer were to move forward with construction without a building permit, the Community Development's Code Compliance offer would issue a Stop Work Order per BMC Sec. 38.200.040.

Installation: SWMP Section 6.3 details the MS4's structurtal BMP review process. During this stage, the MS4 uses the following enforcement protocols:

- Informal, Formal, and Judicial: The MS4 submits a written notification to the owner when an erosion, sediment, and pollutant control issue is identified using the protocol in SWMP

Section 5.3. The Construction Enforcement Response Plan is the authority until the site reaches final stabilization. Requirements and permission to enter property are found in Bozeman Municipal Code Section 40.04.350.

- Formal: If an engineering-related issue, such as groundwater, geometry, location, or depth, or a site plan deviation, such as a utility conflict, occurs the owner is required to coordinate with the Engineering Division to find a solution. The MS4 withholds occupancy on the project or does not accept infrastructure until the owner resolves the identified issues.

Operation and Maintenance: SWMP Section 6.5 outlines the MS4s structural BMP inspection program. Upon sending the documents, the MS4 uses the following enforcement protocol:

- Informal: The MS4 communicates with the owner and offers to review the results of the MS4's inspection. A six-month timeline is set, which requires the owner to submit a maintenance plan to the MS4 describing how the identified issues will be resolved.
- Formal and Judicial: The MS4 does not have formal policy or process at this time. Two projects are ongoing as of late 2020 to determine this portion of the MS4's ERP. The projects include the Engineering Standards Update and the 2021 Stormwater Facilities Plan Update. The MS4 plans to present policy recommendations from these efforts to the Commission for decision-making as soon as they are complete.

6.8 Performance Tracking

The MS4 completes a Structural BMP Compliance Audit annually, evaluating 50 random structural BMPs to determine their condition based on the following criteria:

Vegetation Management: Evidence of reoccurring cattail, grass, and woody shrub removal.
Flow path: As designed, blocked by vegetation and/or sediment, and channelization.
Sediment accumulation, stagnant water or accumulation of vegetation which is reducing volume.

After evaluation, the MS4 grades each structural BMP using one of the following categories:

0-Points: Structural BMP requires sediment dredging, vegetation removal, or infrastructure repairs to restore function.
1-Point: Structural BMP requires minor to moderate sediment and vegetation maintenance to maintain function.
2-Points: Structural BMP appears to be well-maintained and functioning as designed.

The MS4 compiles the collected data and updates Table 6.8.1:

Audit Year	Audit Dates	Trend	Total Points	Earned Score
2018	October 17 - 26	-	25/100	25%
2019	November 14 - 15	Increasing	32/100	32%
2020	November 2 - 6	Increasing	56/100	56%

2018 Summary:

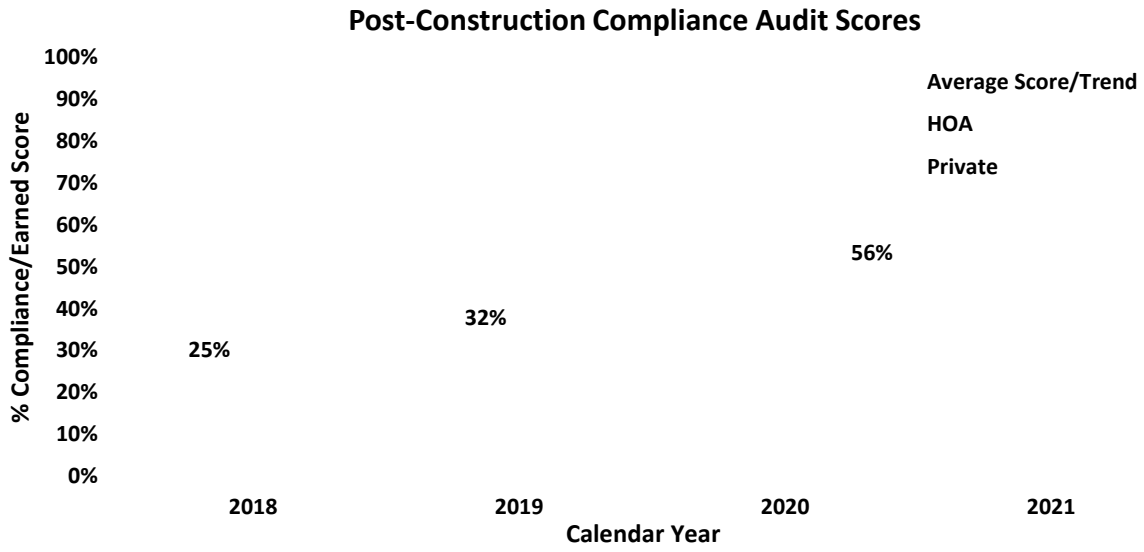
- Wal-Mart, Safeway, and other private entities maintain their structural BMPs more frequently, yielding an average score six times greater than HOAs.
- Structural BMPs integrated into landscapes are in better condition than those hidden.
- The overwhelming majority of HOAs are unaware of their responsibilities and do not complete maintenance regardless of previous engagement by the City.
- Current design standards allow for the construction of inadequate systems.

2019 Summary:

- Structural BMPs integrated into landscapes are in better condition than those hidden.
- The overwhelming majority of HOAs are ignorant of their maintenance responsibilities.
- Current design standards allow for the construction of inadequate systems.
- Legal private property access is an issue that requires consideration and resolution
- Average Scores: Private = 1.0 and HOA = .3

2020 Summary:

- New structural BMPs rate high and were a disproportionate majority, elevating the score.
- HOA scores are improving mainly resulting from the addition of new structural BMPs.
- Older private structural BMPs declined in performance.
- Many structural BMPs are located on parkland property and may be the responsibility of the MS4 due to the recently approved Parks and Trails District.
- Private property access is an issue that requires consideration.
- Average Scores: Private = 1.0 and HOA = 1.2



6.9 Ongoing and Future Initiatives

The following initiatives are planned or ongoing to facilitate improved plans, policies, and ordinances related to the MS4's Post-Construction Program:

2021 Engineering Design Standards Update (Standards Update): A project that includes reviewing and updating the MS4's Engineering Standards. Improvements will consist of better incorporating the MS4 Permit's water quality requirements, integrating the Montana Post-Construction BMP Guidance Manual, and standardizing forms, such as drainage reports and maintenance agreements.

2021 Stormwater Facility Plan Update (Facility Plan Update): The MS4's Facilities Plan has not received an update since 2008. The project will include reviewing and developing policy recommendations related to deficient or previously unexplored programmatic components.

Center for Watershed Protection Code and Ordinance Worksheet: In 2020, the MS4 met with the Parks, Planning, and Engineering Divisions and completed the worksheet to determine barriers to implementing stormwater and land-use structural and non-structural BMPs.

The worksheet was helpful for barrier identification and internal discussion. The MS4 found that some of the recommendations were not applicable or practicable due to various local conditions. Further, the MS4 confirmed it already has aggressive and protective environmental regulations in place, such as watercourse setbacks, open space requirements, a suite of structural BMP options, strategic land use planning, and impervious area maximums. In summary, the MS4 identified the following items for having improvement potential:

- Recommendation: Allow for alternative sidewalk and driveway materials.
    - Current Status: The MS4 has seen a variety of permeable concrete paver surfaces installed in the last few years. Current design standards do not explicitly cover.
    - Future Opportunity: Consider modifying codes as a part of the Standards Update.
- Recommendation: Secure permanent funding arrangements for the long-term management and maintenance of open space.
    - Current Status: The City requires the establishment of HOA's at the time of subdivision development; however, it does not require financial guarantees regarding the maintenance of open space, which often includes stormwater facilities and natural resource areas. This issue spans numerous policies and mainly centers on the lack of assurance that HOAs exist and stay funded into perpetuity. Often HOAs dissolve due to a lack of volunteers, representation, or ability to raise money.
    - Future Opportunity: Review policy options as a part of the Facility Plan Update.
- Recommendation: Long-term management plans that conserve natural systems required for all open space areas.
    - Current Status: Maintenace plans and open space agreements are typically not specific and fail to address all needs adequately.
    - Future Opportunity: Consider reviewing policies during the Park's PROST Plan update.
- Recomendation: Require limits of disturbance to be shown on construction plans and physically marked at the site.
    - Current Status: The Montana Construction General Permit does not require.
    - Future Opportunity: Coordinate with MDEQ during the next permit issuance.
- Recommendation: Require special treatment criteria for discharges to impaired or sensitive waters, such as natural wetlands, lakes, trout streams, nutrient-sensitive estuaries, drinking water supplies, etc.
    - Current Status: The MS4 does not designate or select high-priority drainage areas.
    - Future Opportunity: Consider modifying codes as a part of the Standards Update and/or review policy options as a part of the Facility Plan Update.
- Recomendation: Implement a local wetland protection ordinance.
    - Current Status: Wetland mitigation is covered under USACE policy and requirements.
    - Future Opportuinity: Review project options as a part of the Facility Plan Update.
- Recommendation: Provide a reference to clear, understandable, and local or regionally based design guidance or stormwater manual.

- Current Status: The Montana Post-Construction BMP Design Guidance Manual exists; however, it is not referenced nor codified in the MS4's Engineering Standards.
- Future Opportuinity: Consider modifying codes as a part of the Standards Update.

- Recomendation: Mandate performance bonds and periodic inspections to ensure proper installation of stormwater practices based on the approved plans.
  - Current Status: No requirements exist.
  - Future Opportuinity: Review policy options as a part of the Facility Plan Update.
- Recomendation: Include provisions for runoff reduction practice easements, inspector right-of-entry, maintenance agreements, and post-construction inspections.
  - Current Status: The listed items either do not exist or require improvement.
  - Future Opportuinity: Consider modifying codes as a part of the Standards Update.
- Recomendation: Require some percentage of treatment on-site if off-site stormwater compliance is authorized.
  - Current Status: The MS4 does not allow offsite stormwater management at this time.
  - Future Opportuinity: Review policy options as a part of the Facility Plan Update.

Section 7.0

Good Housekeeping Program

Graphic 7.0.1: Street sweeping debris pile

Graphic 7.0.2: Sediment management facility

Blank Page

7.1 Introduction

The MS4 strives to improve waterway health, protect public safety, and comply with its MS4 Permit through the responsible management of its storm sewer system, facilities, and daily work activities by:

Inspecting, maintaining, and repairing public assets;
Mitigating stormwater pollutants through the development and implementation of Facility and Activity Stormwater Pollution Prevention Plans; and
Maintaining an environmentally conscious workforce through training.

SWMP Section 7.0 details the following components necessary to administer the MS4's Good Housekeeping Program, including:

Infrastructure Operations (7.2)
Facility Stormwater Pollution Prevention Program (7.3)
Activity Stormwater Pollution Prevention Program (7.4)
Training (7.5)

7.2 Infrastructure Operation

The City inspects, maintains, and repairs its storm sewer system on an annual basis. MSU maintains infrastructure within its boundary. The following Divisions are responsible for conducting infrastructure operations:

Operation	Goal	Season	Operational Area
Stormwater Division Operations			
Storm Sewer Inspection (CCTV)	20% per year	Year-round	Citywide
Storm Sewer Cleaning	20% per year	Year-round	Citywide
Storm Sewer Repair	As Required	Spring, Summer, Fall	Citywide
Treatment Unit Maintenance	Annually	Fall	Individual Locations
Infiltration Facility Maintenance	Annually	Fall	Individual Locations
Debris Hauling	Annually	Varies	Sediment Facility
Streets Division Operations			
Spring Cleanup	Annually	Spring	Citywide
Fall Cleanup	Annually	Fall	Citywide
Street Sweeping	Annually	Year-round	Citywide
Sweepings Hauling	Annually	Varies	East Gallatin Area

The MS4 uses the following metrics to track performance. The performance data comes from the MS4's Operation's Dashboard, and infrastructure totals from SWMP Section 4.8. The metrics include:

Inlets and Manholes Cleaned: Storm sewer inlets and manholes serve two purposes: (1) mitigate flood risk by collecting runoff from streets, parking lots, alleyways, and other hard surfaces, and (2) treat stormwater by capturing sediment, trash, and other pollutants in their sumps.

- Performance Measure: Clean 20% of public inlets and manholes annually
- Calculation Type: Total assets (includes duplicate effort)

Year	City/MDT Maintained	City/MDT Total	% Complete	MSU Maintained	MSU Total	% Complete
2018	742	3,778	20%	256	362	71%
2019	809	4,216	19%	263	362	73%
2020	909	4,188	22%	207	365	57%
2021	-	-	-	-	-	-

Storm Sewer Cleaned: Storm sewers serve two purposes: (1) convey stormwater collected by inlets to their point of discharge, and (2) capture sediment, trash, and other pollutants that fall out of suspension, requiring reoccurring maintenance to remain functional.

- Performance Measure: Clean 20% of pipes annually
- Calculation Type: Total assets (mains and laterals, includes duplicate effort)

Year	City/MDT Maintained	City/MDT Total	% Complete	MSU Maintained	MSU Total	% Complete
2018	17 Miles	71 Miles	24%	.1 Miles	8 Miles	1%
2019	14 Miles	77 Miles	18%	.1 Miles	8 Miles	1%
2020	17 Miles	78 Miles	22%	.1 Miles	8 Miles	1%
2021	-	-	-	-	-	-

Infrastructure Repairs: Infrastructure repairs or “spot repairs” serve two purposes: (1) fix known pipe failures and restrictions to ensure the adequate flow of stormwater, and (2) repair open sections of pipe where scouring of subgrade soils occur, mitigating the chance of a road failure and sediment load contribution.

- Performance Measure: Pipe integrity indicator
- Calculation Type: Total repairs

Year	City Total	MSU Total
2018	16 Repairs	2 Repairs
2019	10 Repairs	0 Repairs
2020	3 Repairs	1 Repair
2021	-	-

Storm Sewer Inspection: Storm sewer inspections serve two purposes: (1) identification and prioritization of structural and maintenance needs for underground infrastructure and (2) identifies illicit discharges, cross-connections, or illegal pipe connections.

- Performance Measure: Inspect 20% of storm sewer mains annually
- Calculation Type: Total assets (mains and laterals, includes duplicate effort)

Year	City/MDT Maintained	City/MDT Total	% Complete	MSU Maintained	MSU Total	% Complete
2018	14 Miles	71 Miles	20%	.4 Miles	8 Miles	5%
2019	11 Miles	77 Miles	14%	.02 Miles	8 Miles	.2%
2020	9 Miles	78 Miles	12%	.5 Miles	8 Miles	6%
2021	-	-	-	-	-	-

7.3 Facility Stormwater Pollution Prevention Program

The purpose of the MS4's Facility Stormwater Pollution Prevention Program (FSWPPP) is to mitigate stormwater pollutants generated on municipal facilities. To complete, the MS4 works to ensure all municipal facilities meet or exceed the following Facility Minimum Standards (FMS):

Connect wash bays and interior floor drains to the sanitary sewer.
Store chemicals under cover and within secondary containment.
Prevent tracking at entries, exits, and within parking areas.
Stock spill kits with instructions, disposable bags, PPE, and absorbent products.
Perform preventative maintenance on vehicles and equipment.
Wash vehicles and equipment in designated locations.
Contain fuel tanks with secondary containment.
Implement BMPs for identified pollutants.
Maintain stormwater facilities per the following frequencies: (1) Stormwater basins, annual vegetation and debris clearing, 10-15 year dredging; (2) Mechanical separators, annual vacuuming; (3) Infiltration facilities, annual flushing; (4) Parking and drive surfaces, as required; and (5) Inlets, manholes, and pipes, five-year flushing, vacuuming, and inspection cycle.
Stabilize disturbed areas within 14-days.

The MS4 uses the following FSWPPP inspection protocol:

If applicable, collect stormwater runoff sample to characterize facility pollutant concentrations.
Inspect facility and establish baseline compliance with FMSs.
Review existing documents, such as existing Standard Operating Guides (SOGs), safety data sheets, spill documentation, and stormwater facility record drawings.
Coordinate with applicable leadership and develop FSWPPP that includes:

- Overview
- Stormwater Team
- Site Description
- Impaired Waterbodies
- Sampling
- Pollution Identification
- Site Assessment
- Spill Response Plan
- Training
- Inspections
- Infrastructure Improvements
- Record Keeping and Reporting
- Site Map

Implement FSWPPP.
Train applicable staff annually.
Re-inspect and update the FSWPPP annually.

The following facilities are subject to the FSWPPP protocol:

Facility ID	Facility Name	Facility Classification	Initial Inspection	FSWPPP Development	FSWPPP Update
1.1	City Shops Complex	Operations and Storage Area	2019	2019	2020, 2021
1.2	Vehicle Maintenance Facility	Operations and Storage Area	2019	2019	2020, 2021

1.3	Laurel Glen Operations Facility	Operations and Storage Area	2020	2020	2021
2.1	Water Treatment Plant	Treatment Works	2020	2020	2021
2.2	Water Reclamation Facility	Treatment Works	2019	2019	2020, 2021
3.1	East Gallatin Storage Area	Material Storage Area	2020	2020	2021
3.2	Closed Landfill	Material Storage Area	2019	2019	2020, 2021
3.3	Snow Storage Area	Material Storage Area	2019	2019	2020 2021
4.1	Public Parking Garage	Parking Facilities	2021	2021	2022
4.2	Public Parking Lots (4)	Parking Facilities	2021	2021	2022
5.1	Bozeman Public Safety Facility	Public Safety Facility	2019	2019	2020 2021
5.2	Fire Stations #1-3	Public Safety Facility	2021	2021	2022

Facility ID	Facility Name	Facility Classification	Initial Inspection	FSWPPP Development	FSWPPP Update
1.4	University Shops Facility	Operations and Storage Area	2019	2021	2022
3.4	MSU Material Storage Area	Material Storage Area	2020	2021	2022
4.3	MSU Parking Garage	Parking Facilities	2021	2021	2022
4.4	MSU Parking Lots (17)	Parking Facilities	2021	2021	2022

Graphic 7.3.3: MS4 facilities

7.4 Activity Stormwater Pollution Prevention Program

The purpose of the MS4's Activity Stormwater Pollution Prevention Program (ASWPPP) is to mitigate stormwater pollutants generated from municipal operations. To complete, the MS4 works to ensure all operations meet or exceed the following Activity Minimum Standards (AMS):

Protect street surfaces and inlets by deploying controls that capture, contain, and allow the collection and disposal of generated pollutants.
Cover or contain material stockpiles, and control run-on.
Stabilize disturbed areas within 14-days of activities.
Prevent tracking and the off-site migration of debris.
Capture and dispose concrete waste.
Manage dewatering flows to remove sediment to the maximum extent practicable before entering the storm sewer system or waterways.

The MS4 uses the following ASWPPP inspection protocol:

Review activity and establish baseline compliance with AMSs.
Coordinate with applicable leadership and develop ASWPPP that includes:

- Overview
- Stormwater Team
- Activity Description
- Pollutant Identification
- Standards Assessment and SOGs
- Training
- Record Keeping

Implement ASWPPP.
Train applicable crews annually.

The following activities are subject to the ASWPPP protocol:

Activity ID	Activity Name	Division	Responsible Entity	Location	Inspection Year	ASWPPP Development
1.1	Emergency Water Main Breaks	Water/Sewer	City	Citywide	2019	2019
1.2	Sanitary Sewer Overflows	Water/Sewer	City, MSU	Citywide	2019	2019
1.3	Trenching and Excavation	Water and Sewer	City	Citywide	2020	2020
2.1	Sidewalk and Curb Construction	Water/Sewer, Streets	City	Citywide	2021	2021
2.2	Concrete Cutting	Water/Sewer, Streets	City	Citywide	2021	2021
3.1	Roadway Traction Sand Application	Streets	City, MSU	Citywide	2020	2020
4.1	Solid Waste Collection	Solid Waste	City, MSU	Citywide	2020	2020
5.1	Arena Construction	MSU	MSU	Campus	2021	2021
6.1	Parks Mowing	Parks	City, MSU	Citywide	2021	2021
6.2	Tree Planting, Pruning, Removal	Parks	City, MSU	Citywide	2021	2021

7.5 Training

The MS4 participates in local, state, and national trainings. The following lists completed efforts:

Comprehensive Stormwater Training

- Stormwater Program Coordinator (Kayla Mehrens)
    - 2017: Montana Water Environment Association Conference, Bellevue StormCon Conference
    - 2018: Montana Stormwater Conference, Denver StormCon Conference
    - 2019: n/a
    - 2020: Virtual Designing Successful Stormwater Facilities with Maintenance and Enforcement in Mind, Virtual National Stormwater Symposium Stormwater Digital Conference, Virtual Stormwater Rate Study with FCS Group, Virtual StormCon Conference, Virtual Stormwater Pond Problems Webcast
- Stormwater Program Specialist (Frank Greenhill)
    - 2017: Montana Water Environment Association Conference
    - 2018: International Erosion Control Association Conference, Montana Stormwater Conference
    - 2019: BMP 101 Introduction to Stormwater Management, BMP 201 Certified SWPPP Administrator/Preparer, WQM 130 Stormwater Management for Industrial Operations
    - 2020: Virtual StormCon Conference
- Stormwater Project Manager (Adam Oliver)
    - 2020: Virtual Designing Successful Stormwater Facilities with Maintenance and Enforcement in Mind, Virtual ADS/Baysaver BMP Design and Maintenance Workshop, Virtual StormCon Conference
- Stormwater Program Technician (Cody Flammond, Jon Silva)
    - 2018:International Erosion Control Association Conference, Montana Stormwater Conference, Phase 1 Leadership Training, Hazardous Waste Training
    - 2019: Weekly meeting, bimonthly meeting, Weftech Chicago, WQM 130 Stormwater Management for Industrial Operations
    - 2020: Virtual StormCon Conference
- Stormwater Operations Foreman (Mike Dilbeck)
    - 2018: Montana Stormwater Conference
    - 2019: Weftech Chicago
    - 2020: n/a
- MSU Director, Facilities Services (EJ Hook)
    - 2018: Montana Stormwater Conference
    - 2019: n/a
    - 2020: n/a

Stormwater Operations Training:

- Awareness: Training for employees to increase awareness and reduce stormwater pollutants generated from internal operations. Employees receive training every three years. Employees at the Water Reclamation Facility and in the Solid Waste Division receive training annually. MSU employees receive annual FSWPPP and ASWPPP training applicable to their MSU department and assigned tasks. Training is typically combined with seasonal Safety and Risk Management training.

Division	Stormwater In Bozeman Video	Rain Check Chapter 1: Intro	Rain Check Chapter 2: Housekeeping	Rain Check Chapter 3: Spill control	Rain Check Chapter 4: Fueling	Rain Check Chapter 5: Vehicle Maintenance	Rain Check Chapter 6: Vehicle Washing	Rain Check Chapter 7: Materials Management	Rain Check Chapter 8: Waste Management	Rain Check Chapter 9: Facility Maintenance	Rain Check Chapter 12: Landscaping
Water and Sewer	X	X	X	X	X	X	X	X	X	-	X
Code Compliance	X	X	-	X	-	-	-	-	-	-	-
Facilities	X	X	X	X		X	-	X	X	X	X
Forestry	X	X	X	X	X	X	X	X	X	-	X
Parks and Cemetery	X	X	X	X	X	X	X	X	X	-	X
Fire Operations	X	X	X	X	X	X	X	X	X	X	-
Streets	X	X	X	X	X	X	X	X	X	-	X
Solid Waste	X	X	X	X	X	X	X	X	X	X	-
Water Treatment Plant	X	X	X	X	X	X	X	X	X	X	X
Water Rec. Facility	X	X	X	X	X	X	X	X	X	X	-

- ASWPPP and FSWPPP: Training for applicable employees to increase awareness and reduce stormwater pollutants generated from specific operations and facilities. Employees receive training annually. Training content includes:

Division	Water Main Breaks	Sanitary Sewer Overflows	Trenching and Excavation	Sidewalk and Curb Construction	Curb Cutting	Traction Sand Application	Solid Waste Collection	Arena Construction	Parks Mowing	Tree Planting
Water and Sewer	X	X	X	X	X	-	-	-	-	-
Facilities	-	-	-	-	-	-	-	-	-	-
Forestry	-	-	-	-	-	-	-	-	-	X
Parks and Cemetery	-	-	-	-	-	-	-	-	-	X
Streets	-	-	-	X	X	X	-	-	-	-
Solid Waste	-	-	-	-	-	-	X	-	-	-
MSU Operations	-	X	-	-	-	X	X	X	X	X

Division	MSU Shops Facility	City Shops Complex	Vehicle Maintenance Facility	Laurel Glen Operations Facility	East Gallatin Storage Area	Closed Landfill	Snow Storage Area	MSU Material Storage Area	Water Treatment Plant	Water Reclamation Facility	Public Parking Garage and Lots	MSU Parking Garage and Lots	Bozeman Public Safety Facility	Fire Stations #1-3	Parks and Recreation
Water and Sewer	-	X	X	X	-	-	-	-	-	-	-	-	-	-	-
Facilities	-	X	-	-	-	-	-	-	-	-	X	-	X	X	-
Forestry	-	-	X	-	X	-	-	-	-	-	-	-	-	-	X
Parks and Cemetery	-	X	-	-	X	-	-	-	-	-	-	-	-	-	X
Fire Operations	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
Streets	-	X	X	-	X	-	X	-	-	-	-	-	-	-	-
Solid Waste	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
Water Treatment Plant	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
Water Rec. Facility	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
MSU Operations	X	-	-	-	-	-	-	X	-	-	-	X	-	-	-

Division	2017		2018		2019		2020		2021	
	Awareness Training	FSWPPP and ASWPPP Training	Awareness Training	FSWPPP and ASWPPP Training	Awareness Training	FSWPPP and ASWPPP Training	Awareness Training	FSWPPP and ASWPPP Training	Awareness Training	FSWPPP and ASWPPP Training
Water and Sewer	18	-	7	-	2	-	21	21	-	-
Code Compliance	0	-	0	-	0	-	0	0	-	-
Facilities	0	-	0	-	0	-	0	0	-	-
Forestry	0	-	0	-	0	-	5	5	-	-
Parks and Cemetery	0	-	0	-	14	-	17	17	-	-
Fire Operations	0	-	0	-	0	-	0	0	-	-
Streets	0	-	19	-	9	-	24	24	-	-
Solid Waste*	14	-	17	-	16	-	19	19	-	-
Water Treatment Plant	0	-	10	-	1	-	0	0	-	-
Water Rec. Facility*	13	-	15	-	14	-	14	14	-	-
MSU Operations	0	-	1	-	2	-	23	23	-	-

Construction Site Management Program Training

- Stormwater Program Coordinator (Kayla Mehrens)
    - 2020: Virtual BMP 301 Conducting Stormwater Compliance Evaluation Inspections
- Stormwater Program Specialist (Frank Greenhill)
    - 2017: BMP 101 Introduction to Stormwater Management Training, BMP 201 SWPPP Administrator Training, BMP 202 SWPPP Preparer Training, BMP 101 Introduction to Stormwater Management Training, BMP 102 Field Academy, BMP 201 SWPPP Administrator Training, BMP 202 SWPPP Preparer Training, BMP 301 Compliance Evaluation Inspection Training
    - 2018: International Erosion Control Association Conference, BMP 101 Introduction to Stormwater Management Training, 201/202 SWPPP Administrator and Preparer Training, BMP 100 Construction Dewatering Training, 102 BMP Field Academy
    - 2019: BMP 101 Introduction to Stormwater Management, BMP 201 Certified SWPPP Administrator/Preparer
    - 2020: Virtual BMP 301 Conducting Stormwater Compliance Evaluation Inspections
- Stormwater Project Manager (Adam Oliver)
    - 2020: Virtual BMP 301 Conducting Stormwater Compliance Evaluation Inspections
- Stormwater Program Technician (Cody Flammond, Jon Silva)
    - 2018: International Erosion Control Association Conference, 101 Introduction to Stormwater Management Training, 201/202 SWPPP Administrator and Preparer Training, 100 Construction Dewatering Training, 102 BMP Field Academy
    - 2019: n/a
    - 2020: Virtual CI241 Qualified Compliance Inspector of Stormwater – Montana, Virtual BMP 301 Conducting Stormwater Compliance Evaluation Inspections
- MSU Director of Facilities Services (EJ Hook)
    - 2017: BMP 301 Compliance Evaluation Inspection Training
    - 2018: n/a
    - 2019: n/a
    - 2020: n/a

Post-Construction Program Training

- Stormwater Program Coordinator (Kayla Mehrens):
    - 2017: Montana Water Environment Association Conference, Bellevue StormCon Conference
    - 2018: Montana Stormwater Conference (May 1-3), Denver StormCon Conference
    - 2019: n/a
    - 2020: Virtual The Benefits of Third Party Performance Verification: A Better Understanding of NJDEP and WADOE TAPE Webinar, Virtual StormCon Conference, Virtual Stormwater Pond Problems Webcast
- Stormwater Project Manager (Adam Oliver)

- 2020: Virtual Designing Successful Stormwater Facilities with Maintenance and Enforcement in Mind, Virtual ADS/Baysaver BMP Design and Maintenance Workshop, Virtual StormCon Conference

- Development Review Engineer (Anna Russell P.E., Karl Johnson):
  - 2020: Virtual The Benefits of Third Party Performance Verification: A Better Understanding of NJDEP and WADOE TAPE Webinar
- Development Review Engineer (Griffin Nielsen P.E., Cody Flammond P.E.):
  - 2020: Virtual The Benefits of Third Party Performance Verification: A Better Understanding of NJDEP and WADOE TAPE Webinar
- Development Review Manager (Lance Lehigh P.E.):
  - 2020: Virtual The Benefits of Third Party Performance Verification: A Better Understanding of NJDEP and WADOE TAPE Webinar

Section 8.0

Sampling and Evaluation Program

Graphic: 8.0.1: In-stream sampling equipment

Graphic 8.0.2: Stormwater runoff nutrient analysis

Blank Page

8.1 Introduction

The MS4 strives to improve waterway health, protect public safety, and comply with its MS4 Permit through the collection of stormwater and waterway data points that:

- Monitor stormwater and surface water quality over time;
- Evaluate the effectiveness of infrastructure and administrative program investments;
- Generate data that advises policy, capital, and operational decisions; and
- Provide a data-driven performance metric easily communicated to the public.

SWMP Section 8.0 details the following components necessary to administer the MS4's Sampling and Evaluation Program, including:

- Targeted Waterways (8.2)
- Regulatory Requirements (8.3)
- Urban Runoff Monitoring (8.4)
- In-stream Wet Weather Monitoring (8.5)
- Sediment Reduction Monitoring (8.6)
- Long-term Trend Monitoring (8.7)
- Evaluation (8.8)
- Discussion (8.9)

8.2 Targeted Waterways

Bozeman Creek, a.k.a. Sourdough Creek, originates in the Gallatin Mountains south of the MS4. Flowing north, Bozeman Creek enters the MS4 at E. Kagy Boulevard and continues until its confluence with the E. Gallatin River at E. Griffin Dr. The Montana DEQ determined that Bozeman Creek contained impairments from natural and anthropogenic sources when preparing the 2013 Lower Gallatin Planning Area TMDL.

Probable Cause	Probable Sources	Associated Uses	TMDL
Alteration in stream-side or littoral vegetative cover	Agricultural grazing, crop production	Aquatic Life	No
Chlorophyll-a	Agricultural grazing and crop production, residential districts, municipal area	Primary Contact and Recreation	No
E.coli	Septic tanks, urban runoff, storm sewers, pet waste, livestock	Primary Contact and Recreation	Yes
Nitrogen (Total)	Agricultural grazing and crop production, residential districts, municipal area	Aquatic Life, Primary Contact, and Recreation	Yes
Sediment	Natural sources, unpaved roads/trails, urban runoff, storm sewers, municipal area	Aquatic Life	Yes

Mandeville Creek, a small spring feed watercourse, originates south of Bozeman. Flowing north, Mandeville Creek enters the MS4 at Alder Creek Dr. and continues until its confluence with the E. Gallatin River. The Montana DEQ determined Mandeville Creek contained impairments from anthropogenic sources when preparing the 2013 Lower Gallatin Planning Area TMDL.

Probable Cause	Probable Sources	Associated Uses	TMDL
Nitrogen (Total)	Municipal point source discharges, residential districts, municipal area	Aquatic Life, Primary Contact, and Recreation	Yes
Phosphorous (Total)	Municipal point source discharges, residential districts, municipal area	Aquatic Life, Primary Contact, and Recreation	Yes

8.3 Regulatory Requirements

The MS4 General Permit requires that the MS4 perform sampling, testing, and reporting of stormwater discharges annually, including:

Monitor stormwater discharges based on residential and industrial land-use types

- See SWMP Section 8.4 Urban Runoff Monitoring

Assess in-stream water quality impacts of stormwater discharges to Bozeman and Mandeville Creeks (Self-Monitoring Requirements: Monitoring Option 2)

- See SWMP Section 8.5 In-Stream Wet-Weather Monitoring and SWMP Section 8.7 Long-Term Trend Monitoring.

Conduct TMDL-related monitoring to evaluate the effectiveness of best management practices (BMPs) implemented to reduce pollutant loading from the MS4 to impaired waters (TMDL Related Monitoring: Monitoring Option 2)

- See SWMP Section 8.6 Sediment Reduction Monitoring

Self-evaluate results relative to long-term medians

- See SWMP Section 8.8 Evaluation

For each of the monitoring requirements above, the MS4 conducts sampling, testing, and reporting of the following parameters:

Total Suspended Solids (TSS), mg/L
Chemical Oxygen Demand (COD), mg/L
Total Nitrogen (TN), mg/L
Total Phosphorus (TP), mg/L
Copper (Cu), mg/L
Lead (Pb), mg/L
Zinc (Zn), mg/L
Oils and Greases, mg/L
pH, standard units
Estimated Flow

8.4 Urban Runoff Monitoring

Introduction: The MS4 collects urban runoff samples from representative watersheds to characterize pollutant loading occurring from various land-use types before system treatment, such as stormwater basins, sumps, infiltration galleries, and mechanical separation. In general, urban runoff pollutant concentrations are variable and dependent on numerous environmental conditions, such as precipitation cycles, wind, tree cover, and human activities.

Sites: The MS4 has a network of four monitoring locations: two within residential drainage basins and two within commercial/industrial drainage basins, including:

Site: RES_01

- Location: Near the intersection of S. Bozeman Ave. and E. Garfield St.
- Land-use: Residential
- Drainage Basin: Seven acres
- Inlet ID: I.F06.00082

  Latitude: 45.667143
  Longitude: -111.034474

- Inlet ID: I.F06.00083

  Latitude: 45.667143
  Longitude: -111.034724

- Parameters: TSS, COD, TP, TN, pH, Copper, Lead, Zinc, Oils and Greases, and Flow
- Frequency: Two samples per year

Site: IND_01

- Location: Near Commercial Dr. cul-de-sac (west)
- Land-use: Commercial and Industrial
- Drainage Basin: 10 acres
- Inlet ID: I.E01.00184

  Latitude: 45.703061
  Longitude: -111.030112

- Inlet ID: I.E01.00185

  Latitude: 45.703164
  Longitude: -111.030428

- Parameters: TSS, COD, TP, TN, pH, Copper, Lead, Zinc, Oils and Greases, and Flow
- Frequency: Two samples per year

Site: RES_02

- Location: MSU Campus near the intersection of S. 12th Ave. and W. Garfield St.
- Land-use: Residential
- Drainage Basin: Four acres
- Inlet ID: I.H06.00329

  Latitude: 45.666911
  Longitude: -111.054301

- Inlet ID: I.H06.00259

  Latitude: 45.666970
  Longitude: -111.054226

- Parameters: TSS, COD, TP, TN, pH, Copper, Lead, Zinc, Oils and Greases, and Flow
- Frequency: Two samples per year

Site: IND_02

- Location: MSU Campus near the intersection of S. 6th Ave. and W Garfield St.
- Land-use: Industrial
- Drainage Basin: Two acres
- Inlet ID: I.G06.00603

  Latitude: 45.664409
  Longitude: -111.044957

- Inlet ID: I.G06.00630

  Latitude: 45.664409
  Longitude: -111.044942

- Parameters: TSS, COD, TP, TN, pH, Copper, Lead, Zinc, Oils and Greases, and Flow
- Frequency: Two samples per year

Methods: The MS4 collects urban runoff samples from storm sewer inlets at each site using Thermo-Scientific Nalgene Samplers (Samplers). Before runoff events, Staff installs each Sampler at the selected inlet grate and positions it to collect the first flush of urban runoff. Once full, the Sampler closes itself prohibiting additional collection or dilution of the original sample.

Analysis: The MS4 collects, transfers, packages, and ships samples to a certified laboratory, which analyzes the following parameters:

Total Suspended Solids (TSS), mg/L
Chemical Oxygen Demand (COD), mg/L
Total Nitrogen (TN), mg/L
Total Phosphorus (TP), mg/L
Copper (Cu), mg/L
Lead (Pb), mg/L
Zinc (Zn), mg/L
Oils and Greases, mg/L
pH, standard units
Estimated Flow

The MS4 estimates flow, in gallons per minute (gpm), using the Rational Formula where:

$Q = CiA$ *Equation 1*

Q is peak runoff rate (cfs converted to gpm)
C is the runoff coefficient (C-Factor, Bozeman Engineering Standards)
i is rainfall intensity (in./hr., MSU Rain Gage)
A is the drainage area (acres)

Location Name	Primary Land Use	Runoff Coefficient (C-Factor)
RES_01	Low to Medium Density Residential	0.35
RES_02	Dense Residential	0.50
IND_01	Industrial	0.80
IND_02	Industrial	0.80

Site	TSS mg/L	Oil & Grease mg/L	Total Nitro. mg/L	Phosp. mg/L	Zinc mg/L	Lead mg/L	Cop. mg/L	COD mg/L	pH	Flow gpm
RES_01: 2017 (1)	203	2.00	6.20	0.908	0.1160	0.0052	0.0220	251.00	6.7	N/A
RES_01: 2017 (2)	368	5.10 RL	12.00	1.230	0.1790	0.0073	0.0300	175.00	7.0	N/A
RES_01: 2018 (1)	460	4.00	14.00	1.920	0.2720	0.0092	0.0290	708.00	6.4	55.0
RES_01: 2018 (2)	113	1.00 RL	2.30	0.544	0.1220	0.0033	0.0130	129.00	6.5	22.0
RES_01: 2019 (1)	5890	6.00	28.80	8.400	2.0200	0.1750	0.3380	3330.00	7.4	49.5
RES_01: 2019 (2)	206	1.00 RL	5.50	0.680	0.2100	0.0060	0.0240	258.00	6.9	14.3
RES_01: 2020 (1)	2300	3.00	21.50	4.400	0.6200	0.0530	0.0760	1340.00	6.7	110.0
RES_01: 2020 (2)	109	1.00 RL	3.40	0.6400	0.1400	0.0040	0.0200	363.00	6.3	49.5
RES_01: 2021 (1)	-	-	-	-	-	-	-	-	-	-
RES_01: 2021 (2)	-	-	-	-	-	-	-	-	-	-
RES_01 Median	287	2.50	9.10	1.069	0.1945	0.0067	0.0265	310.50	6.7	88.0
RES_02: 2017 (1)	-	-	-	-	-	-	-	-	-	-
RES_02: 2017 (2)	-	-	-	-	-	-	-	-	-	-
RES_02: 2018 (1)	1430	15.00	8.40	2.030	0.6520	0.0367	0.0840	605.00	7.0	18.0
RES_02: 2018 (2)	199	3.00	3.40	0.457	0.2610	0.0081	0.0220	234.00	6.8	18.0
RES_02: 2019 (1)	806	9.00	8.60	1.930	0.5000	0.0410	0.0820	579.00	7.5	40.39
RES_02: 2019 (2)	568	8.00	17.50	2.060	0.7500	0.0220	0.0810	1100.00	6.8	11.7
RES_02: 2020 (1)	1490	3.00	9.80	2.220	0.5100	0.0300	0.0490	487.00	6.8	89.76
RES_02: 2020 (2)	176	3.00	7.40	0.800	0.2900	0.0070	0.0260	382.00	6.4	40.4
RES_02: 2021 (1)	-	-	-	-	-	-	-	-	-	-
RES_02: 2021 (2)	-	-	-	-	-	-	-	-	-	-
RES_02 Median	687	5.50	8.50	1.980	0.5050	0.0260	0.0650	533.00	6.8	71.8
IND_01: 2017 (1)	149	4.00	17.30	1.380	0.5780	0.0160	0.0440	292.00	7.0	-
IND_01: 2017 (2)	1820	5.10 RL	11.68	1.320	33.3500	0.0371	0.0867	151.00	6.9	-
IND_01: 2018 (1)	602	15.00	8.50	1.890	4.7100	0.0371	0.0620	606.00	7.3	179.5
IND_01: 2018 (2)	293	4.00	3.40	0.588	0.1910	0.0081	0.0270	195.00	7.0	71.8
IND_01: 2019 (1)	1470	4.00	4.90	1.960	1.5600	0.1020	0.1620	647.00	7.6	161.6
IND_01: 2019 (2)	333	2.00	10.70	0.940	0.8800	0.0250	0.0700	651.00	7.2	46.7
IND_01: 2020 (1)	2880	2.00	17.10	6.800	2.7200	0.1070	0.2450	1240.00	6.7	359.1
IND_01: 2020 (2)	347	2.00	4.80	0.880	1.7600	0.0280	0.0540	347.00	7.2	161.6
IND_01: 2021 (1)	-	-	-	-	-	-	-	-	-	-
IND_01: 2021 (2)	-	-	-	-	-	-	-	-	-	-
IND_01 Median	474	4.00	9.60	1.350	1.6600	0.0326	0.0660	476.50	7.1	287.3
IND_02: 2017 (1)	-	-	-	-	-	-	-	-	-	-
IND_02: 2017 (2)	-	-	-	-	-	-	-	-	-	-
IND_02: 2018 (1)	899.0	4.00	8.80	1.600	0.5600	0.0158	0.0570	592.00	6.7	14.4
IND_02: 2018 (2)	380.0	5.00	4.40	0.737	0.2450	0.0099	0.0320	271.00	3.4	14.4
IND_02: 2019 (1)	2570	10.00	2.00	4.440	1.3500	0.0780	0.1760	1420.00	7.6	32.3
IND_02: 2019 (2)	301	3.00	10.20	1.440	0.8200	0.0260	0.1000	634.00	6.8	9.3
IND_02: 2020 (1)	1040	3.00	5.20	1.410	0.6200	0.0230	0.0590	730.00	7.0	71.8
IND_02: 2020 (2)	225	2.00	4.00	0.810	0.3000	0.0080	0.0300	248.00	6.2	32.3
IND_02: 2021 (1)	-	-	-	-	-	-	-	-	-	-
IND_02: 2021 (2)	-	-	-	-	-	-	-	-	-	-
IND_02 Median	639.5	3.50	4.80	1.425	0.5900	0.0194	0.0580	613.00	6.8	23.3

Evaluation: The MS4 enters monitoring results into a local spreadsheet, stores analysis reports for safe record, and analyzes the data using the following Scoring Matrix (Matrix) and protocol to interpret,

evaluate, and communicate the results. The Matrix includes scores ranging from 0 to 4-points, representing a set increase from EPA benchmarks provided in previous MS4 General Permits.

Site	TSS mg/L	Oil & Grease mg/L	Total Nitro. mg/L	Phosp. mg/L	Zinc mg/L	Lead mg/L	Copper mg/L	COD mg/L	pH
Reference	125	10	2	0.4100	0.2100	0.1650	0.0400	80	6 to 9

Example: The TSS Benchmark is 125 mg/L. As such, the 3-Point range is two times that amount (250), the 2-Point range is three times that amount (375), etc.

Parameter	4-Points	3-Points	2-Points	1-Point	0-Points
TSS (mg/L)	0 – 125	126 - 250	251 - 375	376 - 500	> 500
Oil and Grease (mg/L)	0 - 10	11 - 20	21 - 30	31 - 40	> 41
Total Nitrogen (mg/L)	0 - 2.0	2.1 - 4.0	4.1 - 6.0	6.1 - 8.0	> 8.0
Phosphorus (mg/L)	0 - .41	.42 - .82	.83 - 1.23	1.24 - 1.65	> 1.65
Zinc (mg/L)	0 - .20	.21 - .40	.41 - .60	.61 - .80	> .80
Lead (mg/L)	0 - .10	.11 - .20	.21-.30	.31 - .40	> .40
Copper(mg/L)	0 - .04	.041 - .08	.081 - .12	.121 - .160	> .160
COD	0 - 80	81 - 160	161 - 240	241 – 320	> 320
PH (High End)	7.6 - 9.0	9.1 - 10.0	10.1 - 11.0	11.1 -12.0	12.1 - 14.0
PH (Low End)	6.0 - 7.5	5.0 - 5.9	4.0 - 4.9	3.0 - 3.9	1.0 - 3.0

The MS4 relates results to the Matrix and then populate the appropriate Urban Runoff Monitoring charts with the corresponding point totals.

Example: A 2018 RES_01 sample contained 135 mg/L of TSS. The MS4 assigns and populates the Urban Runoff Monitoring: RES_01 chart TSS box with 3-points. The same approach applies to all sites and parameters.

Parameter	2018		2019		2020		2021	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
TSS	1	4	0	3	0	4	-	-
Oil and Grease	4	4	4	4	4	4	-	-
Total Nitrogen	0	3	0	2	0	3	-	-
Phosphorus	0	3	0	3	0	3	-	-
Zinc	3	4	0	3	1	4	-	-
Lead	4	4	3	4	4	4	-	-
Copper	4	4	0	4	3	4	-	-
COD	0	3	0	1	0	0	-	-
PH	4	4	4	4	4	4	-	-
Event Points:	20	33	11	28	16	30	-	-
Annual Points:	53		39		46		-	

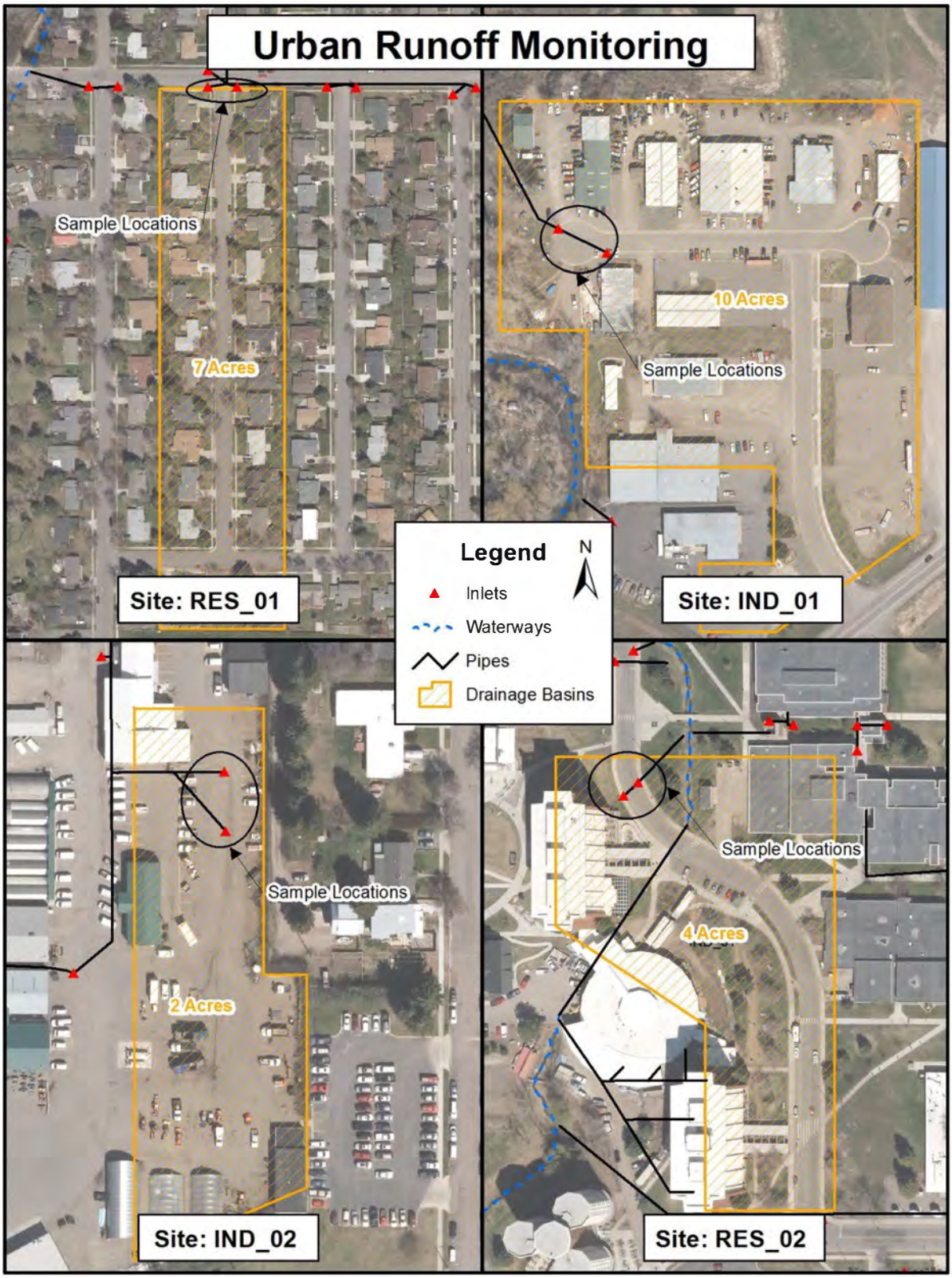
Parameter	2018		2019		2020		2021	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
TSS	0	2	0	2	0	2	-	-
Oil and Grease	3	4	4	4	4	4	-	-
Total Nitrogen	0	3	2	0	0	2	-	-
Phosphorus	0	3	0	2	0	2	-	-
Zinc	0	4	0	0	0	0	-	-
Lead	4	4	4	4	3	4	-	-
Copper	3	4	0	3	0	3	-	-
COD	0	2	0	0	0	0	-	-
PH	4	4	4	4	4	4	-	-
Event Points:	14	30	14	19	11	21	-	-
Annual Points:	44		33		32		-	

Parameter	2018		2019		2020		2021	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
TSS	0	3	0	0	0	3	-	-
Oil and Grease	3	4	4	4	4	4	-	-
Total Nitrogen	0	3	0	0	0	1	-	-
Phosphorus	0	3	0	0	0	3	-	-
Zinc	1	3	2	1	2	3	-	-
Lead	1	4	4	4	4	4	-	-
Copper	2	4	2	2	3	4	-	-
COD	0	2	0	0	0	0	-	-
PH	4	4	4	4	4	4	-	-
Event Points:	11	30	16	15	17	26	-	-
Annual Points:	41		31		43		-	

Parameter	2018		2019		2020		2021	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
TSS	0	1	0	2	0	3	-	-
Oil and Grease	4	4	4	4	4	4	-	-
Total Nitrogen	0	2	4	0	2	3	-	-
Phosphorus	1	3	0	1	1	3	-	-
Zinc	2	3	0	0	1	3	-	-
Lead	4	4	4	4	4	4	-	-
Copper	3	4	0	2	3	4	-	-
COD	0	1	0	0	0	1	-	-
PH	4	1	4	4	4	4	-	-
Event Points:	18	23	16	17	19	29	-	-
Annual Points:	41		33		48		-	

The MS4 sums the individual scores to obtain an Event Point Total, sums both Event Scores to obtain an Annual Point Total, and calculates a Final Score by transferring and summing the Annual Points in the Urban Runoff Monitoring: Results chart. Finally, the MS4 divides the Total Points by the Possible Points to calculate the Final Score and transfers the Final Score to SWMP Section 8.8.

Sites	2018	2019	2020	2021
RES_01 Annual Points	53	39	46	-
IND_01 Annual Points	44	33	32	-
RES_02 Annual Points	41	31	43	-
IND_02 Annual Points	41	33	48	-
Total Points:	179	136	169	-
Possible Points:	288	288	288	288
Final Score (decimal):	.62	.47	.59	-



Graphic 8.4.10: Urban Runoff Monitoring Map

8.5 In-Stream Wet-Weather Monitoring

Introduction: The MS4 conducts In-Stream Wet-Weather Monitoring to analyze the impacts of urban runoff to Bozeman and Mandeville Creeks during wet weather. Combined, the Creeks receive urban runoff from over 1,700 acres of dense development at over 100 individual discharge points or outfalls. Non-point source pollution sources exist upstream of the MS4 as identified in the Lower Gallatin Planning Area TMDL. This approach allows the MS4 to take sole responsibility for and mitigate the impacts stemming from urban runoff.

Sites: The MS4 monitors two (2) locations on Bozeman Creek and two (2) locations on Mandeville Creek. Each Creek has one (1) station upstream and one (1) downstream of the MS4 boundary. Sample sites include:

Site: UPS_01

- Location: Bozeman Creek upstream of MS4, near Kagy Blvd.
- Latitude: 45.657248
- Longitude: -111.028584
- Parameters: TSS, COD, TP, TN, pH, Copper, Lead, Zinc, Oils and Greases, and Flow
- Frequency: Two (2) samples per year

Site: DWS_01

- Location: Bozeman Creek downstream of MS4, near Gold Ave.
- Latitude: 45.699668
- Longitude: -111.027347
- Parameters: TSS, COD, TP, TN, pH, Copper, Lead, Zinc, Oils and Greases, and Flow
- Frequency: Two (2) samples per year

Site: UPS_02

- Location: Mandeville Creek upstream of MS4, near Campus Blvd.
- Latitude: 45.656506
- Longitude: -111.05803
- Parameters: TSS, COD, TP, TN, pH, Copper, Lead, Zinc, Oils and Greases, and Flow
- Frequency: Two (2) samples per year

Site: DWS_02

- Location: Mandeville Creek downstream of MS4, near E. Baxter Ln.
- Latitude: 45.697742
- Longitude: -111.051959
- Parameters: TSS, COD, TP, TN, pH, Copper, Lead, Zinc, Oils and Greases, and Flow
- Frequency: Two (2) samples per year

Methods: The MS4 collects in-stream samples using Thermo-Scientific Nalgene Samplers (Sampler). Before rain events, Staff mounts each Sampler to a metal post driven into the creek bed and positions it to collect a sample as soon as the water levels rise one-half to three-quarters of an inch. The Sampler closes itself and does not allow additional collection or dilution of the original sample once full.

Analysis: The MS4 collects, transfers, packages, and ships samples to a certified laboratory, which analyzes the following parameters:

Total Suspended Solids, mg/L

Chemical Oxygen Demand, mg/L
Total Nitrogen, mg/L
Total Phosphorus, mg/L
Copper, mg/L
Lead, mg/L
Zinc, mg/L
Oils and Greases, mg/L
pH, standard units

The MS4 determines Bozeman Creek's stream-flow using real-time data collected from the Bozeman Creek gaging station. The MS4 estimates flow for Mandeville Creek using historical data collected by Gallatin Local Water Quality District, since no permanent gauging station exists.

Site	TSS mg/L	Oil & Grease mg/L	Total Nitro. mg/L	Phosp. mg/L	Zinc mg/L	Lead mg/L	Copper mg/L	COD mg/L	pH
UPS_01: 2017 (1)	7	5.80 RL	0.41	0.085	0.0054	0.0005	0.0036	11.6	8.2
UPS_01: 2017 (2)	14	1.00 RL	0.50 RL	0.022	0.0100 RL	0.0010 RL	0.0050 RL	15.0	8.1
UPS_01: 2018 (1)	14	1.00 RL	0.50 RL	0.052	0.0100 RL	0.0010 RL	0.0050 RL	10.0	8.1
UPS_01: 2018 (2)	10 RL	1.00 RL	0.60	0.028	0.0090	0.003 RL	0.0020 RL	5.0	8.3
UPS_01: 2019 (1)	30	7.60 RL	2.79	0.147	0.0505	0.0010 RL	0.0017	9.0	7.7
UPS_01: 2019 (2)	72	1.00 RL	1.60	0.160	0.0300	0.0010 RL	0.0050 RL	5.0 RL	8.2
UPS_01: 2020 (1)	74	1.00 RL	0.50 RL	0.260	0.0200	0.0010 RL	0.0050 RL	26.0	8.1
UPS_01: 2020 (2)*	14	1.00	0.50	0.085	0.0100	0.0010	0.0050	10.0	8.1
UPS_01: 2021 (1)	-	-	-	-	-	-	-	-	-
UPS_01: 2021 (2)	-	-	-	-	-	-	-	-	-
UPS_01 Median	14	1.00	0.50	0.085	0.0100	0.0010	0.0050	10.0	8.1
UPS_02: 2017 (1)	-	-	-	-	-	-	-	-	-
UPS_02: 2017 (2)	-	-	-	-	-	-	-	-	-
UPS_02: 2018 (1)	185	1.00 RL	3.10	0.430	0.0330	0.0027	0.0060	49.0	8.2
UPS_02: 2018 (2)	53	1.00 RL	0.50 RL	0.081	0.0180	0.0004	0.0020	16.0	8.1
UPS_02: 2019 (1)	10	6.8 RL	0.74	0.153	0.0422	0.0010 RL	0.0034	6.0	7.9
UPS_02: 2019 (2)	30	1.00 RL	0.80	0.144	0.0300	0.0010 RL	0.0050 RL	5.0	8.1
UPS_02: 2020 (1)	16	1.00 RL	0.80	0.080	0.0100 RL	0.0010 RL	0.0050 RL	11.0	8.3
UPS_02: 2020 (2)	10 RL	1.00 RL	0.60	0.066	0.0200	0.0010 RL	0.0050 RL	5.0	8.4
UPS_02: 2021 (1)	-	-	-	-	-	-	-	-	-
UPS_02: 2021 (2)	-	-	-	-	-	-	-	-	-
UPS_02: Median	23	1.00	0.77	0.113	0.0250	0.0010	0.0050	8.50	8.2
DWS_01: 2017 (1)	10	5.40 RL	0.55	0.088	0.0070	0.0006	0.0036	15.3	8.2
DWS_01: 2017 (2)	134	1.00 RL	1.80	0.264	0.0300	0.0060	0.0060	42.0	8.1
DWS_01: 2018 (1)	34	1.00 RL	0.50 RL	0.082	0.0100 RL	0.0010 RL	0.0005 RL	18.0	8.1
DWS_01: 2018 (2)	17	1.00 RL	0.70	0.057	0.0220	0.0007	0.0002 RL	14.0	8.3
DWS_01: 2019 (1)	100	7.00	3.00	0.238	0.1100	0.0021	0.0045	13.0	7.9
DWS_01: 2019 (2)	350	1.00 RL	3.40	0.645	0.1400	0.0140	0.0210	94.0	8.2
DWS_01: 2020 (1)	58	1.00 RL	0.50 RL	0.141	0.0300	0.0030	0.0050	28.0	8.2
DWS_01: 2020 (2)*	58	1.0	0.70	0.141	0.0300	0.0021	0.0050	18.00	8.2
DWS_01: 2021 (1)	-	-	-	-	-	-	-	-	-
DWS_01: 2021 (2)	-	-	-	-	-	-	-	-	-
DWS_01: Median	58	1.00	0.70	0.141	0.0300	0.0021	0.0050	18.00	8.2
DWS_02: 2017 (1)	-	-	-	-	-	-	-	-	-
DWS_02: 2017 (2)	-	-	-	-	-	-	-	-	-
DWS_02: 2018 (1)	297	1.00 RL	2.80	0.368	0.0700	0.0168	0.0150	53.0	8.2
DWS_02: 2018 (2)	43	1.00 RL	0.80	0.102	0.0280	0.0026	0.0030	18.0	8.2
DWS_02: 2019 (1)	1180	6.80	3.38	1.340	0.1240	0.0222	0.0173	123.0	8.0
DWS_02: 2019 (2)	84	1.00 RL	2.00	0.235	0.0500	0.0040	0.0050 RL	7.0	8.3
DWS_02: 2020 (1)	190	1.00 RL	2.40	0.365	0.0700	0.0100	0.0130	63.0	8.1
DWS_02: 2020 (2)	68	1	2.10	0.191	0.0400	0.0030	0.0080	63.0	8.1
DWS_02: 2021 (1)	-	-	-	-	-	-	-	-	-
DWS_02: 2021 (2)	-	-	-	-	-	-	-	-	-
DWS_02 Median	137	1.00	2.25	0.300	0.0600	0.0070	0.0105	37.00	8.2

* *Unable to obtain sample during the 7/1/2020 - 12/31/2020 timeframe. Additional samples will be collected in 2021, as per MS4 Permit Part IV.6.b. Median concentrations used to calculate 2020 Report Card Grade.*

Evaluation: The MS4 enters data into a local spreadsheet and stores analysis reports for a safe record upon receipt. Further, the MS4 analyzes the data using the following Scoring Matrix (Matrix) and protocol to interpret, evaluate, and communicate the results. The Matrix includes points ranging from 0 to 4-points, which relate to the percent change of pollutants between the upstream and downstream sites.

Example: A percent change of 0-20% equals 4-points, 21-40% equals 3-points, 41-60% equals 2-points, 61-80% equals 1-point, and 81- >100% equals 0-points.

Percent change is determined using the following formula:

$$\% \triangle = ((Y_2 - Y_1) / Y_1) * 100 \qquad \text{Equation 2}$$

For example, TSS: ((200-150)/150) x 100 = 33.3%, resulting in a score of 3-points.

Parameter	4-Points	3-Points	2-Points	1-Point	0-Points
TSS (% △)	(<0) – (20)	(21) – (40)	(41) – (60)	(61) – (80)	(81) – (>100)
Oil/Grease (% △)	(<0) – (20)	(21) – (40)	(41) – (60)	(61) – (80)	(81) – (>100)
Total Nitrogen (% △)	(<0) – (20)	(21) – (40)	(41) – (60)	(61) – (80)	(81) – (>100)
Phosphorus (% △)	(<0) – (20)	(21) – (40)	(41) – (60)	(61) – (80)	(81) – (>100)
Zinc (% △)	(<0) – (20)	(21) – (40)	(41) – (60)	(61) – (80)	(81) – (>100)
Lead (% △)	(<0) – (20)	(21) – (40)	(41) – (60)	(61) – (80)	(81) – (>100)
Copper (% △)	(<0) – (20)	(21) – (40)	(41) – (60)	(61) – (80)	(81) – (>100)
COD (% △)	(<0) – (20)	(21) – (40)	(41) – (60)	(61) – (80)	(81) – (>100)
PH (% △)	(<0) – (20)	(21) – (40)	(41) – (60)	(61) – (80)	(81) – (>100)

The MS4 relates results to the Matrix and then populates the appropriate Urban Runoff Monitoring charts with the corresponding scores.

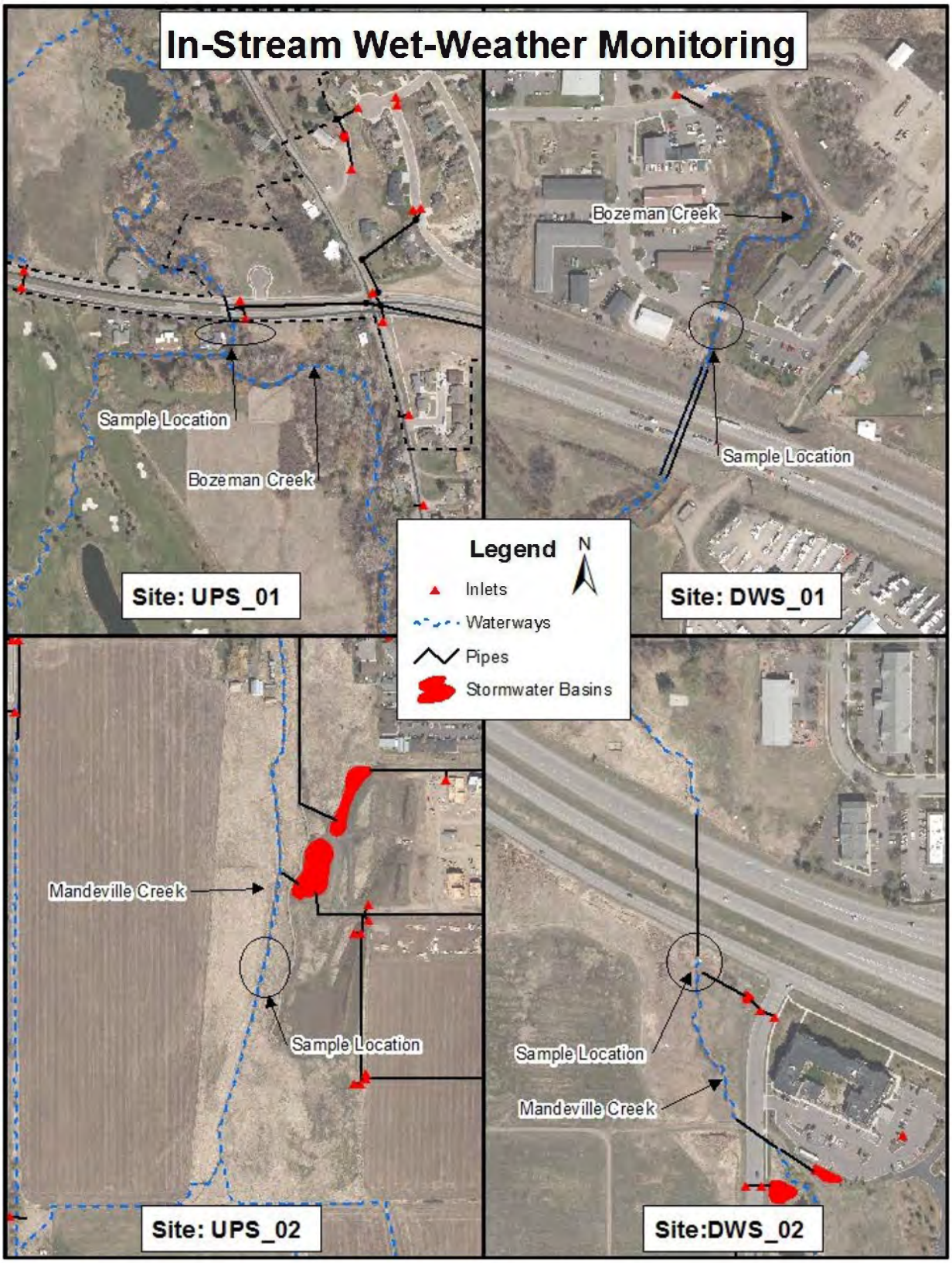
Example: A 2018 Bozeman Creek UPS_01 and DWS_01 TSS percent change equaled 35%. The MS4 assigns and populates the In-Stream Wet-Weather Monitoring: Bozeman Creek UPS_01 and DWS_01 chart TSS box with 3-points. The same approach applies to all sites and parameters.

Parameter	2018		2019		2020		2022	
	Event 1	Event 2	Event 1	Event 2	Event 1	Event 2	Event 1	Event 2
TSS	0	1	0	0	4	0	-	-
Oil and Grease	4	4	4	4	4	4	-	-
Total Nitrogen	4	4	4	0	4	3	-	-
Phosphorus	2	0	1	0	4	1	-	-
Zinc	4	0	0	0	2	0	-	-
Lead	4	0	0	0	0	0	-	-
Copper	4	4	0	0	4	4	-	-
COD	2	0	2	0	4	1	-	-
PH	4	4	4	4	4	4	-	-
Event Points:	28	17	15	8	30	17	-	-
Annual Points:	45		23		47		-	

Parameter	2018		2019		2020		2022	
	Event 1	Event 2	Event 1	Event 2	Event 1	Event 2	Event 1	Event 2
TSS	1	4	0	0	0	0	-	-
Oil and Grease	4	4	4	4	4	4	-	-
Total Nitrogen	4	2	0	0	0	0	-	-
Phosphorus	4	3	0	1	0	0	-	-
Zinc	0	2	0	1	0	0	-	-
Lead	0	0	0	0	0	0	-	-
Copper	0	2	0	0	0	2	-	-
COD	4	4	0	3	0	0	-	-
PH	4	4	4	4	4	4	-	-
Event Points:	21	25	8	13	8	10	-	-
Annual Points:	46		21		18		-	

The MS4 sums the individual scores to obtain an Event Point Total, sums both Event Scores to obtain an Annual Point Total, and calculates a Final Score by transferring and summing the Annual Points in the In-Stream Wet-Weather Monitoring: Results chart. Finally, the MS4 divides the Total Points by the Possible Points. The MS4 transfers the Final Score to SWMP Section 8.8.

Parameter	2018	2019	2021	2022
Bozeman Creek Annual Points	45	23	47	-
Mandeville Creek Annual Points	46	21	18	-
Total Points:	91	44	65	-
Possible Points:	144	144	144	144
Final Score (decimal):	.63	.31	.45	-



Graphic 8.5.6: In-Stream Wet-Weather Monitoring Map

8.6 Sediment Reduction Monitoring

Introduction: The MS4 conducts Sediment Reduction Monitoring to comply with the Montana DEQ's sediment load reduction requirements detailed in the 2013 Lower Gallatin Planning Area TMDL. The MS4 tracks tons captured in BMPs detailed in SWMP Section 2.3 and SWMP Section 2.4.

Sediment Source	Estimated Load	Waste Load Allocation	Required Load Reduction	Load Reduction
MS4	218 tons/year	137 tons/year	37%	81 tons/year **DEQ Imposed**

Sediment Source	Estimated Load	Waste Load Allocation	Required Load Reduction	Load Reduction
MS4	None	None	None	10 tons/year **Self Imposed**

Sites: Stormwater treatment units described in SWMP Section 2.5.

Methods: Measurement process described in SWMP Section 2.5.

Analysis: The MS4 analyzes the following parameter:

- Total Sediment Captured (tons)

Evaluation: The MS4 enters data into a local spreadsheet for safe record upon receipt. Further, the MS4 incorporates the data into the following Scoring Matrix (Matrix) to interpret, evaluate, and communicate the results. The Matrix includes scores ranging from 0 to 4-points, which relate to total annual sediment capture. For example, a load reduction for Bozeman Creek of ≥ 81 tons equals 4-points, 60 – 80 tons equals 3-points, 40 – 59 tons equals 2-points, 20 – 39 tons equals 1-point, and 0 – 19 equals 0-points.

Parameter	4-Points	3-Points	2-Points	1-Point	0-Points
Sediment Captured (tons)	≥81	60 – 80	40 – 59	20 – 39	0 – 19

Parameter	4-Points	3-Points	2-Points	1-Point	0-Points
Sediment Captured (tons)	≥10	7.5 – 9.9	5.0 – 7.4	2.5 – 4.9	0 – 2.4

Results: The MS4 relates results to the Matrix and then populate the Sediment Reduction Monitoring: Results chart with the corresponding scores. The MS4 weighs Bozeman Creek more heavily than Mandeville Creek because of DEQ's imposed reduction requirements.

- 2018 Totals:

  Bozeman Creek: 45.7 tons
  Mandeville Creek: 1.0 tons

- 2019 Totals:

  Bozeman Creek: 44.8 tons
  Mandeville Creek: 5.8 tons

- 2020 Totals:

  Bozeman Creek: 41 tons
  Mandeville Creek: 8 tons

The MS4 calculates a Final Score by summing the weighted Annual Points in the Sediment Reduction Monitoring: Results chart and dividing by the Possible Points to calculate the Final Score. Finally, the MS4 transfers the Final Score to SWMP Section 8.8.

Waterway	2018	2019	2021	2022
Bozeman Creek Annual Points	(2) x (1.5) = 3	(2) x (1.5) = 3	(2) x (1.5) = 3	-
Mandeville Creek Annual Points	(0) x (.5) = 0	(2) x (.5) = 1	(3)x (.5) = 1.5	-
Total Points:	3	4	4.5	-
Possible Points:	8	8	8	8
Final Score (decimal):	0.38	0.50	0.56	-

8.7 Long-Term Trend Monitoring

Introduction: Aquatic macroinvertebrate assemblages respond predictably to sedimentation by shifting from sediment-intolerant to sediment-tolerant taxa. Changes in macroinvertebrate assemblages are quantified using the Observed:Expected (O:E) ratio biological index model, which compares the observed taxa at a site with the expected taxa that would be present at a site under a variety of environmental conditions. Using the percent difference in O:E ratios between upstream and downstream sites the MS4 is able to assess stormwater discharge impacts to macroinvertebrate assemblages. A positive percent difference in O:E ratios indicate that stormwater discharges are not negatively impacting macroinvertebrate community assemblages. Conversely, negative percent differences in O:E ratios indicate that stormwater discharges are negatively impacting macroinvertebrate community assemblies. Sedimentation affects macroinvertebrates community assemblages by:

- Filling interstitial voids in gravel substrate
- Reducing gravel attachment sites
- Altering stream morphology
- Increasing stream temperature

Sites: The MS4 monitors benthic macroinvertebrates on Bozeman and Mandeville Creeks at the In-Stream Wet-Weather Monitoring Sites (SWMP Section 8.5).

Methods: The MS4 derives macroinvertebrate biological index monitoring protocols from MDEQ Sample Collection, Sorting, and Taxonomic Identification of Benthic Macroinvertebrate Communities Standard Operating Procedures (*one sample taken per location per year*).

Analysis: The MS4 collects and preserves macroinvertebrate samples and then delivers to an accredited lab, which completes the analysis of the following parameters:

- Taxonomic Sorting and Identification
- Species Abundance
- Species Diversity
- Observed / Expected Ratios
- Percentage of Sediment Tolerant Species

Upon receiving macroinvertebrate analysis results, the MS4 enters the calculated O:E ratios in the table below and then calculates the percent change between upstream and downstream sites.

Year	O:E Ratio: UPS_01	O:E Ratio: DWS_01	O:E Ratio (% △)
2018	0.20	0.37	+85%
2019	0.33	0.20	-39%
2020	0.29	0.33	+14%
2021	-	-	-

Year	O:E Ratio: UPS_02	O:E Ratio: DWS_02	O:E Ratio (% △)
2018	0.29	0.16	-45%
2019	0.29	0.25	-14%
2020	0.12	0.20	+67%
2021	-	-	-

Evaluation: The MS4 enters data into a local spreadsheet and stores analysis reports for a safe record upon receipt. Further, the MS4 analyzes the data using the following Scoring Matrix and protocol to interpret, evaluate, and communicate the results. The Scoring Matrix includes scores from 0 to 4-points, which relate to percent change in O:E ratios between the upstream and downstream sites for each creek.

Example: An O:E ratio percent change of 0-(-20%) equals 4-points,- 21-(-40%) equals 3-points,- 41-(-60%) equals 2- points, -61-(-80%) equals 1-point, and >-80% equals 0-points.

Percent change is determined using *Equation 2* found in SWMP Section 8.3.

Example: An upstream Bozeman Creek sample has an O:E ratio of 1.1, and the downstream sample has an O:E ratio of 0.8. The MS4 finds the difference and divides by the original to arrive at a percentage ((0.8 - 1.1)/1.1) x 100 = -30%, resulting in a score of 3-points.

O:E Ratio	4-Points	3-Points	2-Points	1-Point	0-Points
O:E Ratio (% △)	>0 – (-20)	-21 – (-40)	-41 – (-60)	-61 – (-80)	-81 – (-100)

The MS4 relates results to the Matrix and then populates the Long-Term Trend Monitoring: Results chart with the corresponding scores, and calculates a Final Score by summing the Event Points in the Long-Term Trend Monitoring: Results chart and dividing by the Possible Points. Finally, the MS4 transfers the Final Score to SWMP Section 8.8.

Waterway	2018	2019	2020	2021
Bozeman Creek Event Points	4	3	4	-
Mandeville Creek Event Points	2	4	4	-
Total Points:	6	7	8	-
Possible Points:	8	8	8	-
Final Score (decimal):	.75	0.88	1.0	-

8.8 Evaluation

The MS4 calculates a Final Grade to determine the overall effectiveness of its programs and initiatives detailed in SWMP Section 1.0 to 7.0 by transferring scores from each protocol (SWMP Sections 8.4 - 8.7) to the Programmatic Evaluation: Final Points chart, and utilizes a weighted sum calculation to make the four scores comparable.

Evaluation Type	Final Scores	Weight	Weighted Total	Weighted Total (%)
Urban Runoff Monitoring	.62	.25	.155	15.5%
In-Stream Wet-Weather Monitoring	.63	.25	.16	16.0%
Sediment Reduction Monitoring	.38	.25	.10	10.0%
Stream Health Monitoring	.75	.25	.19	19.0%
			Final Weighted Total (%):	60.5%

Evaluation Type	Final Scores	Weight	Weighted Total	Weighted Total (%)
Urban Runoff Monitoring	0.47	.25	0.1175	11.75%
In-Stream Wet-Weather Monitoring	0.31	.25	0.0775	7.75%
Sediment Reduction Monitoring	0.50	.25	0.1250	12.50%
Stream Health Monitoring	0.88	.25	0.2200	22.00%
			Final Weighted Total (%):	54.0%

Evaluation Type	Final Scores	Weight	Weighted Total	Weighted Total (%)
Urban Runoff Monitoring	0.59	.25	0.1475	14.75%
In-Stream Wet-Weather Monitoring	*0.45	.25	*0.1125	11.25%
Sediment Reduction Monitoring	0.56	.25	0.1400	14.00%
Stream Health Monitoring	1.0	.25	0.25	25.00%
			Final Weighted Total (%):	65.0%

Evaluation Type	Final Scores	Weight	Weighted Total	Weighted Total (%)
Urban Runoff Monitoring	-	.25	-	-
In-Stream Wet-Weather Monitoring	-	.25	-	-
Sediment Reduction Monitoring	-	.25	-	-
Stream Health Monitoring	-	.25	-	-
			Final Weighted Total (%):	-

The MS4 relates the Final Weighted Total (%) to the following equally distributed ranges (100-percent scale) and their associated Final Grades, and populates the Stormwater Report Card with a Final Grade for the corresponding year.

Table 8.8.5: Grading Matrix

Grade	A	B	C	D	F
Score (%)	90 - 100%	80 - 89%	70 - 79%	60 - 69%	0 - 59%

Table 8.8.6: Stormwater Report Card

2018 Final Grade	2019 Final Grade	2020 Final Grade	2021 Final Grade
D	**F**	**D**	**-**
61%	**54%**	**65%**	

The MS4 utilizes its empirical knowledge, performance measures, and data to continually evaluate and optimize its programmatic workloads detailed in this SWMP. Also, the MS4 compares its Final Grades to the criteria below and, as necessary, works to implement the following improvement strategies:

1. Grade = A: No stormwater impact on receiving waters, allowing for a continuation of administrative programs and reduction of TMDL Action Plan investment to maintain grade.
2. Grade = B: Low stormwater impact to receiving waters, requiring continuation of administrative programs and TMDL Action Plan investment to increase grade.
3. Grade = C: Moderate stormwater impact on receiving waters, requiring an expansion of administrative programs and continuation of TMDL Action Plan investment to increase grade.
4. Grade = D: Significant stormwater impact on receiving waters, requiring an expansion of administrative programs and TMDL Action Plan investment to increase grade.
5. Grade = F: Major stormwater impact on receiving waters, reassessment of administrative programs and TMDL Action Plan investment strategy required.

8.9 Discussion

1. 2017 Result: The MS4 did not document sampling efforts using the scoring matrices described above because Staff had not developed the evaluation. Implementation begins with the first sampling event of 2018.

   Preliminary analysis of available 2017 data indicates that the developed evaluation methodology is effective at tracking program performance, and likely would have resulted in an F. The MS4 expects a positive trend over the MS4 Permit Term as Staff implements the content of this SWMP.

2. 2018 Results: The MS4 received a Stormater River Impact Report Card grade of D. The MS4 has analyzed data, compiled point scores, and developed strategies to improve its grade for 2019, including:

   - <u>Residential Urban Runoff Monitoring</u>

- Problem Statement: Residential urban areas generally yield TSS, total nitrogen, phosphorus, and COD levels that result in suboptimal point scores. Conversely, oil, grease, zinc, lead, and copper concentrations generally result in satisfactory levels.
- Hypothesis: Grass clippings are primarily responsible for elevated levels of TSS, total nitrogen, phosphorus, and COD.
- Rationale: Elevated pollutant levels coincide directly with the growing season, providing justification for the MS4's hypothesis. Fall samples traditionally yield optimal point scores due to growing season subsidence. Organic matter in stormwater runoff:
    - Increases TSS concentrations
    - Increases total nitrogen and phosphorus via decomposition
    - Increases COD via organic matter decomposition
- Action Plan: Increase outreach and education program described in SWMP Section 3.0 and complete capital projects described in SWMP Section 2.3.

➢ <u>Industrial Urban Runoff Monitoring</u>

- Problem Statement: Industrial urban areas generally yield TSS, total nitrogen, phosphorus, zinc, lead, copper, and COD levels that result in suboptimal point scores. Conversely, oil and grease concentrations generally result in satisfactory levels.
- Hypothesis: Gravel parking lots, outdoor equipment storage, and heavy commercial traffic are primarily responsible for elevated levels of TSS, total nitrogen, phosphorus, zinc, copper, lead, and COD.
- Rationale: The MS4 documented these pollutant generating activities and site conditions at both industrial monitoring areas, resulting in:
    - Increased offsite TSS migration (TSS adsorbs and transports pollutants)
    - Increased nutrient levels originating from erosive landscapes
    - Increased metal levels from corrosion, combustion, and brake-dust
    - Increase COD levels via organic and inorganic particle decomposition
- Action Plan: Enforce development regulations described in SWMP Section 6.0, construct capital projects described in SWMP Section 2.3, maintain good housekeeping performance levels described in SWMP Section 7.0, and implement the outreach and education program described in SWMP Section 3.0.

➢ <u>Instream Wet-Weather Monitoring</u>

- Problem Statement: Instream wet-weather samples generally yield TSS, total nitrogen, phosphorus, zinc, lead, copper, and COD levels that result in suboptimal point scores. Conversely, oil and grease concentrations generally result in satisfactory levels.
- Hypothesis: Stormwater discharges from urban areas with a direct connection to aquatic systems negatively affect instream water quality.
- Rationale: Documented increases in pollutant levels between all upstream and downstream instream-monitoring locations, resulting from developments constructed pre-1980 lacking on-site stormwater treatment.
- Action Plan: Enforce development regulations described in SWMP Section 6.0, construct capital projects described in SWMP Section 2.3 and implement administrative programs described in SWMP Sections 3.0, 4.0, 5.0, 6.0, and 7.0.

- Sediment Reduction Monitoring
    - Problem Statement: Remove 81 tons/year of sediment from stormwater discharges to Bozeman Creek and 10 tons/year to Mandeville Creek.
    - Hypothesis: Achieve MDEQ and self-imposed sediment reduction requirements by 2023.
    - Rationale: Quantified sediment removal totals by treatment units as detailed in SWMP Section 2.5 and calculated sediment-loading totals of 0.14 tons/acre.
    - Action Plan: Continue TMDL Action Plan described in SWMP Section 2.2, construct capital projects described in SWMP Section 2.3, and maintain utility operations goals described in SWMP Section 7.0.
- Long-Term Trend Monitoring
    - Problem Statement: Macroinvertebrate O:E ratios decreased in Mandeville Creek, resulting in suboptimal point scores. Conversely, macroinvertebrate O:E ratios increased in Bozeman Creek, resulting in optimal point scores.
    - Hypothesis: Physical habitat characteristics and stream origination points impact macroinvertebrate O:E ratios in addition to stormwater discharges.
    - Rationale:
        - 85% improvement in Bozeman Creek O:E ratios between upstream and downstream sites.
        - 45% reduction in Mandeville Creek O:E ratios between upstream and downstream sites.
    - Action Plan: Continue TMDL Action Plan described in SWMP Section 2.2, construct capital projects described in SWMP Section 2.3, maintain utility operation goals described in SWMP Section 7.0, and implement administrative programs described in SWMP Sections 3.0, 4.0, 5.0, 6.0, and 7.0.

3. 2019 Results: The MS4 received a grade of F (54.0%), which is 6.5% lower than the 2018 grade. Various factors influenced this score and are further described below:
    - Residential Urban Runoff Monitoring
        - Analysis:
            - Spring Samples: Collected on April 20, 2019. Record 2019 snowfall resulted in increased traction sand application and delayed street sweeping cycles, yielding pollutant concentrations above long-term medians for TSS, Oil and Grease, Total Nitrogen, Total Phosphorous, Zinc, Lead, Copper, and COD.
            - Fall Samples: Collected on August 22, 2019. Reoccurring street sweeping and implementation of SWMP programs resulted in a reduction in the number of pollutants exceeding long-term medians. Total Nitrogen, Total Phosphorus, Zinc, and COD concentrations were above the long-term medians, likely resulting from organics, such as grass clippings.
        - Action Plan: Increase outreach and education programs described in SWMP Section 3.0, maintain good housekeeping performance levels described in SWMP Section 7.0, and complete capital projects described in SWMP Section 2.3.
    - Industrial Urban Runoff Monitoring

- Analysis:
  - ❖ Spring Samples: Collected on April 20, 2019. Record 2019 snowfall resulted in increased traction sand application and delayed street sweeping cycles, yielding pollutant concentrations above long-term medians for TSS, Oils and Grease, Total Phosphorous, Zinc, Lead, Copper, and COD.
  - ❖ Fall Samples: Collected on August 22, 2019. Reoccurring street sweeping and implementation of SWMP programs resulted in a reduction of the number of pollutants exceeding long-term medians. Total Nitrogen, Zinc, Lead, Copper, and COD concentrations were above the long-term medians, resulting from heavy commercial traffic, equipment storage, and historical development practices.
- Action Plan: Enforce development regulations described in SWMP Section 6.0, construct capital projects described in SWMP Section 2.3, maintain good housekeeping performance levels described in SWMP Section 7.0, and implement the outreach and education program described in SWMP Section 3.0.

➢ <u>Instream Wet-Weather Monitoring</u>

- Analysis:
  - ❖ Spring Samples: Collected on June 13, 2019 during a non-typical high intensity and short duration storm (greater than 1" per hour) that resulted in suboptimal percent change scores for TSS, Total Nitrogen, Total Phosphorous, Zinc, Lead, Copper, and COD. Bozeman Creek flow at the time of collection was 63 cfs (221 cfs max daily flow). Non-typical storms result in increased erosion and mobilization of pollutants.
  - ❖ Fall Samples: Collected on September 6, 2019 during low base-flow conditions that resulted in suboptimal percent change scores for TSS, Total Nitrogen, Total Phosphorous, Zinc, Lead, Copper, and COD. Bozeman Creek flow at the time of collection was 27 cfs (38 cfs max daily flow).
- Action Plan: Enforce development regulations described in SWMP Section 6.0, construct capital projects described in SWMP Section 2.3, and implement administrative programs described in SWMP Sections 3.0, 4.0, 5.0, 6.0, and 7.0.

➢ <u>Sediment Reduction Monitoring</u>

- Analysis: Sediment loading within the various treated urban basins averaged .13 tons/acre, .01 tons/acre less than the previous year. Sediment collection totals increased from 46.7 in 2018 to 50.6 tons in 2019. The MS4 installed five new treatment structures in 2019, resulting in increased sediment collection totals.
- Action Plan: Continue TMDL Action Plan described in SWMP Section 2.2, construct capital projects described in SWMP Section 2.3, and maintain utility operations goals described in SWMP Section 7.0.

➢ <u>Long-Term Trend Monitoring</u>

- Analysis: Data showed a 39% decrease in Bozeman Creek and a 14% decrease in Mandeville Creek O:E ratios. Bozeman Creek's macroinvertebrate community did not show an improvement based on the prior year's data. Mandeville Creek's macroinvertebrate community did improve based on the prior year's data. More

sampling events are required to show a trend in this data set, as two data points for each location are not adequate to assess stream health. O:E ratios for both Creek's upstream sample locations are well below the reference streams benchmark and appear to be impacted by other pollution sources originating outside of MS4 limits.

- Action Plan: Continue TMDL Action Plan described in SWMP Section 2.2, construct capital projects described in SWMP Section 2.3, maintain utility operation goals described in SWMP Section 7.0, and implement administrative programs described in SWMP Sections 3.0, 4.0, 5.0, 6.0, and 7.0.

4. 2020 Results: The MS4 received a grade of D (65%), which is 11% higher than the 2019 grade, 4% higher than the 2018 grade, and the highest score recorded to date. The increase in the score may suggest the various structural and administrative BMPs implementd in this SWMP are having a positive impact, providing justification to contiue its planned efforts. Various factors influenced this score and are further described below:

   - <u>Residential Urban Runoff Monitoring</u>
     - Analysis:
       - Spring Samples: Collected on June 24, 2020. A high intensity-short duration storm event and an abundance of grass clippings in the RES_01 sample yielded pollutant concentrations above long-term medians for TSS, Oils and Greases, Total Nitrogen, Total Phosphorous, Zinc, Lead, Copper, and COD. TSS concentration was 700% above it long-term median, likely a result of grass clippings. The RES_02 sample yielded pollutant concentrations above long-term medians for TSS, Total Nitrogen, Total Phosphorus, Zinc, and Lead. Oils and Greases, Copper, and COD concentrations were below long-term medians. High intensity - short duration storm events are known to have increased pollutant concentrations in the first flush of runoff.
       - Fall Samples: Collected on October 13, 2020. Reoccurring street sweeping and implementation of SWMP programs resulted in pollutant concentration below the long-term median for all parameters, except for COD (RES_01), which was 16.9% above the long-term median.
     - Action Plan: Increase outreach and education programs described in SWMP Section 3.0, maintain good housekeeping performance levels described in SWMP Section 7.0, and complete capital projects described in SWMP Section 2.3.
   - <u>Industrial Urban Runoff Monitoring</u>
     - Analysis:
       - Spring Samples: Collected on June 24, 2020. Gravel parking lots, metal buildings, lack of street sweeping, observed outdoor industrial operations and storage, and a high intensity – short duration storm event yielded pollutant concentrations above long-term medians for TSS, Total Nitrogen, Total Phosphorous, Zinc, Lead, Copper, and COD at IND_01. Oils and Greases concentration at IND_01 were below long-term median concentrations. IND_02 results yield pollutant concentrations above long-term medians for TSS, Total Nitrogen, Zinc, Lead, Copper, and COD, likely due to storm event characteristics and the surrounding industrial land use. Oils and Greases and

Total Phosphorus concentrations were below their long-term medians at IND_02.

- ❖ Fall Samples: Collected on October 13, 2020. Zinc was the only pollutant to exceed its long-term median at IND_01. Elevated levels of Zinc may be the result from surrounding metal buildings, lack of street sweeping, and observed outdoor industrial operations and storage. IND_01 TSS, Oils and Greases, Total Nitrogen, Total Phosphorus, Lead, Copper, and COD concentrations were all below long-term median concentrations, possibly because of the low intensity nature of the storm event sampled. Pollutant concentrations for all parameters at IND_02 were below long-term medians.

- o Action Plan: Enforce development regulations described in SWMP Section 6.0, construct capital projects described in SWMP Section 2.3, maintain good housekeeping performance levels described in SWMP Section 7.0, and implement the outreach and education program described in SWMP Section 3.0.

➢ <u>Instream Wet-Weather Monitoring</u>

- o Analysis:
  - ❖ Spring Samples: Collected on June 28, 2020 during a high intensity - short duration storm that resulted in suboptimal percent change scores for only Zinc and Lead. Bozeman Creek flow at the time of collection was 48 cfs (54 cfs max daily flow). Minimal impacts to Bozeman Creek resulting from stormwater discharges. On Mandeville Creek, the sampling event led to suboptimal point scores for all parameters except for Oils and Greases and pH. Stormwater discharges had significant impacts to Mandeville Creek.
  - ❖ Fall Samples: The MS4 was unable to collect a fall sample from UPS_01/DWS_01 due to sampling equipment malfunction at UPS_01. The long-term medians for both UPS_01 and DWS_01 were used to calculate the point score. A substitute sample will be collected as per General Permit Sec. IV.6.b. Sampling results, point score, and Report Card grade will be updated upon analysis of the substitute sample. On Mandeville Creek, the sampling event led to suboptimal point scores for all parameters except for Oils and Greases and pH. Stormwater discharges had significant impacts to Mandeville Creek.
- o Action Plan: Collect UPS_01/DWS_01 substitute samples, enforce development regulations described in SWMP Section 6.0, construct capital projects described in SWMP Section 2.3, and implement administrative programs described in SWMP Sections 3.0, 4.0, 5.0, 6.0, and 7.0.

➢ <u>Sediment Reduction Monitoring</u>

- o Analysis: Sediment loading within the various treated urban basins averaged .09 tons/acre, .04 tons/acre less than the previous year. Sediment collection totals increased from 50.6 in 2019 to 54.6 tons in 2020. The MS4 installed eight new treatment structures in 2020, however the new structures' sediment capture totals are not included due to the timing of installation.

- Action Plan: Continue TMDL Action Plan described in SWMP Section 2.2, construct capital projects described in SWMP Section 2.3, and maintain utility operations goals described in SWMP Section 7.0.

- Long-Term Trend Monitoring

  - Analysis: Data showed a 14% increase in Bozeman Creek and a 67% increase in Mandeville Creek O:E ratios. Bozeman Creek's macroinvertebrate community showed a 53% improvement based on the prior year's data. Mandeville Creek's macroinvertebrate community showed an 81% improvement based on the prior year's data. More sampling events are required to show a trend in this data set, as three data points for each location are not adequate to assess stream health. O:E ratios for both Creek's upstream sample locations are well below the reference streams benchmark and appear to be impacted by other pollution sources originating outside of the MS4.
  - Action Plan: Continue TMDL Action Plan described in SWMP Section 2.2, construct capital projects described in SWMP Section 2.3, maintain utility operation goals described in SWMP Section 7.0, and implement administrative programs described in SWMP Sections 3.0, 4.0, 5.0, 6.0, and 7.0.

Section 9.0

Stormwater Management Plan Updates



Graphic: 9.0.1: Permeable Paver Walkway



Graphic 9.0.2: Boulevard Infiltration Gallery

Blank Page

9.1 Introduction

The MS4 updates the information in this SWMP annually, and tracks change specific to each section. This SWMP requires changes to meet operation and policy adjustments that occur in local government.

9.2 Program Administration (SWMP Section 1.0)

January/February 2020:

- Section 1.1: Updated and simplified MS4 objective language.
- Section 1.2: Completed minor grammar updates.
- Section 1.3: Removed ERU total of "$3.23" as the fee changes annually with rate increases.
- Section 1.3: Updated the description of the utility rate model workflow to improve clarity.
- Section 1.3: Updated the 2019 total impervious area and total site plan performance measure.
- Section 1.3: Added the FY20 Approved Budget information.
- Section 1.3: Added Graphic 1.3.1 to show budget and staffing changes over time.
- Section 1.4: Updated project information and staff hours, added FY20 Budget information.
- Section 1.5: Added new Stormwater Infrastructure Specialist, clarified organizational structure, added SWMP Support Divisions, removed future positions, and changed meeting frequencies.
- Section 1.5: Updated Graphic 1.5.1.
- Section 1.5: Updated Graphic 1.5.2 to include 2019 numbers, recalculated totals.
- Section 1.6: Added mechanical separation unit, added responsibilities related to the Post Construction Program.
- Section 1.7: Updated Gallatin Watershed Council's name.
- Section 1.10: Updated 2019 and 2020 SWMP advertisement dates, and added public comments.

January/February 2021:

- Sections 1.1-1.10: Streamlined sections, removed excess language, reformatted duplicate information into charts, and corrected grammatical errors.
- Section 1.1: Added puctuation and removed language referencing "Master Plan".
- Section 1.2: Completed minor grammar updates and clarified language.
- Section 1.2: Removed language regarding an MOU requirement between the City and MSU.
- Section 1.3: Updated the 20 total impervious area and total site plan performance measure.
- Section 1.3: Added the FY21 Approved Budget information.
- Section 1.3: Updated Graphic 1.3.1 and 1.3.2.
- Section 1.3: Added Graphics 1.3.3 -1.3.6.
- Section 1.3: Removed excess language, clarified content, and reformatted.
- Section 1.4: Added the FY21 Approved Budget information.
- Section 1.4: Removed excess language, clarified content, and reformatted.
- Section 1.5: Updated and clarified language for all positions.
- Section 1.5: Updated Graphic 1.5.1 to include 2020 numbers, recalculated totals.
- Section 1.6: Completed minor language edits.
- Section 1.7: Updated section title and completed wording edits.
- Section 1.8: Removed two permit references.
- Section 1.10: Updated 2021 SWMP advertisement dates, and updated Graphic 1.10.1.

9.3 Capital Project Program (SWMP Section 2.0)

January/February 2020:

- Section 2.1: Removed language related to specialized equipment, updated subprogram goals

- Section 2.2: Added “over” before $650,000 and updated vitrified clay pipe total
- Section 2.2: Completed numerous grammar updates
- Section 2.3: Updated performance metrics, clarified some language, relocated completed projects and added new projects
- Section 2.4: Updated Ongoing and Completed projects, clarified some names and categories
- Section 2.4.2 and 2.4.3: Updated graphics
- Section 2.5: Updated pollutant reduction totals
- Section 2.6: Updated performance measures

January/February 2021:

- Sections 2.1-2.6: Streamlined sections, removed excess language, reformatted duplicate information into charts, and corrected grammatical errors.
- Section 2.2: Revised the Total Maximum Daily Load Action Plan.
- Section 2.3: Updated performance metrics and projects.
- Section 2.4: Updated projects and graphics, and clarified some names and categories.
- Section 2.5: Updated pollutant reduction totals.
- Section 2.6: Updated performance measures.

9.3 Public Education Program (SWMP Section 3.0)

January/February 2020:

- Section 3.2: Clarified language under passive and active engagement sections
- Section 3.3: Updated group to include MSU Students
- Section 3.4: Clarified existing activities, added new activities, updated performance measures, added tasks, goal, and notes for each item per year
- Section 3.5: Removed Adopt A Rain Garden and moved it into the ongoing initiatives section

January/February 2021:

- Sections 3.1-3.4: Streamlined sections, removed excess language, reformatted duplicate information into charts, and corrected grammatical errors.
- Section 3.3: Improved formatting.
- Section 3.4: Updated intiative information.

9.4 Illicit Discharge Detection and Elimination Program (SWMP Section 4.0)

January/February 2020:

- Section 4.4: Added 2019 events and updated Graphics 4.4.1 and 4.4.2
- Section 4.6: Updated total outfall numbers per each waterway, updated high priority outfall information and 2019 inspection results, and updated 2019 ORI inspection totals
- Section 4.7: Added 2019 infrastructure totals and updated Graphic 4.7.1

January/February 2021:

- Sections 4.1-4.8: Streamlined sections, removed excess language, reformatted duplicate information into charts, and corrected grammatical errors.
- Section 4.3: Changed Response Protocol to Corrective Action Plan. Expanded and added detail to contained sections to provide additional detail regarding the MS4’s process.
- Section 4.4: Improved language related to the MS4’s Enforcement Response Plan.
- Section 4.5: Added 2020 events and updated Graphics

- Section 4.6: Updated controls for hot tub and pool discharge and remove construction dewatering, which is covered under SWMP Section 5.0.
- Section 4.7: Updated graphics provided more information regarding the MS4's ORI Inspection Plan, and updated high-priority outfall inspection information.
- Section 4.8: Updated storm sewer infrastructure totals.

9.5 Construction Site Management Program (SWMP Section 5.0)

January/February 2020:

- Section 5.1: Updated #3 to include the mention of inspection
- Section 5.3: Added final occupancy and infrastructure approval section
- Section 5.3: Added 2019 totals and updated Graphic 5.3.1
- Section 5.4: Added 2019 performance totals and audit results, updated Graphic 5.4.1
- Section 5.5: Removed timeline for item #1

January/February 2021:

- Sections 5.1-5.8: Streamlined sections, removed excess language, reformatted duplicate information into charts, and corrected grammatical errors.
- Section 5.3: Updated to be specific to the MS4's permitting program and account for operational changes made during 2020.
- Section 5.4: Added section to better aling with the requirments of the MS4 Permit, including a flow chart and description of the MS4's enforcement process.
- Section 5.5: Added section to include more detailed information regarding high-priority sites and rain events, added 2020 totals, reformatted tables, and updated Graphic.
- Section 5.6: Added 2020 performance totals and audit results and updated the chart.
- Section 5.8: Updated document names.

9.6 Post-Construction Program (SWMP Section 6.0)

January/February 2020:

- Section 6.3: Updated Graphic 6.3.1
- Section 6.4: Added 2019 performance totals, updated Graphic 6.4.1, added 2019 audit results, and updated Graphic 6.4.2

January/February 2021:

- Sections 6.1-6.9: Streamlined sections, removed excess language, reformatted duplicate information into charts, and corrected grammatical errors.
- Sections 6.1-6.9: Revised the entire section to account for programmatic changes and improve alignment with the MS4 Permit.

9.7 Good Housekeeping Program (SWMP Section 7.0)

January/February 2020:

- Section 7.2: Clarified language and added 2019 performance totals
- Section 7.3: Clarified Facility Minimum Standards, updated Facility Stormwater Pollution Prevention Plan protocols, updated Graphic 7.3.1, updated completion performance metric, and removed performance metric related to standard violations

- Section 7.4: Clarified Activity Minimum Standards, updated Activity Stormwater Pollution Prevention Plan protocols, updated completion performance metric, and removed performance metric related to standard violations
- Section 7.5: Updated 2019 training activities and totals

January/February 2021:

- Sections 7.1-7.5: Streamlined section, removed excess language, reformatted duplicate information into charts, and corrected grammatical errors.
- Section 7.2: Adjusted infrastructure maintenance frequencies and updated performance totals.
- Section 7.3: Modified Facility Minimum Standards, updated Facility Stormwater Pollution Prevention Plan protocols, added tables and updated map, and removed performance metric.
- Section 7.4: Modified Activity Minimum Standards, updated Activity Stormwater Pollution Prevention Plan protocols, and removed completion performance metric.
- Section 7.5: Developed training section to include tables and updated strategies, updated participation numbers, and updated training events.

9.8 Sampling and Evaluation Program (SWMP Section 8.0)

January/February 2020:

- Section 8.4: Added 2019 raw data and updated point scores
- Section 8.5: Added 2019 raw data and updated point scores
- Section 8.6: Added 2019 raw data and updated point scores
- Section 8.7: Added 2019 raw data and updated point scores
- Section 8.8: Calculated 2019 score and updated Graphic 8.8.5
- Section 8.9: Added 2019 Results

January/February 2021:

- Sections 8.1-8.9: Streamlined section, removed excess language, reformatted duplicate information into charts, and corrected grammatical errors.
- Section 8.4: Added 2020 raw data and updated point scores.
- Section 8.5: Added 2020 raw data and updated point scores.
- Section 8.6: Added 2020 raw data and updated point scores.
- Section 8.7: Added 2020 raw data and updated point scores.
- Section 8.8: Calculated 2020 score and updated Graphic 8.8.5.
- Section 8.9: Added 2020 Results.

2020 Post-Construction Facility Inventory

ID	FacilityID	Owner Name	Receiving Water Body	Last Inspection Year	Latitude	Longitude	BMP Type	Install Date
			2021					
769	DP.G08.00051	HOA - Allison Sub	Figgins Creek		-111.0491178	45.6530823	Surface Detention Facility	1/19/2021
768	DP.G08.00050	HOA - Allison Sub	Figgins Creek		-111.047265	45.65536616	Surface Detention Facility	1/19/2021
			2020					
767	DP.I01.00066	Private - Town Pump	N/A		-111.0671383	45.70610093	Surface Retention Facility	11/4/2020
766	DP.L02.00010	Private	N/A		-111.0977704	45.69619896	Underground Retention Facility	10/27/2020
765	DP.J51.00002	Private	N/A		-111.0777134	45.72187086	Underground Retention Facility	10/27/2020
764	DP.J51.00001	Private	N/A		-111.0799931	45.72147442	Underground Retention Facility	10/27/2020
763	DP.K04.00046	Private	N/A		-111.0855609	45.67900675	Surface Retention Facility	10/26/2020
762	DP.E15.00002	Public - City of Bozeman	N/A		-111.0229608	45.60094457	Surface Retention Facility	10/26/2020
761	DP.I03.00074	HOA - Rose Park Sub	N/A		-111.0702663	45.69287109	Surface Retention Facility	10/26/2020
760	DP.I03.00073	HOA - Rose Park Sub	West Fork Catron Creek		-111.0683685	45.69289945	Surface Detention Facility	10/26/2020
759	DP.I03.00072	HOA - Rose Park Sub	West Fork Catron Creek		-111.0681308	45.69253214	Surface Detention Facility	10/26/2020
758	DP.I03.00071	HOA - Rose Park Sub	West Fork Catron Creek		-111.0681834	45.69171838	Surface Detention Facility	10/26/2020
757	DP.I03.00070	HOA - Rose Park Sub	N/A		-111.0705779	45.69224787	Surface Retention Facility	10/26/2020
756	DP.I03.00069	HOA - Rose Park Sub	N/A		-111.0705913	45.69196409	Surface Retention Facility	10/26/2020
755	DP.M04.00023	Private	Baxter Creek		-111.108289	45.6812065	Surface Detention Facility	10/26/2020
754	DP.K05.00049	Private - Crescent Valley	Unnamed Tributary		-111.0933814	45.67590026	Surface Detention Facility	10/26/2020
753	DP.D04.00012	HOA - Parkland Sub	N/A		-111.0194263	45.68278884	Surface Retention Facility	10/22/2020
752	DP.D04.00011	HOA - Parkland Sub	N/A		-111.0194901	45.68267404	Surface Retention Facility	10/22/2020
751	DP.D04.00010	HOA - Parkland Sub	N/A		-111.0195689	45.68250875	Surface Retention Facility	10/22/2020
750	DP.D04.00009	HOA - Parkland Sub	N/A		-111.0196483	45.68234727	Surface Retention Facility	10/22/2020
749	DP.D04.00008	HOA - Parkland Sub	N/A		-111.0197325	45.68219056	Surface Retention Facility	10/22/2020
748	DP.D04.00007	HOA - Parkland Sub	N/A		-111.0198385	45.68204479	Surface Retention Facility	10/22/2020
747	DP.D04.00006	HOA - Parkland Sub	N/A		-111.0199499	45.68190808	Surface Retention Facility	10/22/2020
746	DP.D04.00005	HOA - Parkland Sub	N/A		-111.0200735	45.68177851	Surface Retention Facility	10/22/2020
745	DP.D04.00004	HOA - Parkland Sub	N/A		-111.0202128	45.68165751	Surface Retention Facility	10/22/2020
744	DP.G03.00050	Private	Mandeville Creek		-111.0497196	45.68664996	Surface Detention Facility	10/14/2020
743	DP.G03.00049	Private			-111.050441	45.68686211	N/A	10/14/2020
742	DP.J05.00413	Private - Mountain Vista	N/A		-111.0774549	45.67814031	Surface Retention Facility	10/12/2020
741	DP.H02.00013	HOA - Arrowleaf	N/A		-111.0571303	45.69902731	Surface Retention Facility	10/9/2020
740	DP.H02.00012	HOA - Arrowleaf	Farmers Canal		-111.0583489	45.6993727	Surface Retention Facility	10/9/2020
739	DP.H02.00011	HOA - Arrowleaf	Arrowleaf		-111.0571724	45.69718794	Surface Retention Facility	10/9/2020
738	DP.J05.00411	HOA - Babcock Meadows	Unknown Tributary		-111.0786283	45.67819865	Surface Detention Facility	9/23/2020
737	DP.J05.00412	HOA - Babcock Vista	N/A		-111.0735408	45.67821447	Surface Retention Facility	9/23/2020
736	DP.J05.00411	HOA - Babcock Vista	N/A		-111.073584	45.67671509	Surface Retention Facility	9/23/2020
735	DP.L05.00100	HOA - Ridge	N/A		-111.0959312	45.674909	Surface Retention Facility	9/23/2020
734	DP.F01.00101	Private - Resonon	N/A		-111.0311318	45.70357371	Surface Retention Facility	9/22/2020
733	DP.J05.00410	HOA - 223 Minor	N/A		-111.0809783	45.67729674	Surface Retention Facility	9/22/2020
732	DP.J05.00409	HOA - 223 Minor	N/A		-111.0807668	45.67822796	Surface Retention Facility	9/22/2020
731	DP.J05.00408	HOA - 223 Minor	N/A		-111.0809682	45.67794959	Surface Retention Facility	9/22/2020
730	DP.J05.00407	HOA - 223 Minor	N/A		-111.0809646	45.67767007	Surface Retention Facility	9/22/2020
729	DP.J05.00406	Public - City of Bozeman	N/A		-111.0820835	45.67622384	Surface Retention Facility	9/22/2020
728	DP.I00.00086	Private	N/A		-111.0660161	45.71054145	Surface Retention Facility	9/22/2020
727	DP.I00.00085	Private	N/A		-111.0661515	45.7111544	Surface Retention Facility	9/22/2020
726	DP.I00.00084	Private - Rib&Chop	Catron Creek	2020	-111.0663319	45.71163272	Surface Detention Facility	9/22/2020
725	DP.L05.00099	Private - Icon Apts	N/A		-111.100225	45.67692774	Underground Retention Facility	9/22/2020
724	DP.L05.00098	Private - Icon Apts	N/A		-111.1020944	45.67765114	Surface Retention Facility	9/22/2020
723	DP.L05.00097	Private - Icon Apts	N/A		-111.1020517	45.67716453	Surface Retention Facility	9/22/2020
722	DP.L05.00096	Private - Icon Apts	N/A		-111.1018818	45.67747574	Surface Retention Facility	9/22/2020
721	DP.L05.00095	Private - Icon Apts	N/A		-111.1015473	45.6774727	Surface Retention Facility	9/22/2020
720	DP.L05.00094	Private - Icon Apts	N/A		-111.1013235	45.67747015	Surface Retention Facility	9/22/2020
719	DP.L05.00093	Private - Icon Apts	N/A		-111.1010865	45.67746729	Surface Retention Facility	9/22/2020

2020 Post-Construction
Facility Inventory

718	DP.L05.00092	Private - Icon Apts	N/A		-111.1007521	45.6774646	Surface Retention Facility	9/22/2020
717	DP.L05.00091	Private - Icon Apts	N/A		-111.1002624	45.67745992	Surface Retention Facility	9/22/2020
716	DP.L05.00090	Private - Icon Apts	N/A		-111.1001518	45.6774209	Surface Retention Facility	9/22/2020
715	DP.L05.00089	Private - Icon Apts	N/A		-111.1005447	45.67772395	Surface Retention Facility	9/22/2020
714	DP.L05.00088	Private - Icon Apts	N/A		-111.1005338	45.67825045	Surface Retention Facility	9/22/2020
713	DP.L05.00087	Private - Icon Apts	N/A		-111.1007293	45.677987	Surface Retention Facility	9/22/2020
712	DP.L05.00086	Private - Icon Apts	N/A		-111.1010657	45.67799027	Surface Retention Facility	9/22/2020
711	DP.L05.00085	Private - Icon Apts	N/A		-111.1013154	45.67799317	Surface Retention Facility	9/22/2020
710	DP.L05.00084	Private - Icon Apts	N/A		-111.1015348	45.67799593	Surface Retention Facility	9/22/2020
709	DP.L05.00083	Private - Icon Apts	N/A		-111.1018804	45.6779985	Surface Retention Facility	9/22/2020
708	DP.L05.00082	Private - Icon Apts	N/A		-111.1020907	45.67785908	Surface Retention Facility	9/22/2020
707	DP.L05.00081	Private - Icon Apts	N/A		-111.1023294	45.67794272	Surface Retention Facility	9/22/2020
706	DP.I07.00038	Private	N/A		-111.0650356	45.66105413	Underground Retention Facility	9/18/2020
705	DP.I07.00037	Private	N/A		-111.0646384	45.66132318	Underground Retention Facility	9/18/2020
704	DP.I07.00036	Private	N/A		-111.0650289	45.66162366	Underground Retention Facility	9/18/2020
703	DP.I07.00035	Private	N/A		-111.0647373	45.66178169	Underground Retention Facility	9/18/2020
702	DP.J00.00037	Private	N/A		-111.0771899	45.71272397	Underground Retention Facility	9/18/2020
701	DP.J00.00036	Private	N/A		-111.0772665	45.71304676	Underground Retention Facility	9/18/2020
700	DP.L06.00009	HOA - Cottonwood Subdivision	Baxter Creek		-111.1037168	45.66850151	Underground Detention Facility	9/17/2020
699	DP.L06.00008	HOA - Cottonwood Subdivision	Baxter Creek		-111.1015716	45.6688294	Underground Detention Facility	9/17/2020
698	DP.L06.00007	HOA - Cottonwood Subdivision	Baxter Creek		-111.1021134	45.66696626	Underground Detention Facility	9/17/2020
697	DP.L06.00006	HOA - Cottonwood Subdivision	Baxter Creek		-111.1036015	45.66742478	Underground Detention Facility	9/17/2020
696	DP.L06.00005	HOA - Cottonwood Sub			-111.1038483	45.66743483	Underground Detention Facility	9/17/2020
695	DP.I00.00068	Private - Car Wash	Catron Creek		-111.0674347	45.71169303	Surface Detention Facility	9/16/2020
694	DP.I00.00067	Private - Car Wash	Catron Creek		-111.0679078	45.7110853	Surface Retention Facility	9/16/2020
693	DP.I00.00066	Private - Car Wash	Catron Creek		-111.0679297	45.71148769	Surface Detention Facility	9/16/2020
692	DP.I00.00065	Private - Car Wash	Catron Creek		-111.0674035	45.71214368	Surface Detention Facility	9/16/2020
691	DP.L01.00035	HOA - Flanders Mill	N/A		-111.1028185	45.69983481	Surface Retention Facility	8/26/2020
690	DP.L02.00009	Public - City of Bozeman	West Gallatin Canal		-111.0955034	45.70047929	Surface Detention Facility	8/26/2020
689	DP.K01.00062	HOA - Four Points Subdivision	Unnamed Tributary		-111.0884064	45.70723951	Surface Detention Facility	8/20/2020
688	DP.K01.00061	HOA - Four Points	N/A		-111.0919876	45.70725795	Surface Retention Facility	8/20/2020
687	DP.M04.00022	HOA - Lakes Ph6	N/A		-111.1140636	45.68305213	Underground Detention Facility	8/18/2020
686	DP.K52.00002	HOA - Nelson Meadows	Catron Creek		-111.0843697	45.73315632	Surface Detention Facilty	8/7/2020
685	DP.K52.00001	HOA - Nelson Meadows	Cattail Creek		-111.0863112	45.73309432	Surface Detention Facilty	8/7/2020
684	DP.I08.00025	HOA - Nexus	Middle Creek Ditch		-111.0676122	45.65349619	Underground Detention Facility	8/7/2020
683	DP.I09.00081	Private - L1B4 Southbridge	N/A		-111.0639125	45.64756687	Surface Retention Facility	8/6/2020
682	DP.I09.00080	Private - L1B4 Southbridge	N/A		-111.0634673	45.64753975	Surface Retention Facility	8/6/2020
681	DP.I09.00079	Private - L1B4 Southbridge	N/A		-111.063081	45.64706827	Surface Retention Facility	8/6/2020
680	DP.I09.00078	Private - L1B4 Southbridge	N/A		-111.0635173	45.64703999	Surface Retention Facility	8/6/2020
679	DP.L03.00023	Private - Bozeman School District	Unnamed Tributary		-111.101675	45.68941878	Surface Detention Facility	8/6/2020
678	DP.L03.00022	Unknown	N/A		-111.09929	45.69324196	Surface Retention Facility	8/6/2020
677	DP.L03.00021	Private - Bozeman School District	Maynard Border Ditch		-111.0990582	45.69268451	Surface Detention Facility	8/6/2020
676	DP.L02.00008	Unknown	N/A		-111.1034702	45.69350132	Surface Retention Facilitiy	8/6/2020
675	DP.M03.00044	Unknown	N/A		-111.1042961	45.69311934	Surface Retention Facilitiy	8/6/2020
674	DP.L03.00020	Private - Bozeman School District	Unnamed Tributary		-111.1032249	45.69254146	Surface Detention Facility	8/6/2020
673	DP.L06.00001	HOA - Cottonwood Subdivision	Baxter Creek		-111.1038167	45.66951553	Surface Detention Facility	8/6/2020
672	DP.L04.00036	Private - Vlaanderen Condos	Tributary - SWWW 00006		-111.1041217	45.68651781	Surface Detention Facility	8/3/2020
671	DP.C05.00008	Private - Subaru	N/A		-111.0027115	45.67376202	Surface Detention Facility	7/29/2020
670	DP.C05.00007	Private - Subaru	N/A		-111.0020727	45.67363614	Surface Detention Facility	7/29/2020
669	DP.C05.00006	Private - Subaru	N/A		-111.0024466	45.67220346	Surface Retention Facility	7/29/2020
668	DP.G01.00058	HOA - Bridgervale	EGR Tributary		-111.0388321	45.70604751	Surface Detention Facility	7/29/2020
667	DP.G01.00057	HOA - Bridgervale	EGR Tributary		-111.0394255	45.70666976	Surface Detention Facility	7/29/2020
666	DP.G01.00056	HOA - Bridgervale	EGR Tributary		-111.0406081	45.70694281	Surface Detention Facility	7/29/2020
665	DP.K01.00060	Private - Gallatin Green Condos	N/A		-111.090239	45.7024448	Underground Retention Facility	7/29/2020
664	DP.L05.00080	Private - Icon Apts	N/A		-111.1004935	45.67566536	Surface Retention Facility	7/28/2020
663	DP.L05.00079	Private - Icon Apts	N/A		-111.1004914	45.67577805	Surface Retention Facility	7/28/2020

2020 Post-Construction
Facility Inventory

662	DP.L05.00078	Private - Icon Apts	N/A		-111.1004782	45.67608472	Surface Retention Facility	7/28/2020
661	DP.L05.00077	Private - Icon Apts	N/A		-111.1004756	45.67619766	Surface Retention Facility	7/28/2020
660	DP.L05.00076	Private - Icon Apts	N/A		-111.1023991	45.67594813	Surface Retention Facility	7/28/2020
659	DP.L05.00075	Private - Icon Apts	N/A		-111.1002327	45.6754866	Surface Retention Facility	7/28/2020
658	DP.L05.00074	Private - Icon Apts	N/A		-111.1003536	45.67552686	Surface Retention Facility	7/28/2020
657	DP.L05.00073	Private - Icon Apts	N/A		-111.1009018	45.67535649	Surface Retention Facility	7/28/2020
656	DP.L05.00072	Private - Icon Apts	N/A		-111.1015283	45.67512832	Surface Retention Facility	7/28/2020
655	DP.L05.00071	Private - Icon Apts	N/A		-111.1023756	45.675372	Surface Retention Facility	7/28/2020
654	DP.L05.00070	Private - Icon Apts	N/A		-111.1018695	45.67536541	Surface Retention Facility	7/28/2020
653	DP.L05.00069	Private - Icon Apts	N/A		-111.1021914	45.67541854	Surface Retention Facility	7/28/2020
652	DP.L05.00068	Private - Icon Apts	N/A		-111.1021267	45.67597932	Surface Retention Facility	7/28/2020
651	DP.L05.00067	Private - Icon Apts	N/A		-111.1003191	45.67646687	Surface Retention Facility	7/28/2020
650	DP.L05.00066	Private - Icon Apts	N/A		-111.1018895	45.67631004	Surface Retention Facility	7/28/2020
649	DP.L05.00065	Private - Icon Apts	N/A		-111.1015364	45.67630707	Surface Retention Facility	7/28/2020
648	DP.L05.00064	Private - Icon Apts	N/A		-111.1011755	45.67630385	Surface Retention Facility	7/28/2020
647	DP.L05.00063	Private - Icon Apts	N/A		-111.1008239	45.67629953	Surface Retention Facility	7/28/2020
646	DP.L05.00062	Private - Icon Apts	N/A		-111.1006139	45.67646861	Surface Retention Facility	7/28/2020
645	DP.L05.00061	Private - Icon Apts	N/A		-111.1009248	45.67647232	Surface Retention Facility	7/28/2020
644	DP.L05.00060	Private - Icon Apts	N/A		-111.1012616	45.67647643	Surface Retention Facility	7/28/2020
643	DP.L05.00059	Private - Icon Apts	N/A		-111.1015747	45.67647974	Surface Retention Facility	7/28/2020
642	DP.L05.00058	Private - Icon Apts	N/A		-111.1018796	45.67648251	Surface Retention Facility	7/28/2020
641	DP.L05.00057	Private - Icon Apts	N/A		-111.1021155	45.67663926	Surface Retention Facility	7/28/2020
640	DP.L05.00056	Private - Icon Apts	N/A		-111.102167	45.67676141	Surface Retention Facility	7/28/2020
639	DP.G01.00055	HOA - Bridgervale	EGR Tributary		-111.0403643	45.70672642	Surface Detention Facility	7/28/2020
638	DP.E05.00019	Private	Unknown		-111.0308907	45.67789769	Underground Retention Facility	7/28/2020
637	DP.I09.00012	HOA - Meadow Creek Subdivision	East Fork Catron Creek Tributary		-111.0725941	45.64784272	Underground Detention Facility	7/24/2020
636	DP.I09.00011	HOA - Meadow Creek Subdivision	East Fork Catron Creek Tributary		-111.0721169	45.64871278	Underground Retention Facility	7/24/2020
635	DP.J01.00060	HOA - Willow Springs	Cattail Creek		-111.0756913	45.70330661	Surface Detention Facility	6/30/2020
634	DP.J01.00061	HOA - Willow Springs	Cattail Creek		-111.0756928	45.70313276	Surface Detention Facility	6/30/2020
633	DP.J01.00062	HOA - Willow Springs	N/A		-111.0751172	45.70361511	Surface Retention Facility	6/30/2020
632	DP.J01.00063	HOA - Willow Springs	N/A		-111.0752355	45.70361437	Surface Retention Facility	6/30/2020
631	DP.J01.00064	HOA - Willow Springs	N/A		-111.0754456	45.70361314	Surface Retention Facility	6/30/2020
630	DP.J01.00065	HOA - Willow Springs	Cattail Creek		-111.0756912	45.7037667	Surface Detention Facility	6/30/2020
629	DP.I08.00024	Private	N/A		-111.0623596	45.65271632	Surface Retention Facility	6/30/2020
628	DP.F06.00001	Private	N/A		-111.0628095	45.69096374	Surface Detention Facility	5/28/2020
627	DP.F08.00028	Private	N/A		-111.0702439	45.67370994	Surface Retention Facility	5/27/2020
626	DP.F08.00027	Private	N/A		-111.070259	45.67344899	Surface Retention Facility	5/27/2020
625	DP.F08.00026	Private	N/A		-111.070679	45.67345265	Surface Retention Facility	5/27/2020
624	DP.F08.00025	Private	N/A		-111.0706716	45.67366297	Surface Retention Facility	5/27/2020
623	DP.M03.00043	HOA - The Nest	Unnamed Tributary		-111.109583	45.68609024	Surface Detention Facility	5/26/2020
622	DP.I00.00083	Private	Unnamed Tributary		-111.0698209	45.70927804	Underground Retention Facility	4/15/2020
621	DP.I00.00082	Private	Unnamed Tributary		-111.0700463	45.70853376	Underground Retention Facility	4/15/2020
620	DP.I00.00081	Private	Unnamed Tributary		-111.0718919	45.70885343	Underground Detention Facility	4/15/2020
619	DP.F06.00002	Private	Mathew Bird Creek		-111.0365315	45.66816331	Surface Detention Facility	4/14/2020
618	DP.E05.00018	Private	Bozeman Creek		-111.0300457	45.67451698	Surface Detention Facility	4/14/2020
617	DP.J05.00044	Private	Cattail Creek		-111.0798529	45.67450875	Surface Detention Facility	4/14/2020
616	DP.K03.00055	Public - City of Bozeman	N/A		-111.0890778	45.69326068	Surface Retention Facility	4/14/2020
615	DP.H01.00026	Private	N/A		-111.059891	45.70312823	Surface Retention Facility	4/13/2020
614	DP.L02.00007	HOA - Flanders Mill	Maynard-Border Ditch		-111.0988172	45.69980019	Surface Detention Facility	4/13/2020
613	DP.I02.00082	Private	N/A		-111.063717	45.69949628	Surface Retention Facility	4/13/2020
612	DP.I02.00081	Private	N/A		-111.0643999	45.69957262	Surface Retention Facility	4/13/2020
611	DP.I02.00080	HOA - Stoneridge Subdivision	Catron Creek		-111.0646454	45.70017911	Surface Detention Facility	4/13/2020
610	DP.K01.00058	Private	N/A		-111.0899561	45.7041862	Underground Retention Facility	4/10/2020
609	DP.J50.00031	Private	Catron Creek		-111.0718288	45.71543625	Surface Detention Facility	4/9/2020
608	DP.J00.00028	Private	Unnamed Tributary		-111.0723376	45.7084766	Surface Detention Facility	4/9/2020
607	DP.L06.00004	HOA - Ferguson Farm	N/A		-111.1007456	45.6715165	Surface Retention Facility	4/9/2020

2020 Post-Construction
Facility Inventory

606	DP.F04.00029	Private	N/A		-111.0365118	45.68172492	Underground Retention Facility	4/9/2020
605	DP.F01.00028	Private	Glen Lake		-111.0407112	45.70371266	Surface Detention Facility	4/9/2020
604	DP.E04.00012	Private	Story Ditch		-111.0248436	45.68131393	Surface Detention Facility	4/9/2020
603	DP.B05.00013	Private	Unnamed Tributary		-110.9950665	45.67141318	Surface Detention Facility	4/9/2020
602	DP.B05.00012	Private	Unnamed Tributary		-110.9946181	45.67154268	Surface Detention Facility	4/9/2020
601	DP.B05.00011	Private	Unnamed Tributary		-110.9940293	45.67188964	Surface Detention Facility	4/9/2020
600	DP.B05.00010	Private	Unnamed Tributary		-110.9951771	45.67210985	Surface Detention Facility	4/9/2020
599	DP.J01.00059	Private	N/A		-111.0735134	45.70205772	Underground Retention Facility	4/9/2020
598	DP.B05.00009	Private	Unnamed Tributary		-110.9965484	45.6723491	Surface Retention Facility	4/8/2020
597	DP.B05.00008	Private	N/A		-110.9983607	45.67143768	Surface Retention Facility	4/8/2020
596	DP.B05.00007	Private	N/A		-111.0003931	45.67178857	Surface Retention Facility	4/8/2020
595	DP.B05.00006	Private	N/A		-110.9988456	45.672816	Surface Retention Facility	4/8/2020
594	DP.C06.00006	HOA - Minor Sub 417	Rocky Creek Tributary		-111.0074917	45.67040672	Surface Detention Facility	4/8/2020
593	DP.C06.00005	HOA - Minor Sub 467	Rocky Creek Tributary		-111.0069338	45.67009682	Surface Detention Facility	4/8/2020
592	DP.H07.00025	Private - Bozeman Apartments	Mandeville Creek		-111.0535806	45.66167084	Surface Detention Facility	4/8/2020
591	DP.D04.00003	Private	Rocky Creek Tributary		-111.0207667	45.68052985	Underground Retention Facility	1/30/2020
590	DP.E04.00011	Private	Rocky Creek Tributary		-111.0215516	45.68007942	Underground Retention Facility	1/30/2020
589	DP.E04.00010	Private	Rocky Creek Tributary		-111.022076	45.67986508	Underground Retention Facility	1/30/2020
588	DP.F04.00028	Private	N/A		-111.037117	45.68064325	Underground Retention Facility	1/30/2020
587	DP.F05.00004	Private	Bozeman Creek		-111.0355333	45.67817868	Surface Detention Facility	1/10/2020
586	DP.I04.00041	Private	N/A		-111.0644357	45.68018447	Surface Detention Facility	1/10/2020
585	DP.E01.00009	Private	N/A		-111.0273567	45.70422415	Surface Retention Facility	1/3/2020
			2019					
584	DP.F03.00002	Public - City of Bozeman	N/A		-111.0318679	45.68828625	Underground Retention Facility	12/4/2019
583	DP.L05.00055	HOA - Cottonwood Condominiums	N/A	2019	-111.0997153	45.67757003	Surface Retention Facility	12/2/2019
582	DP.L05.00053	HOA - Cottonwood Condominiums	N/A	2019	-111.0942456	45.67621054	Surface Retention Facility	12/2/2019
581	DP.K01.00056	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.0841372	45.70530328	Surface Retention Facility	11/6/2019
580	DP.F04.00027	Private	N/A		-111.033931	45.68113597	Underground Retention Facility	11/1/2019
579	DP.G01.00054	Private	N/A		-111.0420039	45.70653155	Underground Retention Facility	10/17/2019
578	DP.F05.00002	Private	N/A		-111.0322559	45.67577755	Surface Retention Facility	10/17/2019
577	DP.G01.00053	Private	N/A		-111.0450651	45.70030785	Surface Retention Facility	10/8/2019
576	DP.K05.00008	Private	Unnamed Tributary		-111.0933106	45.67819877	Surface Detention Facility	10/3/2019
575	DP.I50.00082	Private	N/A		-111.0661223	45.71930844	Underground Retention Facility	9/27/2019
574	DP.H05.00006	Private	Mandeville Creek Tributary		-111.0595719	45.67793509	Underground Detention Facility	9/20/2019
573	DP.H05.00005	Private	Mandeville Creek Tributary		-111.0591494	45.67793503	Underground Detention Facility	9/20/2019
572	DP.G03.00048	Private	East Gallatin River Tributary		-111.0443668	45.68827981	Underground Detention Facility	9/18/2019
571	DP.C05.00005	Private - Bozeman Audi	N/A		-111.0010046	45.67339821	Surface Detention Facility	9/16/2019
570	DP.B05.00005	Private - Bozeman Audi	N/A		-111.0003315	45.67326255	Surface Detention Facility	9/16/2019
569	DP.C05.00004	Private - Bozeman Audi	N/A		-111.0017281	45.67206322	Surface Detention Facility	9/16/2019
568	DP.M05.00029	Private	N/A		-111.1093021	45.67823886	Surface Retention Facility	9/12/2019
567	DP.I01.00065	Private - Town Pump	Catron Creek		-111.0672231	45.7053652	Surface Detention Facility	9/11/2019
566	DP.I04.00040	Private	East Fork Catrion Creek		-111.0649252	45.68097156	Surface Detention Facility	9/11/2019
565	DP.E04.00008	Private	Rocky Creek Tributary		-111.0244393	45.67971647	Underground Retention Facility	9/10/2019
564	DP.K01.00055	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.087904	45.70238071	Surface Detention Facility	9/9/2019
563	DP.H01.00025	Private	N/A		-111.0592898	45.70243633	Surface Retention Facility	9/9/2019
562	DP.M06.00015	Private	N/A		-111.1058381	45.67013915	Surface Retention Facility	9/6/2019
561	DP.M06.00014	Private	N/A		-111.1053121	45.67026086	Surface Retention Facility	9/6/2019
560	DP.M06.00013	Private	N/A		-111.1053376	45.66969519	Surface Retention Facility	9/6/2019
559	DP.M06.00012	Private	N/A		-111.1057657	45.6708365	Surface Retention Facility	9/6/2019
558	DP.E02.00007	Private	N/A		-111.0279458	45.69329477	Surface Retention Facility	9/5/2019
557	DP.G08.00049	Private - Overbrook at Westridge	Figgens Creek	2019	-111.0429139	45.65653464	Surface Detention Facility	9/4/2019
556	DP.G08.00048	Private - Overbrook at Westridge	N/A	2019	-111.0432115	45.65617385	Surface Retention Facility	9/4/2019
555	DP.L04.00035	Public - City of Bozeman	Unnamed Tributary		-111.104151	45.68526383	Underground Detention Facility	9/4/2019
554	DP.L04.00034	Public - City of Bozeman	Unnamed Tributary		-111.1041372	45.68496011	Underground Detention Facility	9/4/2019
553	DP.I02.00079	Private	N/A		-111.0713538	45.6939995	Surface Retention Facility	8/29/2019

2020 Post-Construction
Facility Inventory

552	DP.K00.00002	Private	N/A		-111.0821871	45.71102669	Underground Retention Facility	8/28/2019
551	DP.L05.00050	Private - Icon Apts	N/A		-111.1026948	45.67820966	Underground Retention Facility	8/26/2019
550	DP.L05.00049	Private - Icon Apts	N/A		-111.1023783	45.6770486	Underground Retention Facility	8/26/2019
549	DP.G04.00003	Private	N/A		-111.0453031	45.68593345	Underground Retention Facility	8/22/2019
548	DP.G04.00002	Private	N/A		-111.0454222	45.68593822	Surface Retention Facility	8/22/2019
547	DP.L05.00051	HOA - Ferguson Farm	N/A		-111.1028285	45.67367596	Surface Retention Facility	8/22/2019
546	DP.H03.00044	HOA - Walton Homestead Subdivision	Mandeville Creek Tributary		-111.0573476	45.69199118	Underground Detention Facility	8/7/2019
545	DP.H03.00043	HOA - Walton Homestead Subdivision	Mandeville Creek Tributary		-111.0566056	45.69135085	Surface Detention Facility	8/7/2019
544	DP.H03.00042	HOA - Walton Homestead Subdivision	Mandeville Creek Tributary		-111.0572331	45.69110981	Surface Detention Facility	8/7/2019
543	DP.H03.00039	HOA - Walton Homestead Subdivision	Mandeville Creek Tributary		-111.0560852	45.69283716	Underground Detention Facility	7/23/2019
542	DP.H03.00038	HOA - Walton Homestead Subdivision	Mandeville Creek Tributary		-111.055536	45.69283504	Underground Detention Facility	7/23/2019
541	DP.H03.00037	HOA - Walton Homestead Residential Subdivision	Mandeville Creek Tributary	2019	-111.0556685	45.68688535	Underground Detention Facility	7/23/2019
540	DP.H03.00040	HOA - Walton Homestead Residential Subdivision	Mandeville Creek Tributary	2019	-111.0556198	45.6878309	Underground Detention Facility	7/23/2019
539	DP.H03.00036	HOA - Walton Homestead Residential Subdivision	Mandeville Creek Tributary	2019	-111.055578	45.68881489	Underground Detention Facility	7/23/2019
538	DP.H03.00035	HOA - Walton Homestead Residential Subdivision	Mandeville Creek Tributary	2019	-111.0571392	45.68766921	Underground Detention Facility	7/23/2019
537	DP.H03.00034	HOA - Walton Homestead Subdivision	Mandeville Creek Tributary		-111.0551957	45.69137146	Surface Detention Facility	7/23/2019
536	DP.H03.00033	HOA - Walton Homestead Subdivision	Mandeville Creek Tributary		-111.0566905	45.69153538	Surface Detention Facility	7/23/2019
535	DP.H03.00032	HOA - Walton Homestead Subdivision	Mandeville Creek Tributary		-111.0560095	45.69221877	Underground Detention Facility	7/23/2019
534	DP.H03.00031	HOA - Walton Homestead Subdivision	Mandeville Creek Tributary		-111.0558524	45.6922134	Underground Detention Facility	7/23/2019
533	DP.H03.00030	HOA - Walton Homestead Subdivision	Mandeville Creek Tributary		-111.056573	45.69284905	Underground Detention Facility	7/23/2019
532	DP.H03.00029	HOA - Walton Homestead Subdivision	Mandeville Creek Tributary		-111.0557844	45.69166531	Surface Detention Facility	7/22/2019
531	DP.H03.00028	HOA - Walton Homestead Subdivision	Mandeville Creek Tributary		-111.0560627	45.69167687	Surface Detention Facility	7/22/2019
530	DP.H03.00027	HOA - Walton Homestead Subdivision	Mandeville Creek Tributary		-111.0573155	45.69092274	Underground Detention Facility	7/22/2019
529	DP.H03.00026	HOA - Walton Homestead Residential Subdivision	Mandeville Creek Tributary	2019	-111.055655	45.69003393	Underground Detention Facility	7/22/2019
528	DP.H03.00041	HOA - Walton Homestead Residential Subdivision	Mandeville Creek Tributary	2019	-111.0572268	45.69006673	Underground Detention Facility	7/22/2019
527	DP.F04.00026	Private	N/A		-111.0391817	45.68165617	Underground Retention Facility	6/21/2019
526	DP.I09.00031	HOA - Southbridge Subdivision	East Fork Catron Creek	2019	-111.0635952	45.64484014	Surface Detention Facility	6/19/2019
525	DP.G03.00047	Private	N/A		-111.0417489	45.68596885	Underground Retention Facility	6/17/2019
524	DP.G03.00046	Private	N/A		-111.0414595	45.68596985	Underground Retention Facility	6/17/2019
523	DP.K02.00044	HOA - The Crossing Subdivision	Unnamed Tributary		-111.0856964	45.69626699	Surface Detention Facility	6/6/2019
522	DP.K02.00043	HOA - The Crossing Subdivision	Unnamed Tributary		-111.0893362	45.69899935	Surface Detention Facility	6/6/2019
521	DP.M03.00042	Private	N/A		-111.1138263	45.69201098	Surface Retention Facility	5/28/2019
520	DP.K01.00053	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.0881957	45.70267046	Surface Detention Facility	5/24/2019
519	DP.K01.00052	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.0879678	45.70266048	Surface Detention Facility	5/24/2019
518	DP.I02.00077	Private	Unnamed Tributary		-111.068229	45.69635668	Surface Detention Facility	5/16/2019
517	DP.I02.00076	Private	N/A		-111.0689098	45.69565788	Surface Retention Facility	5/16/2019
516	DP.I02.00075	Private	N/A		-111.0697684	45.69645829	Surface Retention Facility	5/16/2019
515	DP.F09.00028	HOA - West Meadow Subdivision	N/A	2019	-111.036936	45.64850244	Surface Retention Facility	4/16/2019
514	DP.N04.00001	HOA - Lakes at Valley West	N/A		-111.1172987	45.68326901	Underground Detention Facility	4/2/2019
513	DP.J06.00051	HOA - Bozeman Gateway Subdivision	Cattail Creek		-111.0767659	45.67027339	Underground Detention Facility	3/20/2019
512	DP.J06.00050	HOA - Bozeman Gateway Subdivision	Cattail Creek		-111.0792113	45.6703213	Underground Detention Facility	3/20/2019
511	DP.J06.00049	HOA - Bozeman Gateway Subdivision	Cattail Creek		-111.0765834	45.67075343	Underground Detention Facility	3/20/2019
510	DP.J06.00048	HOA - Bozeman Gateway Subdivision	Cattail Creek		-111.0782799	45.67009489	Underground Detention Facility	3/20/2019
509	DP.J06.00047	HOA - Bozeman Gateway Subdivision	Cattail Creek		-111.0776567	45.67079877	Underground Detention Facility	3/20/2019
508	DP.J06.00046	HOA - Bozeman Gateway Subdivision	Cattail Creek		-111.0787683	45.67071185	Underground Detention Facility	3/20/2019
507	DP.J06.00045	HOA - Bozeman Gateway Subdivision	Cattail Creek		-111.0816011	45.6692729	Underground Detention Facility	3/20/2019

2020 Post-Construction
Facility Inventory

506	DP.L05.00048	HOA - Ferguson Farm	N/A		-111.1026908	45.67151318	Surface Retention Facility	3/4/2019
505	DP.L05.00047	HOA - Ferguson Farm	N/A		-111.1028002	45.67203587	Surface Retention Facility	3/4/2019
504	DP.L05.00046	HOA - Ferguson Farm	N/A		-111.102792	45.67229149	Surface Retention Facility	3/4/2019
503	DP.L05.00045	HOA - Ferguson Farm	N/A		-111.1028314	45.67347242	Surface Retention Facility	3/4/2019
502	DP.L05.00044	HOA - Ferguson Farm	N/A		-111.1027959	45.67418058	Surface Retention Facility	3/4/2019
501	DP.K00.00001	Private	N/A		-111.0823831	45.71436124	Surface Retention Facility	2/26/2019
500	DP.J50.00029	Private	N/A		-111.0818504	45.71464169	Surface Retention Facility	2/26/2019
499	DP.G04.00001	Private	N/A		-111.0452545	45.6847865	Underground Retention Facility	2/11/2019
498	DP.E04.00007	Private	Rocky Creek Tributary		-111.0260164	45.68014708	Underground Retention Facility	2/11/2019
497	DP.I06.00045	HOA - Innovation	West Fork Catron Creek		-111.0693012	45.66863773	Surface Detention Facility	1/31/2019
496	DP.I06.00044	HOA - Innovation	West Fork Catron Creek		-111.0691093	45.66881503	Surface Detention Facility	1/31/2019
495	DP.D05.00031	Private	Rocky Creek Tributary		-111.0171914	45.6773829	Underground Detention Facility	1/22/2019
494	DP.J01.00057	HOA - Willow Springs	Cattail Creek		-111.0756047	45.70336378	Underground Detention Facility	1/9/2019
			2018					
493	DP.I05.00048	Private	N/A		-111.0628417	45.67608566	Surface Retention Facility	12/6/2018
492	DP.I05.00046	Private	N/A		-111.0632724	45.67607734	Surface Retention Facility	12/6/2018
491	DP.J00.00035	Private	N/A		-111.0723297	45.71450279	Underground Retention Facility	12/6/2018
490	DP.M05.00028	HOA - Billion	Baxter Creek Tributary		-111.1067208	45.67393697	Surface Detention Facility	12/6/2018
489	DP.G01.00051	Private	N/A		-111.0428771	45.70536828	Surface Retention Facility	12/6/2018
488	DP.I06.00043	Private	N/A		-111.066908	45.67145312	Surface Retention Facility	12/6/2018
487	DP.I05.00045	Private	N/A		-111.0669087	45.67214413	Surface Retention Facility	12/6/2018
486	DP.I05.00044	Private	N/A		-111.0670346	45.67153515	Surface Retention Facility	12/6/2018
485	DP.I06.00042	Private	N/A		-111.0669797	45.67131703	Surface Retention Facility	12/5/2018
484	DP.I06.00041	Private	N/A		-111.0673178	45.67133334	Surface Retention Facility	12/5/2018
483	DP.I05.00042	Private	N/A		-111.0672859	45.6715439	Surface Retention Facility	12/5/2018
482	DP.I05.00041	Private	N/A		-111.0673331	45.6717905	Surface Retention Facility	12/5/2018
481	DP.I05.00040	Private	N/A		-111.0672873	45.67213229	Surface Retention Facility	12/5/2018
480	DP.J01.00054	Private	N/A		-111.0733535	45.70214064	Underground Retention Facility	11/30/2018
479	DP.J01.00053	Private	N/A		-111.0729199	45.70214558	Underground Retention Facility	11/30/2018
478	DP.I02.00074	Private	Catron Creek Tributary		-111.0697374	45.69833622	Underground Detention Facility	11/16/2018
477	DP.I02.00073	Private	Catron Creek Tributary		-111.0691009	45.69833428	Underground Detention Facility	11/16/2018
476	DP.E01.00008	Private	N/A		-111.0307187	45.70070238	Surface Retention Facility	10/12/2018
475	DP.L05.00043	HOA - Ferguson Farm	N/A		-111.1002389	45.67445232	Surface Retention Facility	10/12/2018
474	DP.H04.00008	Private	N/A		-111.0619959	45.67992328	Surface Retention Facility	10/10/2018
473	DP.H04.00007	Private	N/A		-111.0618048	45.67960169	Surface Retention Facility	10/10/2018
472	DP.J00.00027	Private - Costco	Catron Creek Tributary		-111.0715311	45.71428519	Surface Detention Facility	10/8/2018
471	DP.I00.00080	Private - Costco	Catron Creek Tributary		-111.0712701	45.71448903	Surface Detention Facility	10/8/2018
470	DP.I03.00068	Private	East Fork Catron Creek		-111.0643016	45.69189071	Surface Detention Facility	10/3/2018
469	DP.M03.00041	Private	Unnamed Tributary		-111.1052351	45.6916363	Surface Retention Facility	10/3/2018
468	DP.M03.00040	Private	Unnamed Tributary		-111.1061461	45.69165169	Surface Retention Facility	10/3/2018
467	DP.F02.00004	Private - Cannery District	N/A		-111.0359954	45.6931598	Surface Retention Facility	10/2/2018
466	DP.H03.00025	Private	N/A		-111.0611641	45.6893545	Underground Retention Facility	10/2/2018
465	DP.H03.00024	Private	N/A		-111.0610987	45.6894266	Underground Retention Facility	10/2/2018
464	DP.H03.00023	Private	N/A		-111.0610898	45.68934986	Surface Retention Facility	10/2/2018
463	DP.G02.00050	Private	East Gallatin River Tributary		-111.0442554	45.69881489	Surface Detention Facility	10/2/2018
462	DP.H03.00022	HOA - Walton Homestead Subdivision	N/A		-111.0560219	45.69060463	Surface Retention Facility	10/2/2018
461	DP.H03.00021	HOA - Walton Homestead Subdivision	N/A		-111.0553144	45.69059942	Surface Retention Facility	10/2/2018
460	DP.B05.00004	Private	Rocky Creek Tributary		-110.9963147	45.67138622	Underground Detention Facility	10/2/2018
459	DP.B06.00001	Private	Rocky Creek Tributary		-110.9959132	45.6709567	Surface Detention Facility	10/2/2018
458	DP.E05.00017	Private	N/A		-111.0290834	45.67808114	Underground Retention Facility	10/2/2018
457	DP.E05.00016	Private	N/A		-111.0292207	45.67825795	Surface Retention Facility	10/2/2018
456	DP.G09.00021	Private - Bozeman School District	N/A		-111.0475722	45.64247072	Surface Retention Facility	10/1/2018
455	DP.G09.00020	Private - Bozeman School District	N/A		-111.0498373	45.64458719	Surface Retention Facility	10/1/2018
454	DP.G08.00047	Unknown	N/A		-111.0508753	45.64980484	Surface Retention Facility	8/28/2018
453	DP.H08.00002	Unknown	N/A		-111.057204	45.64987749	Surface Detention Facility	8/28/2018

2020 Post-Construction
Facility Inventory

452	DP.G08.00046	HOA - Allison Sub	N/A		-111.0516417	45.65335339	Surface Retention Facility	8/28/2018
451	DP.M03.00039	HOA - Boulder Creek	Unnamed Tributary		-111.1123101	45.69257578	Surface Detention Facility	8/9/2018
450	DP.M03.00037	HOA - Westbrook Subdivision	Unnamed Tributary		-111.1107422	45.68840132	Surface Detention Facility	8/9/2018
449	DP.M03.00035	HOA - The Nest	Unnamed Tributary		-111.1100375	45.68894325	Surface Detention Facility	8/9/2018
448	DP.K03.00053	Public - City of Bozeman	N/A		-111.0929783	45.69324093	Surface Retention Facility	8/9/2018
447	DP.K02.00041	HOA - Flanders Mill Subdivision	Maynard Border Ditch Tributary		-111.0935334	45.69990093	Surface Detention Facility	8/9/2018
446	DP.I01.00064	HOA - Opportunity	N/A		-111.0693807	45.70686049	Surface Retention Facility	8/9/2018
445	DP.I03.00067	Private	Catron Creek Tributary		-111.0711647	45.69282956	Surface Detention Facility	6/18/2018
444	DP.I03.00066	Private	Catron Creek Tributary		-111.0715585	45.69282667	Underground Detention Facility	6/18/2018
443	DP.L02.00005	HOA - Flanders Mill Subdivision	Maynard Border Ditch Tributary		-111.0952936	45.69835818	Surface Detention Facility	6/12/2018
442	DP.L02.00004	HOA - Flanders Mill Subdivision	Maynard Border Ditch		-111.0979769	45.69898364	Surface Detention Facility	6/12/2018
441	DP.L02.00003	HOA - Flanders Mill Subdivision	Maynard Border Ditch Tributary		-111.0956759	45.69696738	Surface Detention Facility	6/12/2018
440	DP.L02.00002	HOA - Flanders Mill Subdivision	Maynard Border Ditch Tributary		-111.0963891	45.69989573	Surface Detention Facility	6/12/2018
439	DP.L02.00001	HOA - Flanders Mill Subdivision	Maynard Border Ditch Tributary		-111.0948829	45.6998818	Surface Detention Facility	6/12/2018
438	DP.D01.00012	HOA - Legends at Bridger Creek II Subdivision	N/A	2018	-111.0158876	45.70623105	Underground Retention Facility	5/30/2018
437	DP.D01.00010	HOA - Legends at Bridger Creek Subdivision	N/A	2018	-111.019699	45.70591623	Underground Retention Facility	2/12/2018
436	DP.D01.00009	HOA - Legends at Bridger Creek Subdivision	N/A	2018	-111.0193517	45.70711211	Underground Retention Facility	2/12/2018
435	DP.D01.00008	HOA - Legends at Bridger Creek Subdivision	N/A	2018	-111.0204666	45.70711694	Underground Retention Facility	2/12/2018
434	DP.D01.00007	HOA - Legends at Bridger Creek Subdivision	N/A	2018	-111.0207211	45.70680084	Underground Retention Facility	2/12/2018
433	DP.D01.00006	HOA - Legends at Bridger Creek Subdivision	N/A	2018	-111.020802	45.70575511	Underground Retention Facility	2/12/2018
			2017					
430	DP.E50.00001	Public - City of Bozeman	East Gallatin River Tributary	2019	-111.0304393	45.7153239	Surface Detention Facility	12/7/2017
431	DP.F50.00008	Public - City of Bozeman	East Gallatin River Tributary	2019	-111.0328917	45.71741069	Surface Detention Facility	12/7/2017
432	DP.E50.00003	Public - City of Bozeman	East Gallatin River Tributary	2019	-111.0257992	45.71804991	Surface Retention Facility	12/7/2017
429	DP.K03.00051	Public - City of Bozeman	N/A		-111.0840552	45.69322024	Surface Retention Facility	10/23/2017
428	DP.K03.00050	Public - City of Bozeman	N/A		-111.0824145	45.69260834	Surface Detention Facility	10/23/2017
427	DP.I09.00030	HOA - Southbridge Subdivision	East Fork Catron Creek	2019	-111.0638748	45.64313195	Surface Detention Facility	6/6/2017
426	DP.F02.00003	Private - Cannery District	N/A		-111.0350658	45.69408583	Surface Retention Facility	5/30/2017
425	DP.H01.00024	Private	N/A		-111.0573882	45.70078797	Surface Retention Facility	5/24/2017
424	DP.F00.00006	HOA - Bridger Creek Subdivision	East Gallatin River	2017	-111.0328852	45.7138967	Surface Detention Facility	4/21/2017
423	DP.F00.00005	HOA - Bridger Creek Subdivision	East Gallatin River	2017	-111.0356733	45.7123542	Surface Detention Facility	4/20/2017
422	DP.F00.00004	HOA - Bridger Creek Subdivision	East Gallatin River	2017	-111.0350955	45.71412756	Surface Detention Facility	4/20/2017
421	DP.F50.00005	HOA - Bridger Creek Subdivision	East Gallatin River	2017	-111.0343694	45.71459418	Surface Detention Facility	4/20/2017
420	DP.F00.00003	HOA - Bridger Creek Subdivision	East Gallatin River	2017	-111.0312324	45.71357155	Surface Detention Facility	4/20/2017
419	DP.F00.00002	HOA - Bridger Creek Subdivision	East Gallatin River	2017	-111.0320849	45.71375419	Surface Detention Facility	4/20/2017
418	DP.I02.00050	Public - City of Bozeman	N/A		-111.0703254	45.69650395	Surface Retention Facility	4/12/2017
417	DP.K02.00039	HOA - The Crossing Subdivision	Unnamed Tributary		-111.0870008	45.69792937	Surface Detention Facility	4/12/2017
416	DP.J02.00030	Public - City of Bozeman	N/A		-111.0721299	45.69645058	Surface Retention Facility	2/9/2017
			2016					
415	DP.I05.00039	Private	East Fork Catron Creek Tributary		-111.0667874	45.67713792	Underground Detention Facility	12/15/2016
414	DP.H03.00019	HOA - Oak Meadows Subdivision	Mandeville Creek		-111.0531573	45.69275145	Underground Detention Facility	12/15/2016
413	DP.H03.00018	HOA - Oak Meadows Subdivision	Mandeville Creek Tributary		-111.0543049	45.69275177	Underground Detention Facility	12/15/2016
412	DP.G10.00001	Private	N/A		-111.0460295	45.63868998	Underground Detention Facility	12/15/2016
411	DP.D05.00003	Private	Rocky Creek Tributary		-111.0123238	45.67200695	Underground Detention Facility	12/15/2016
410	DP.E03.00002	Public - City of Bozeman	N/A		-111.0278203	45.68948164	Surface Retention Facility	12/2/2016
409	DP.H03.00020	HOA - Oak Meadows Subdivision	N/A		-111.0538554	45.6925911	Surface Retention Facility	11/29/2016
408	DP.N03.00008	HOA - Laurel Glen Subdivision	Unnamed Tributary		-111.1179887	45.68782936	Surface Detention Facility	11/14/2016
407	DP.N03.00007	HOA - Laurel Glen Subdivision	Unnamed Tributary		-111.1158455	45.69188662	Surface Retention Facility	11/14/2016
406	DP.N03.00006	HOA - Laurel Glen Subdivision	Unnamed Tributary		-111.1189179	45.68906705	Surface Detention Facility	11/14/2016
405	DP.J04.00053	HOA - Valley Meadows Subdivision	N/A		-111.0791213	45.68485203	Surface Retention Facility	10/24/2016

2020 Post-Construction
Facility Inventory

404	DP.M03.00031	HOA - Traditions Subdivision	Unnamed Tributary	2016	-111.1087185	45.69244786	Surface Detention Facility	10/19/2016
403	DP.L03.00019	HOA - Flanders Mill Subdivision	Maynard-Border Ditch		-111.0954575	45.69159742	Surface Detention Facility	10/19/2016
402	DP.M03.00033	HOA - Flanders Creek Subdivision	Unnamed Tributary	2016	-111.1056059	45.69273034	Surface Detention Facility	10/18/2016
401	DP.M03.00034	HOA - Flanders Creek Subdivision	Unnamed Tributary	2016	-111.1045097	45.69273135	Surface Detention Facility	10/18/2016
400	DP.J04.00052	HOA - Pine Meadows	N/A		-111.080595	45.68553867	Surface Detention Facility	9/7/2016
399	DP.I07.00019	Private	East Fork Catron Creek Tributary		-111.0673375	45.66169198	Surface Retention Facility	8/5/2016
398	DP.I07.00018	Private	East Fork Catron Creek Tributary		-111.0674243	45.66152228	Surface Retention Facility	8/5/2016
397	DP.I07.00017	Private	East Fork Catron Creek Tributary		-111.0667499	45.66170328	Surface Retention Facility	8/5/2016
396	DP.I07.00016	Private	East Fork Catron Creek Tributary		-111.0667622	45.66207661	Surface Retention Facility	8/5/2016
395	DP.I07.00015	Private	East Fork Catron Creek Tributary		-111.0670154	45.66207763	Surface Retention Facility	8/5/2016
394	DP.E15.00001	Public - City of Bozeman	Bozeman Creek Tributary		-111.0262198	45.59956955	Surface Detention Facility	7/1/2016
393	DP.J06.00044	Private	N/A		-111.0751948	45.67080434	Surface Retention Facility	6/29/2016
392	DP.M05.00027	HOA - Billion	N/A		-111.1044774	45.67442728	Surface Retention Facility	6/17/2016
391	DP.M04.00011	HOA - Lakes at Valley West	Baxter Creek		-111.1112554	45.6855498	Surface Detention Facility	6/17/2016
390	DP.L04.00014	Public - City of Bozeman	Unnamed Tributary		-111.1041644	45.68550131	Surface Detention Facility	6/17/2016
389	DP.M04.00010	Public - City of Bozeman	Unnammed Tributary		-111.1060325	45.68561426	Surface Detention Facility	6/17/2016
388	DP.H07.00024	Private - Ressurection Parish	Mandeville Creek		-111.0534404	45.66135002	Surface Detention Facility	6/16/2016
387	DP.H07.00023	Public - City of Bozeman	Mandeville Creek		-111.0572898	45.65710786	Surface Detention Facility	6/10/2016
386	DP.H07.00022	Public - City of Bozeman	Mandeville Creek		-111.0566753	45.65802288	Surface Detention Facility	6/10/2016
385	DP.I51.00079	Private	East Gallatin River Tributary		-111.0652616	45.72153272	Surface Detention Facility	6/2/2016
384	DP.M06.00011	Private	N/A		-111.106824	45.6700917	Surface Retention Facility	6/1/2016
383	DP.M06.00010	Private	N/A		-111.1071367	45.67067765	Surface Retention Facility	6/1/2016
382	DP.M06.00009	Private	N/A		-111.1081802	45.67064304	Surface Retention Facility	6/1/2016
381	DP.M06.00008	Private	N/A		-111.1081897	45.66998412	Surface Retention Facility	6/1/2016
380	DP.G02.00024	Private	N/A		-111.043773	45.6998448	Surface Retention Facility	6/1/2016
379	DP.J03.00043	HOA - Harvest Creek Subdivision	Cattail Creek	2016	-111.0745321	45.68627708	Surface Detention Facility	5/23/2016
378	DP.J03.00042	HOA - Harvest Creek Subdivision	N/A	2016	-111.0743774	45.687396	Surface Retention Facility	5/23/2016
377	DP.E04.00006	Private - Town Pump	Rocky Creek Tributary		-111.024952	45.6801543	Surface Detention Facility	4/12/2016
376	DP.L03.00018	HOA - Flanders Mill Subdivision	Maynard-Border Ditch		-111.0966415	45.6900642	Surface Detention Facility	3/22/2016
2015 or prior								
375	DP.I51.00078	Public - City of Bozeman	N/A	2019	-111.0673981	45.72354197	Surface Retention Facility	12/21/2015
374	DP.I51.00077	Public - City of Bozeman	N/A	2019	-111.0685159	45.7238086	Surface Retention Facility	12/21/2015
373	DP.K02.00020	HOA - Baxter Meadow Subdivision	Unnamed Tributary		-111.0866968	45.69831334	Surface Detention Facility	10/28/2015
372	DP.L01.00003	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.0994399	45.70401696	Surface Detention Facility	10/26/2015
371	DP.L01.00002	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.0995336	45.70482955	Surface Detention Facility	10/26/2015
370	DP.L01.00001	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.0995454	45.70562509	Surface Detention Facility	10/26/2015
369	DP.G08.00010	HOA - Allison Subdivision	Figgens Creek		-111.0497674	45.65028548	Surface Detention Facility	10/21/2015
368	DP.M05.00002	HOA - Norton Ranch Subdivision	Baxter Creek Tributary		-111.1146201	45.678584	Surface Detention Facility	10/20/2015
367	DP.M05.00001	HOA - Norton Ranch Subdivision	Baxter Creek Tributary		-111.1140374	45.67619257	Surface Detention Facility	10/20/2015
366	DP.N05.00001	HOA - Norton Ranch Subdivision	N/A		-111.1185498	45.67870179	Surface Retention Facility	10/20/2015
365	DP.L05.00004	HOA - Cottonwood Condominiums	N/A		-111.0973726	45.6781974	Surface Retention Facility	10/19/2015
364	DP.L05.00003	HOA - Cottonwood Condominiums	N/A		-111.0947611	45.67826529	Surface Retention Facility	10/19/2015
363	DP.L05.00002	HOA - Cottonwood Condominiums	N/A		-111.0955551	45.678257	Surface Retention Facility	10/19/2015
362	DP.J01.00011	HOA - Baxter Square	N/A		-111.074835	45.70378263	Surface Retention Facility	10/19/2015
361	DP.K03.00048	HOA - Partridge Downs Subdivision	N/A		-111.0856461	45.68749751	Surface Retention Facility	10/19/2015
360	DP.I09.00008	HOA - Meadow Creek Subdivision	East Fork Catron Creek Tributary		-111.0719588	45.64373761	Surface Detention Facility	10/15/2015
359	DP.I09.00009	HOA - Meadow Creek Subdivision	East Fork Catron Creek Tributary		-111.0719014	45.64524784	Surface Detention Facility	10/15/2015
358	DP.I09.00010	HOA - Meadow Creek Subdivision	East Fork Catron Creek Tributary		-111.0716986	45.646863	Surface Detention Facility	10/15/2015
357	DP.K01.00051	HOA - Four Points Subdivision	Unnamed Tributary		-111.0898774	45.70634118	Surface Detention Facility	10/1/2015
356	DP.F01.00100	Private - Northwestern Energy	N/A		-111.0355526	45.70311356	Surface Detention Facility	9/3/2014
1	DP.F10.00013	HOA - Sundance Springs Subdivision	Mathew Bird Creek Tributary		-111.0394371	45.63832291	Surface Detention Facility	
2	DP.F10.00012	HOA - Sundance Springs Subdivision	Mathew Bird Creek Tributary		-111.0395604	45.63883764	Surface Detention Facility	
3	DP.F10.00011	HOA - Sundance Springs Subdivision	Nash Spring Creek		-111.0340055	45.63852425	Surface Detention Facility	
4	DP.F10.00018	HOA - Sundance Springs Subdivision	Mathew Bird Creek Tributary		-111.0370832	45.64176633	Surface Detention Facility	
5	DP.F10.00019	HOA - Sundance Springs Subdivision	Mathew Bird Creek Tributary		-111.0356079	45.6419361	Surface Detention Facility	
6	DP.F10.00017	HOA - Sundance Springs Subdivision	N/A		-111.0364432	45.64022764	Surface Retention Facility	

2020 Post-Construction
Facility Inventory

7	DP.F09.00002	HOA - West Meadow Subdivision	Flat Creek	2019	-111.0335618	45.64461148	Surface Detention Facility	
8	DP.F09.00003	Private - South Meadows Condominiums	Flat Creek		-111.0336236	45.64487665	Surface Detention Facility	
9	DP.F09.00004	Private - South Meadows Condominiums	Flat Creek		-111.0337866	45.64492052	Surface Detention Facility	
10	DP.F09.00016	HOA - West Meadow Subdivision	Mathew Bird Creek	2019	-111.0382893	45.64840182	Surface Detention Facility	
11	DP.F09.00027	HOA - West Meadow Subdivision	Mathew Bird Creek	2019	-111.0384502	45.64472222	Surface Detention Facility	
12	DP.G09.00005	HOA - Westfield South Subdivision	Figgens Creek Tributary		-111.0438199	45.64572164	Surface Detention Facility	
13	DP.G09.00007	HOA - Alder Creek Subdivision	Figgens Creek	2018	-111.0508989	45.64809616	Surface Detention Facility	
14	DP.G09.00008	HOA - Alder Creek Subdivision	Figgens Creek	2018	-111.0504353	45.64855518	Surface Detention Facility	
15	DP.G09.00009	HOA - Alder Creek Subdivision	Figgens Creek	2018	-111.0514666	45.64694487	Surface Detention Facility	
16	DP.G09.00010	HOA - Alder Creek Subdivision	Figgens Creek	2018	-111.051017	45.64859818	Surface Detention Facility	
17	DP.G09.00019	HOA - Alder Creek Subdivision	Figgens Creek	2018	-111.0507475	45.64846822	Surface Detention Facility	
18	DP.G09.00006	HOA - Alder Creek Subdivision	Figgens Creek	2018	-111.0512657	45.64809826	Surface Detention Facility	
19	DP.H09.00004	HOA - Alder Creek Subdivision	N/A	2018	-111.0570793	45.64852156	Surface Retention Facility	
20	DP.H09.00005	HOA - Alder Creek Subdivision	Figgens Creek Tributary	2018	-111.0526131	45.64772584	Surface Detention Facility	
21	DP.J09.00039	HOA - Meadow Creek Subdivision	N/A		-111.0777568	45.64535572	Surface Retention Facility	
22	DP.F08.00022	HOA - Spring Meadows Subdivision	Mathew Bird Creek		-111.0373848	45.65007621	Surface Detention Facility	
23	DP.F08.00023	HOA - Spring Meadows Subdivision	Mathew Bird Creek		-111.0366194	45.65292241	Surface Detention Facility	
24	DP.F08.00024	HOA - Westridge Meadows Subdivision	Mathew Bird Creek		-111.0371463	45.65449875	Surface Detention Facility	
25	DP.G08.00011	Private - Overbrook at Westridge	Figgens Creek	2019	-111.0445154	45.6562284	Surface Detention Facility	
26	DP.G08.00012	Private - Overbrook at Westridge	Figgens Creek	2019	-111.0440333	45.65641903	Surface Detention Facility	
27	DP.G08.00013	Private - Overbrook at Westridge	Figgens Creek	2019	-111.043995	45.65619326	Surface Detention Facility	
28	DP.G08.00014	Private - Overbrook at Westridge	Figgens Creek	2019	-111.0437009	45.65642709	Surface Detention Facility	
29	DP.G08.00044	Private - Overbrook at Westridge	Figgens Creek	2019	-111.04515	45.65579708	Surface Detention Facility	
30	DP.G08.00004	Private - Overbrook at Westridge	Figgens Creek	2019	-111.0448489	45.65591068	Surface Detention Facility	
31	DP.G08.00020	HOA - FT Minor Subdivision	Figgins Creek Tributary		-111.0495927	45.65629444	Surface Detention Facility	
32	DP.I08.00011	Private	East Fork Catron Creek		-111.0655371	45.65612467	Surface Detention Facility	
33	DP.I08.00020	Private	East Fork Catron Creek Tributary		-111.0684898	45.65416357	Surface Detention Facility	
34	DP.I08.00023	Private	East Fork Catron Creek Tributary		-111.0690461	45.65464828	Surface Detention Facility	
35	DP.I08.00010	HOA - Meadow Creek Subdivision	East Fork Catron Creek Tributary		-111.0692499	45.65272511	Surface Detention Facility	
36	DP.I08.00009	HOA - Meadow Creek Subdivision	East Fork Catron Creek Tributary		-111.0701723	45.65058341	Surface Detention Facility	
37	DP.D07.00003	HOA - New Hyalite View Subdivision	Rocky Creek Tributary		-111.0168555	45.66201479	Surface Detention Facility	
38	DP.G07.00046	Private	Mathew Bird Creek Tributary		-111.0434689	45.66057419	Surface Detention Facility	
39	DP.G07.00051	Public - Montana State University	Parking lot		-111.0469226	45.66377413	Surface Detention Facility	
40	DP.C06.00004	HOA - Minor Sub 417	Rocky Creek Tributary		-111.0081413	45.67092197	Surface Detention Facility	
41	DP.E06.00004	HOA - Knolls Subdivision	Rocky Creek Tributary		-111.0265303	45.66614293	Surface Detention Facility	
42	DP.E06.00003	Private - Bozeman Health	Rocky Creek Tributary		-111.0261395	45.66655043	Surface Detention Facility	
43	DP.E06.00001	HOA - Knolls Subdivision	Rocky Creek Tributary		-111.0221113	45.66603814	Surface Detention Facility	
44	DP.E06.00011	Private - Bozeman Health	Rocky Creek Tributary		-111.0222964	45.66860373	Surface Retention Facility	
45	DP.H06.00023	Public - Montana State University	Mandeville Creek	2019	-111.0536052	45.66886822	Surface Detention Facility	
46	DP.H06.00024	Public - Montana State University	Mandeville Creek	2019	-111.0540392	45.66916585	Surface Detention Facility	
47	DP.H06.00028	Public - Montana State University	Mandeville Creek	2019	-111.0531911	45.67024582	Surface Detention Facility	
48	DP.H06.00025	Public - Montana State University	Mandeville Creek	2019	-111.05345	45.67081543	Surface Detention Facility	
49	DP.H06.00027	Public - Montana State University	Mandeville Creek		-111.0563166	45.66714001	Surface Detention Facility	
50	DP.H06.00026	Public - Montana State University	Mandeville Creek	2019	-111.0550434	45.66493715	Surface Detention Facility	
51	DP.I06.00016	Unknown	East Fork Catron Creek		-111.0648483	45.66872801	Surface Detention Facility	
52	DP.I06.00022	Unknown	West Fork Catron Creek		-111.0700399	45.66771909	Surface Detention Facility	
53	DP.I06.00040	Private	East Fork Catron Creek		-111.0647258	45.66911356	Surface Detention Facility	
54	DP.I06.00015	HOA - Bozeman Gateway	East Fork Catron Creek		-111.0644269	45.66767342	Surface Detention Facility	
55	DP.I06.00039	Private	East Fork Catron Creek		-111.0647318	45.67064369	Surface Detention Facility	
56	DP.J06.00038	HOA - Bozeman Gateway Subdivision	Cattail Creek		-111.08093	45.66769206	Surface Detention Facility	
57	DP.J06.00043	HOA - Bozeman Gateway Subdivision	Cattail Creek		-111.0803457	45.6703714	Surface Detention Facility	
58	DP.K06.00005	Unknown	Unnamed Ditch		-111.0831029	45.67137852	Surface Detention Facility	
59	DP.K06.00041	Unknown	Irrigation Ditch		-111.083716	45.67073639	Surface Detention Facility	
60	DP.K06.00042	Unknown	Irrigation Ditch		-111.0830459	45.66852333	Surface Detention Facility	
61	DP.M06.00003	HOA - Loyal Garden Subdivision	Baxter Creek	2016	-111.1059017	45.66987528	Surface Detention Facility	
62	DP.M06.00004	HOA - Loyal Garden Subdivision	Baxter Creek	2016	-111.1066521	45.67032476	Surface Detention Facility	

2020 Post-Construction
Facility Inventory

63	DP.M06.00005	HOA - Loyal Garden Subdivision	N/A	2016	-111.1085251	45.67069832	Surface Retention Facility	
64	DP.M06.00006	HOA - Loyal Garden Subdivision	N/A	2016	-111.1093507	45.67072429	Surface Retention Facility	
65	DP.M06.00007	Private	N/A		-111.1059412	45.67090816	Surface Detention Facility	
66	DP.M06.00001	HOA - Loyal Garden Subdivision	Baxter Creek	2016	-111.1051537	45.66753327	Surface Detention Facility	
67	DP.M06.00002	HOA - Loyal Garden Subdivision	Baxter Creek	2016	-111.1054452	45.6683132	Surface Detention Facility	
68	DP.B05.00002	Private	Rocky Creek Tributary		-110.9969105	45.67245306	Surface Retention Facility	
69	DP.B05.00003	Private	Rocky Creek Tributary		-110.997325	45.67251853	Surface Retention Facility	
70	DP.B05.00001	Private - West Paw	Rocky Creek Tributary		-110.9983108	45.67263864	Surface Detention Facility	
71	DP.C05.00001	Private	Rocky Creek Tributary		-111.0109285	45.67239734	Surface Detention Facility	
72	DP.C05.00002	Private	Rocky Creek Tributary		-111.0107691	45.67264482	Surface Detention Facility	
73	DP.C05.00003	Private	Rocky Creek Tributary		-111.0105642	45.67251727	Surface Detention Facility	
74	DP.E05.00015	Public - City of Bozeman	Rocky Creek Tributary		-111.0270014	45.67796258	Surface Detention Facility	
75	DP.H05.00003	Private	Mandeville Creek Tributary		-111.0585486	45.6746224	Surface Detention Facility	
76	DP.K05.00002	Private - Bozeman School District	West Gallatin Canal		-111.0867163	45.67815107	Surface Detention Facility	
77	DP.K05.00003	Private - Bozeman School District	West Gallatin Canal		-111.085834	45.67816496	Surface Detention Facility	
78	DP.K05.00004	Private	Maynard-Border Ditch Tributary		-111.0848853	45.67209559	Surface Detention Facility	
79	DP.K05.00005	Private	Unnamed Tributary		-111.0931661	45.67292013	Surface Detention Facility	
80	DP.K05.00043	Private	N/A		-111.0827777	45.6778214	Surface Retention Facility	
81	DP.L05.00001	HOA - Ferguson Farm	N/A		-111.1026042	45.67465461	Surface Retention Facility	
82	DP.L05.00035	HOA - Ridge	N/A		-111.0942125	45.67591581	Surface Retention Facility	
83	DP.L05.00017	Private - Cottonwood Condominiums	Maynard-Border Ditch	2019	-111.0993723	45.6750001	Surface Detention Facility	
84	DP.L05.00018	Unknown	Maynard-Border Ditch		-111.0992618	45.67470604	Surface Detention Facility	
85	DP.L05.00020	Private	Baxter Creek Tributary		-111.1036951	45.67478195	Surface Detention Facility	
86	DP.L05.00021	Private	Baxter Creek Tributary		-111.1031781	45.67388979	Surface Detention Facility	
87	DP.L05.00022	Unknown	N/A		-111.1037358	45.67825097	Surface Detention Facility	
88	DP.L05.00033	HOA - Ridge	N/A		-111.0959515	45.67533206	Surface Retention Facility	
89	DP.L05.00039	HOA - Cottonwood Condominiums	N/A	2019	-111.0975393	45.67693286	Surface Retention Facility	
90	DP.L05.00038	HOA - Cottonwood Condominiums	N/A	2019	-111.0972606	45.67712138	Surface Retention Facility	
91	DP.L05.00040	HOA - Cottonwood Condominiums	Maynard Border Ditch Tributary	2019	-111.0942061	45.67711491	Surface Detention Facility	
92	DP.L05.00037	HOA - Cottonwood Condominiums	N/A	2019	-111.0976984	45.6781919	Surface Retention Facility	
93	DP.L05.00036	HOA - Cottonwood Condominiums	N/A	2019	-111.0995294	45.67815477	Surface Retention Facility	
94	DP.L05.00041	Private - Icon Apts	N/A		-111.1001978	45.67830615	Surface Retention Facility	
95	DP.L05.00042	HOA - Cottonwood Condominiums	N/A	2019	-111.0996842	45.67830844	Surface Retention Facility	
96	DP.M05.00016	Unknown	Baxter Creek		-111.1086464	45.67825326	Surface Detention Facility	
97	DP.M05.00020	HOA - Norton Ranch Subdivision	Baxter Creek Tributary		-111.113157	45.67813402	Surface Detention Facility	
98	DP.M05.00022	Unknown	Baxter Creek		-111.1069749	45.67818071	Surface Detention Facility	
99	DP.M05.00023	HOA - Norton Ranch Subdivision	Baxter Creek Tributary		-111.1134586	45.67665632	Surface Detention Facility	
100	DP.M05.00026	HOA - Billion	N/A		-111.1045403	45.67473028	Surface Retention Facility	
101	DP.M05.00008	HOA - Billion	Baxter Creek		-111.1065725	45.67282155	Surface Detention Facility	
102	DP.H04.00006	Private - Bozeman School District	Mandeville Creek		-111.0521052	45.68463143	Surface Detention Facility	
103	DP.I04.00031	HOA - Brookside Subdivision	West Fork Catron Creek		-111.069764	45.67961575	Surface Detention Facility	
104	DP.I04.00032	HOA - West Babcock Subdivision	West Fork Catron Creek		-111.0696256	45.68193515	Surface Detention Facility	
105	DP.I04.00035	Private - Lessley Estates	N/A		-111.0681305	45.6820341	Surface Retention Facility	
106	DP.I04.00037	Private - Lessley Estates	N/A		-111.0683656	45.68206379	Surface Retention Facility	
107	DP.I04.00033	HOA - Brookside Subdivision	West Fork Catron Creek		-111.0704778	45.68021048	Surface Detention Facility	
108	DP.J04.00033	Private - Morgan Creek Condominiums	Cattail Creek		-111.0760524	45.68551372	Surface Detention Facility	
109	DP.J04.00034	Private - Morgan Creek Condominiums	Cattail Creek		-111.0756018	45.68548297	Surface Detention Facility	
110	DP.J04.00035	HOA - Greenway Subdivision	Cattail Creek		-111.0738351	45.68490129	Surface Detention Facility	
111	DP.J04.00049	HOA - Westgate Subdivision	N/A		-111.0751949	45.68191032	Surface Retention Facility	
112	DP.J04.00048	HOA - Glenwood Meadows Subdivision	N/A		-111.0745708	45.68195089	Surface Retention Facility	
113	DP.J04.00047	Private	N/A		-111.0733985	45.68193441	Surface Retention Facility	
114	DP.J04.00051	HOA - Westglen Subdivision	N/A		-111.0801566	45.68186391	Surface Retention Facility	
115	DP.J04.00050	HOA - Westglen Subdivision	N/A		-111.0775712	45.68190419	Surface Retention Facility	
116	DP.K04.00009	HOA - Ferguson Meadows Subdivision	Maynard-Border Ditch Tributary	2019	-111.0931106	45.68171751	Surface Detention Facility	
117	DP.K04.00007	HOA - Ferguson Meadows Subdivision	Maynard-Border Ditch Tributary	2019	-111.0930633	45.68377403	Surface Detention Facility	

2020 Post-Construction
Facility Inventory

118	DP.K04.00008	HOA - Ferguson Meadows Subdivision	Maynard-Border Ditch Tributary	2019	-111.0930317	45.68543558	Surface Detention Facility	
119	DP.K04.00006	HOA - Ferguson Meadows Subdivision	Maynard-Border Ditch Tributary	2019	-111.093256	45.6794285	Surface Detention Facility	
120	DP.K04.00019	HOA - Fowler Place Subdivision	N/A		-111.0829318	45.68541059	Surface Detention Facility	
121	DP.K04.00044	HOA - Valley Unit Subdivision	Maynard-Border Ditch Tributary		-111.0872696	45.68494672	Surface Detention Facility	
122	DP.K04.00045	HOA - Valley Unit Subdivision	Maynard-Border Ditch Tributary		-111.0873796	45.68413276	Surface Detention Facility	
123	DP.L04.00002	HOA - Valley West Subdivision	Unnamed Tributary		-111.1033541	45.68447822	Surface Detention Facility	
124	DP.L04.00003	HOA - Valley West Subdivision	Maynard-Border Ditch		-111.0981185	45.67963595	Surface Detention Facility	
125	DP.L04.00004	HOA - Valley West Subdivision	Maynard-Border Ditch		-111.0985669	45.67964989	Surface Detention Facility	
126	DP.L04.00005	HOA - Valley West Subdivision	Maynard-Border Ditch		-111.0987648	45.68110606	Surface Detention Facility	
127	DP.L04.00006	HOA - Valley West Subdivision	Maynard-Border Ditch Tributary		-111.0947291	45.68293814	Surface Detention Facility	
128	DP.L04.00008	HOA - Valley West Subdivision	Maynard-Border Ditch		-111.0985396	45.6831334	Surface Detention Facility	
129	DP.L04.00007	HOA - Valley West Subdivision	Maynard-Border Ditch Tributary		-111.0941283	45.6829334	Surface Detention Facility	
130	DP.L04.00009	HOA - Valley West Subdivision	Maynard-Border Ditch Tributary		-111.0943437	45.6855704	Surface Detention Facility	
131	DP.L04.00010	HOA - Valley West Subdivision	Maynard-Border Ditch Tributary		-111.0956465	45.68558747	Surface Detention Facility	
132	DP.L04.00011	HOA - Valley West Subdivision	Unnamed Tributary		-111.1029338	45.68558897	Surface Detention Facility	
133	DP.L04.00013	HOA - Valley West Subdivision	Unnamed Tributary		-111.1034408	45.68163995	Surface Detention Facility	
134	DP.L04.00014	HOA - Valley West Subdivision	Unnamed Tributary		-111.1028589	45.68163266	Surface Detention Facility	
135	DP.L04.00029	Private	Maynard-Border Ditch Tributary		-111.0964455	45.68552088	Surface Detention Facility	
136	DP.L04.00030	Private	Maynard-Border Ditch Tributary		-111.097251	45.68558298	Surface Detention Facility	
137	DP.L04.00031	HOA - Valley West Subdivision	Unnamed Tributary		-111.1004034	45.6855929	Surface Detention Facility	
138	DP.L04.00032	HOA - Valley West Subdivision	Unnamed Tributary		-111.1009832	45.68559527	Surface Detention Facility	
139	DP.M04.00018	Private	Baxter Creek Tributary		-111.1083266	45.68419196	Surface Detention Facility	
140	DP.M04.00021	Private	Baxter Creek Tributary		-111.1073006	45.68385415	Surface Detention Facility	
141	DP.G03.00001	Private	East Gallatin River Tributary		-111.0439601	45.6925932	Surface Detention Facility	
142	DP.G03.00045	Private	N/A		-111.0441764	45.68643495	Surface Retention Facility	
143	DP.H03.00012	HOA - Walton Homestead Residential Subdivision	Mandeville Creek Tributary	2019	-111.0564874	45.69029498	Surface Detention Facility	
144	DP.H03.00013	HOA - Walton Homestead Subdivision	Mandeville Creek Tributary		-111.0570782	45.69213634	Surface Detention Facility	
145	DP.H03.00014	HOA - Walton Homestead Subdivision	Mandeville Creek Tributary		-111.0567284	45.69205316	Surface Detention Facility	
146	DP.H03.00015	HOA - Walton Homestead Subdivision	Mandeville Creek Tributary		-111.0551691	45.69204895	Surface Detention Facility	
147	DP.H03.00016	HOA - Walton Homestead Subdivision	Mandeville Creek Tributary		-111.0572056	45.69283257	Surface Detention Facility	
148	DP.H03.00017	HOA - Oak Meadows Subdivision	Mandeville Creek Tributary		-111.0548264	45.69276992	Surface Detention Facility	
149	DP.K03.00013	HOA - Diamond Estates Subdivision	Maynard-Border Ditch Tributary		-111.0901977	45.68815894	Surface Detention Facility	
150	DP.K03.00047	HOA - Diamond Estates Subdivision	Maynard-Border Ditch Tributary		-111.0896902	45.69031414	Surface Detention Facility	
151	DP.K03.00015	HOA - Diamond Estates Subdivision	Maynard-Border Ditch Tributary		-111.0911028	45.69262427	Surface Detention Facility	
152	DP.K03.00016	HOA - Diamond Estates Subdivision	Maynard-Border Ditch Tributary		-111.0903296	45.69259167	Surface Detention Facility	
153	DP.K03.00018	Public - City of Bozeman	N/A		-111.0852218	45.69320372	Surface Retention Facility	
154	DP.K03.00007	Public - City of Bozeman	Maynard-Border Ditch Tributary		-111.0903545	45.68601493	Surface Detention Facility	
155	DP.K03.00008	HOA - Diamond Estates Subdivision	Maynard-Border Ditch Tributary		-111.0904375	45.68727027	Surface Detention Facility	
156	DP.K03.00009	HOA - Diamond Estates Subdivision	Maynard-Border Ditch Tributary		-111.0902954	45.68871106	Surface Detention Facility	
157	DP.K03.00010	HOA - Diamond Estates Subdivision	Maynard-Border Ditch Tributary		-111.090227	45.68905944	Surface Detention Facility	
158	DP.K03.00011	HOA - Diamond Estates Subdivision	Maynard-Border Ditch Tributary		-111.0899758	45.68917976	Surface Detention Facility	
159	DP.K03.00012	HOA - Diamond Estates Subdivision	Maynard-Border Ditch Tributary		-111.0899021	45.68957945	Surface Detention Facility	
160	DP.K03.00014	HOA - Diamond Estates Subdivision	Maynard-Border Ditch Tributary		-111.0899902	45.69076952	Surface Detention Facility	
161	DP.K03.00028	HOA - Annie Street Cottages	N/A		-111.0855236	45.68923748	Surface Retention Facility	
162	DP.K03.00046	HOA - Diamond Estates Subdivision	Maynard-Border Ditch Tributary		-111.0899091	45.69043551	Surface Detention Facility	
163	DP.L03.00012	Private	Maynard-Border Ditch Tributary		-111.0970536	45.68722873	Surface Detention Facility	
164	DP.M03.00010	HOA - Traditions Subdivision	Unnamed Tributary	2016	-111.107023	45.68776011	Surface Detention Facility	
165	DP.M03.00012	HOA - Boulder Creek Subdivision	Unnamed Tributary		-111.1134152	45.69015955	Surface Detention Facility	
166	DP.M03.00013	HOA - Traditions Subdivision	Unnamed Tributary	2016	-111.1079704	45.68944854	Surface Detention Facility	
167	DP.M03.00015	HOA - Traditions Subdivision	Unnamed Tributary	2016	-111.1088311	45.69080581	Surface Detention Facility	
168	DP.M03.00014	HOA - Traditions Subdivision	Unnamed Tributary	2016	-111.1082976	45.6906443	Surface Detention Facility	
169	DP.M03.00011	HOA - Flanders Creek Subdivision	Unnamed Tributary	2016	-111.1061895	45.68719841	Surface Detention Facility	
170	DP.M03.00029	Unknown	Unnamed Tributary		-111.1128962	45.69257551	Surface Detention Facility	

2020 Post-Construction
Facility Inventory

171	DP.M03.00030	HOA - Flanders Creek Subdivision	N/A	2016	-111.1059097	45.68900386	Surface Retention Facility	
172	DP.N03.00001	HOA - Laurel Glen Subdivision	Unnamed Tributary		-111.1182854	45.68591525	Surface Detention Facility	
173	DP.N03.00002	HOA - Laurel Glen Subdivision	Unnamed Tributary		-111.1188518	45.687375	Surface Detention Facility	
174	DP.N03.00004	HOA - Laurel Glen Subdivision	Unnamed Tributary		-111.11539	45.69250325	Surface Detention Facility	
175	DP.N03.00005	HOA - Laurel Glen Subdivision	Unnamed Tributary		-111.1191166	45.68845847	Surface Detention Facility	
176	DP.E02.00006	Public - City of Bozeman	East Gallatin River	2019	-111.0298343	45.69976732	Surface Detention Facility	
177	DP.G02.00018	Private	Mandeville Creek		-111.0507179	45.69626734	Surface Detention Facility	
178	DP.G02.00016	Unknown	Mandeville Creek		-111.0514797	45.69748026	Surface Detention Facility	
179	DP.G02.00021	Private	East Gallatin River Tributary		-111.0436335	45.69725203	Surface Detention Facility	
180	DP.G02.00023	Private	East Gallatin River Tributary		-111.0439098	45.69733543	Surface Detention Facility	
181	DP.G02.00003	Private	East Gallatin River Tributary		-111.0424681	45.69569932	Surface Detention Facility	
182	DP.G02.00017	Unknown	Mandeville Creek		-111.051156	45.69615129	Surface Detention Facility	
183	DP.G02.00047	Private	N/A		-111.0492216	45.69316051	Surface Detention Facility	
184	DP.G02.00048	Private	N/A		-111.0493057	45.6950094	Surface Detention Facility	
185	DP.G02.00049	Private	N/A		-111.0493289	45.69519923	Surface Detention Facility	
186	DP.H02.00001	Private - Kenyon Noble	Mandeville Creek		-111.052273	45.69501763	Surface Detention Facility	
187	DP.H02.00002	HOA - Bridger Peaks Town Center	Mandeville Creek Tributary		-111.0580846	45.69512997	Surface Detention Facility	
188	DP.H02.00007	HOA - Arrowleaf	Farmers Canal		-111.0575879	45.69953072	Surface Detention Facility	
189	DP.H02.00008	HOA - PT Land Phase 1	Mandeville Creek Tributary		-111.056571	45.69618171	Surface Detention Facility	
190	DP.H02.00009	HOA - PT Land Phase 1	Mandeville Creek Tributary		-111.0560933	45.69719046	Surface Detention Facility	
191	DP.H02.00010	Private	Mandeville Creek Tributary		-111.0570913	45.69497603	Surface Detention Facility	
192	DP.I02.00041	HOA - Stoneridge Subdivision	Catron Creek		-111.0663116	45.69610717	Surface Detention Facility	
193	DP.I02.00060	Private - Highgate	East Fork Catron Creek		-111.0655283	45.69392859	Surface Detention Facility	
194	DP.I02.00061	Private - Highgate	West Fork Catron Creek		-111.0668835	45.69379528	Surface Detention Facility	
195	DP.I02.00067	Unknown	N/A		-111.0677893	45.69651254	Surface Retention Facility	
196	DP.I02.00068	Unknown	N/A		-111.0680311	45.69677944	Surface Retention Facility	
197	DP.I02.00043	Unknown	N/A		-111.0703515	45.69995802	Surface Retention Facility	
198	DP.I02.00071	HOA - Stoneridge Subdivision	Catron Creek		-111.0657119	45.699766	Surface Detention Facility	
199	DP.I02.00042	HOA - Stoneridge Subdivision	Catron Creek		-111.0662062	45.69693965	Surface Detention Facility	
200	DP.J02.00006	HOA - West Winds Subdivision	Cattail Creek		-111.0765066	45.69647977	Surface Detention Facility	
201	DP.J02.00021	HOA - West Winds Subdivision	Cattail Creek		-111.0768394	45.69799757	Surface Detention Facility	
202	DP.J02.00020	HOA - West Winds Subdivision	Cattail Creek		-111.0769789	45.69547986	Surface Detention Facility	
203	DP.J02.00022	HOA - West Winds Subdivision	Cattail Creek		-111.0755507	45.69992447	Surface Detention Facility	
204	DP.J02.00029	Unknown	N/A		-111.0741282	45.70009681	Surface Retention Facility	
205	DP.J02.00046	HOA - West Winds Subdivision	Cattail Creek		-111.0790295	45.69996465	Surface Detention Facility	
206	DP.K02.00021	HOA - Baxter Meadow Subdivision	Unnamed Tributary		-111.0867493	45.70002608	Surface Detention Facility	
207	DP.K02.00023	HOA - Baxter Meadow Subdivision	Unnamed Tributary		-111.087924	45.69907012	Surface Detention Facility	
208	DP.K02.00025	Unknown	Maynard-Border Ditch Tributary		-111.0928335	45.69990603	Surface Detention Facility	
209	DP.K02.00026	Public - City of Bozeman	Unnamed Tributary		-111.0842763	45.69528388	Surface Detention Facility	
210	DP.K02.00027	Public - City of Bozeman	Unnamed Tributary		-111.0841666	45.69571289	Surface Detention Facility	
211	DP.K02.00022	HOA - Baxter Meadow Subdivision	Unnamed Tributary		-111.0887843	45.69989256	Surface Detention Facility	
212	DP.K02.00024	Unknown	Maynard-Border Ditch Tributary		-111.0924881	45.69995922	Surface Detention Facility	
213	DP.K02.00038	HOA - Baxter Meadows Subdivision	N/A		-111.0830903	45.69999367	Surface Retention Facility	
214	DP.C01.00005	HOA - Creekwood Subdivision	N/A		-111.0042639	45.70505383	Surface Retention Facility	
215	DP.C01.00006	HOA - Creekwood Subdivision	N/A		-111.0039291	45.70576709	Surface Retention Facility	
216	DP.D01.00004	HOA - Legends at Bridger Creek II Subdivision	N/A	2018	-111.0155507	45.70448053	Surface Retention Facility	
217	DP.D01.00005	HOA - Legends at Bridger Creek Subdivision	N/A	2018	-111.0199327	45.70557842	Surface Retention Facility	
218	DP.F01.00026	Private	East Gallatin River	2020	-111.0312965	45.70381179	Surface Detention Facility	
219	DP.I01.00044	Private - US Postal Service	N/A		-111.0681329	45.70178932	Surface Retention Facility	
220	DP.I01.00062	Unknown	N/A		-111.0685917	45.70735574	Surface Retention Facility	
221	DP.I01.00063	Unknown	N/A		-111.0694556	45.7072641	Surface Retention Facility	
222	DP.J01.00009	HOA - Baxter Square Subdivision	Cattail Creek		-111.0761317	45.7017672	Surface Detention Facility	
223	DP.J01.00010	Unknown	Cattail Creek		-111.0759882	45.70048863	Surface Detention Facility	
224	DP.J01.00052	HOA - Baxter Square Subdivision	Cattail Creek		-111.0760958	45.70220327	Surface Retention Facility	

2020 Post-Construction
Facility Inventory

225	DP.E00.00009	HOA - Bridger Creek Subdivision	East Gallatin River Tributary	2017	-111.0256877	45.70762684	Surface Detention Facility	
226	DP.G00.00022	HOA - Gallatin Park Subdivision	N/A		-111.0421572	45.70846956	Surface Detention Facility	
227	DP.I00.00064	HOA - Gallatin Center Subdivision	Catron Creek		-111.0685973	45.7083419	Surface Detention Facility	
228	DP.I00.00069	Private	Catron Creek		-111.0685364	45.71066178	Surface Detention Facility	
229	DP.I00.00070	Private - Target	Catron Creek		-111.0694719	45.71195403	Surface Detention Facility	
230	DP.I00.00078	Private - Bozeman Ford	N/A		-111.062922	45.70985314	Surface Detention Facility	
231	DP.I00.00079	Private	N/A		-111.0662782	45.71372808	Surface Retention Facility	
232	DP.J00.00011	HOA - Cattail Creek Subdivision	Cattail Creek	2016	-111.0780973	45.70893594	Surface Detention Facility	
233	DP.J00.00012	HOA - Cattail Creek Subdivision	Cattail Creek	2016	-111.0783969	45.70991136	Surface Detention Facility	
234	DP.J00.00013	HOA - Cattail Creek Subdivision	Cattail Creek	2016	-111.0774687	45.71049739	Surface Detention Facility	
235	DP.J00.00014	HOA - Cattail Creek Subdivision	Cattail Creek	2016	-111.07758	45.71226653	Surface Detention Facility	
236	DP.J00.00015	HOA - Cattail Creek Subdivision	Cattail Creek	2016	-111.0785376	45.71229898	Surface Detention Facility	
237	DP.J00.00016	HOA - Cattail Creek Subdivision	Cattail Creek	2016	-111.0780591	45.71422809	Surface Detention Facility	
238	DP.J00.00024	Private	Catron Creek Tributary		-111.071926	45.70959015	Surface Detention Facility	
239	DP.J00.00025	Private - Target	Catron Creek Tributary		-111.0719944	45.7119881	Surface Detention Facility	
240	DP.K50.00018	HOA - Cattail Lake Subdivision	Cattail Creek		-111.0822508	45.71738299	Surface Detention Facility	
241	DP.K50.00040	HOA - Cattail Lake Subdivision	Cattail Creek		-111.0822334	45.71903089	Surface Detention Facility	
242	DP.I51.00073	Public - City of Bozeman	East Gallatin River	2019	-111.0710232	45.72515794	Surface Detention Facility	
243	DP.I51.00074	Public - City of Bozeman	East Gallatin River	2019	-111.0693012	45.72420802	Surface Detention Facility	
244	DP.I51.00075	Public - City of Bozeman	East Gallatin River	2019	-111.0679366	45.72415316	Surface Detention Facility	
245	DP.I51.00076	Public - City of Bozeman	East Gallatin River	2019	-111.0670177	45.72398405	Surface Detention Facility	
246	DP.F07.00014	Private - South Town Square	Figgens Creek		-111.0395663	45.66017359	Surface Detention Facility	
247	DP.F07.00021	Private - South Town Square	N/A		-111.0412546	45.65975183	Surface Retention Facility	
248	DP.L01.00023	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.0985542	45.70274622	Surface Detention Facility	
249	DP.L01.00024	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.0989933	45.70139445	Surface Detention Facility	
250	DP.L01.00025	Private - Bozeman School District	Unnamed Tributary		-111.0964255	45.70527812	Surface Detention Facility	
251	DP.L01.00026	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.0951769	45.70450557	Surface Detention Facility	
252	DP.L01.00027	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.0994755	45.7051523	Surface Detention Facility	
253	DP.L01.00028	HOA - Baxter Meadows Subdivision	Maynard-Border Ditch		-111.0981836	45.70043583	Surface Detention Facility	
254	DP.L01.00034	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.1030606	45.7032875	Surface Retention Facility	
255	DP.I07.00012	Private	East Fork Catron Creek		-111.0656706	45.66240287	Surface Detention Facility	
256	DP.I07.00013	Private	East Fork Catron Creek		-111.0656598	45.66288401	Surface Detention Facility	
257	DP.I07.00014	Private	East Fork Catron Creek		-111.0654457	45.66298842	Surface Detention Facility	
258	DP.I07.00034	Private	N/A		-111.0640456	45.66117791	Surface Retention Facility	
259	DP.D05.00030	Private	Rocky Creek Tributary		-111.0158752	45.67168763	Surface Detention Facility	
260	DP.J50.00028	Unknown	N/A		-111.0736323	45.71592668	Surface Retention Facility	
261	DP.J50.00027	Unknown	N/A		-111.0741655	45.71610063	Surface Retention Facility	
262	DP.J50.00026	Unknown	N/A		-111.0735852	45.71759957	Surface Retention Facility	
263	DP.E07.00002	Unknown	Rocky Creek Tributary		-111.0262449	45.66295117	Surface Detention Facility	
264	DP.E07.00010	Unknown	Rocky Creek Tributary		-111.0267568	45.65886971	Surface Detention Facility	
265	DP.G01.00002	Private	East Gallatin River Tributary		-111.0435814	45.70169396	Surface Detention Facility	
266	DP.G01.00015	Private	East Gallatin River Tributary		-111.0438242	45.70325401	Surface Detention Facility	
267	DP.G01.00050	HOA - Gallatin Park Subdivision	N/A		-111.0434351	45.70727167	Surface Detention Facility	
268	DP.I05.00038	Private	N/A		-111.069099	45.67574577	Surface Detention Facility	
269	DP.I05.00036	Private	Mandeville Creek Tributary		-111.0623974	45.67764113	Surface Detention Facility	
270	DP.J05.00031	HOA - Babcock Meadows Subdivision	Cattail Creek		-111.0764641	45.67806187	Surface Detention Facility	
271	DP.J05.00036	HOA - Babcock Meadows Subdivision	Cattail Creek		-111.0766298	45.67679206	Surface Detention Facility	
272	DP.J05.00037	HOA - Babcock Meadows Subdivision	Cattail Creek		-111.0771398	45.67587724	Surface Detention Facility	
273	DP.J05.00042	Private	Unknown Tributary		-111.0819757	45.67822299	Surface Detention Facility	
274	DP.D04.00002	HOA - Parkland Sub	Rocky Creek Tributary		-111.0201275	45.68318511	Surface Detention Facility	
275	DP.E04.00005	HOA - Village Downtown Subdivision	Rocky Creek Tributary		-111.0245804	45.68076654	Surface Detention Facility	
276	DP.K01.00029	Private - Bozeman School District	Unnamed Tributary		-111.0934114	45.70711336	Surface Detention Facility	
277	DP.K01.00030	HOA - Four Points Subdivision	Unnamed Tributary		-111.0855476	45.70573554	Surface Detention Facility	
278	DP.K01.00032	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.089588	45.70375045	Surface Detention Facility	
279	DP.K01.00033	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.0891061	45.70418792	Surface Detention Facility	
280	DP.K01.00034	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.0895935	45.70446365	Surface Detention Facility	

2020 Post-Construction
Facility Inventory

281	DP.K01.00035	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.0893922	45.70265996	Surface Detention Facility	
282	DP.K01.00036	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.089523	45.70307511	Surface Detention Facility	
283	DP.K01.00037	HOA - Baxter Meadows Subdivision	Unnamed Tributary		-111.0893194	45.70132591	Surface Detention Facility	
284	DP.K01.00049	HOA - Four Points Subdivision	Unnamed Tributary		-111.0903056	45.70660532	Surface Detention Facility	
285	DP.K01.00050	HOA - Four Points Subdivision	Unnamed Tributary		-111.0903906	45.70715148	Surface Detention Facility	
286	DP.H07.00018	HOA - Stadium Center Subdivision	N/A		-111.0559582	45.66004145	Surface Retention Facility	
287	DP.H07.00019	HOA - Stadium Center Subdivision	N/A		-111.0547403	45.65963888	Surface Retention Facility	
288	DP.H07.00020	HOA - Stadium Center Subdivision	N/A		-111.0536713	45.65958515	Surface Retention Facility	
289	DP.H07.00021	HOA - Stadium Center Subdivision	N/A		-111.0536598	45.66003759	Surface Retention Facility	
290	DP.J03.00002	HOA - Harvest Creek Subdivision	Cattail Creek	2016	-111.0786349	45.69069313	Surface Detention Facility	
291	DP.J03.00003	HOA - Harvest Creek Subdivision	N/A	2016	-111.0781039	45.69273321	Surface Retention Facility	
292	DP.J03.00004	HOA - Harvest Creek Subdivision	Cattail Creek	2016	-111.0765807	45.69242614	Surface Detention Facility	
293	DP.J03.00008	HOA - Harvest Creek Subdivision	Cattail Creek	2016	-111.0762365	45.69245817	Surface Detention Facility	
294	DP.J03.00023	HOA - Harvest Creek Subdivision	Cattail Creek	2016	-111.0754432	45.68922381	Surface Detention Facility	
295	DP.J03.00030	HOA - Harvest Creek Subdivision	Cattail Creek	2016	-111.0752948	45.68887157	Surface Detention Facility	
296	DP.J03.00032	HOA - Harvest Creek Subdivision	Cattail Creek	2016	-111.0755441	45.6911628	Surface Detention Facility	
297	DP.J03.00040	HOA - Harvest Creek Subdivision	Cattail Creek	2016	-111.0746305	45.68780642	Surface Detention Facility	
298	DP.J03.00041	HOA - Harvest Creek Subdivision	Cattail Creek	2016	-111.0746503	45.68725736	Surface Detention Facility	
299	DP.J03.00001	HOA - Harvest Creek Subdivision	N/A	2016	-111.0807622	45.69272274	Surface Retention Facility	
300	DP.I03.00026	HOA - Annie Subdivision	West Fork Catron Creek		-111.0677365	45.68864963	Surface Detention Facility	
301	DP.I03.00027	Private - Bozeman School District	West Fork Catron Creek		-111.0683138	45.69100259	Surface Detention Facility	
302	DP.I03.00028	HOA - Durston Meadows Subdivision	Catron Creek Tributary		-111.0709686	45.69105814	Surface Detention Facility	
303	DP.I03.00029	Private	East Fork Catron Creek		-111.063538	45.68671656	Surface Detention Facility	
304	DP.I03.00045	Private	East Fork Catron Creek		-111.0641699	45.69124813	Surface Detention Facility	
305	DP.I03.00046	Private	East Fork Catron Creek		-111.0641562	45.69097065	Surface Detention Facility	
306	DP.I03.00047	Private	East Fork Catron Creek		-111.0641115	45.69076695	Surface Detention Facility	
307	DP.I03.00048	Private	East Fork Catron Creek		-111.06406	45.69053589	Surface Detention Facility	
308	DP.I03.00049	Private	East Fork Catron Creek		-111.063974	45.69022263	Surface Detention Facility	
309	DP.I03.00050	HOA - Brentwood Subdivision	East Fork Catron Creek		-111.0639385	45.68949846	Surface Detention Facility	
310	DP.I03.00051	Private	East Fork Catron Creek		-111.0636494	45.68941688	Surface Detention Facility	
311	DP.I03.00052	Private	East Fork Catron Creek		-111.0636969	45.68892988	Surface Detention Facility	
312	DP.I03.00053	Private	East Fork Catron Creek		-111.0637082	45.68848339	Surface Detention Facility	
313	DP.I03.00055	HOA - Brentwood Subdivision	East Fork Catron Creek		-111.0639048	45.68855711	Surface Detention Facility	
314	DP.I03.00056	Private	East Fork Catron Creek		-111.0638809	45.68804473	Surface Detention Facility	
315	DP.I03.00057	HOA - Brentwood Subdivision	East Fork Catron Creek		-111.0648711	45.69193035	Surface Detention Facility	
316	DP.I03.00058	Private	East Fork Catron Creek		-111.0645445	45.69260598	Surface Detention Facility	
317	DP.I03.00059	HOA - Brentwood Subdivision	East Fork Catron Creek		-111.0647488	45.69269586	Surface Detention Facility	
318	DP.I03.00065	HOA - Brentwood Subdivision	East Fork Catron Creek		-111.0643865	45.69227951	Surface Detention Facility	
319	DP.I03.00054	Private	East Fork Catron Creek		-111.063776	45.6886029	Surface Detention Facility	
320	DP.F04.00025	Private	Bozeman Creek		-111.0328419	45.67873979	Surface Detention Facility	
321	DP.I09.00001	HOA - Meadow Creek Subdivision	East Fork Catron Creek Tributary		-111.0706375	45.64319902	Surface Detention Facility	
322	DP.I09.00002	HOA - Southbridge Subdivision	East Fork Catron Creek	2019	-111.0644857	45.64311832	Surface Detention Facility	
323	DP.I09.00003	HOA - Southbridge Subdivision	East Fork Catron Creek Tributary	2019	-111.0679689	45.64480373	Surface Detention Facility	
324	DP.I09.00004	HOA - Meadow Creek Subdivision	East Fork Catron Creek Tributary		-111.0686522	45.64542115	Surface Detention Facility	
325	DP.I09.00005	HOA - Meadow Creek Subdivision	East Fork Catron Creek Tributary		-111.0687287	45.64577694	Surface Detention Facility	
326	DP.I09.00006	HOA - Meadow Creek Subdivision	East Fork Catron Creek Tributary		-111.0696595	45.64732962	Surface Detention Facility	
327	DP.I09.00019	HOA - Southbridge Subdivision	East Fork Catron Creek	2019	-111.0640983	45.64661274	Surface Detention Facility	
328	DP.I09.00024	HOA - Meadow Creek Subdivision	East Fork Catron Creek Tributary		-111.0699702	45.64775984	Surface Detention Facility	
329	DP.I09.00018	HOA - Southbridge Subdivision	East Fork Catron Creek	2019	-111.0638508	45.64520074	Surface Detention Facility	
330	DP.I09.00025	HOA - Southbridge Subdivision	East Fork Catron Creek	2019	-111.064304	45.64738806	Surface Detention Facility	
331	DP.I09.00007	HOA - Southbridge Subdivision	East Fork Catron Creek Tributary	2019	-111.0686247	45.64740072	Surface Detention Facility	
332	DP.I09.00021	Private - Hope Lutheran Church	East Fork Catron Creek		-111.0646941	45.64898663	Surface Detention Facility	
333	DP.I09.00077	Unknown	N/A		-111.0631442	45.64914042	Surface Retention Facility	
334	DP.M04.00009	HOA - Norton Ranch Subdivision	Baxter Creek Tributary		-111.1135868	45.67898385	Surface Detention Facility	
335	DP.F02.00001	Private	East Gallatin River Tributary		-111.0409406	45.69433934	Surface Retention Facility	
336	DP.L03.00017	HOA - Flanders Mill Subdivision	Maynard-Border Ditch		-111.0937208	45.69259768	Surface Retention Facility	

2020 Post-Construction
Facility Inventory

337	DP.J00.00017	HOA - Cattail Creek Subdivision	Cattail Creek	2016	-111.0787009	45.71434568	Surface Detention Facility	
338	DP.J50.00019	HOA - Cattail Lake Subdivision	Cattail Creek		-111.0816991	45.71762182	Surface Detention Facility	
339	DP.I10.00045	HOA - Southbridge Subdivision	East Fork Catron Creek	2019	-111.0646844	45.64225604	Surface Detention Facility	
340	DP.I08.00008	HOA - Meadow Creek Subdivision	East Fork Catron Creek Tributary		-111.0703302	45.64968637	Surface Detention Facility	
341	DP.I02.00066	Private - Highgate	West Fork Catron Creek		-111.0677343	45.69340539	Surface Detention Facility	
342	DP.E01.00007	HOA - Bridger Creek Subdivision	East Gallatin River	2019	-111.030743	45.70619535	Surface Detention Facility	
343	DP.J02.00048	HOA - West Winds Subdivision	Cattail Creek		-111.0813095	45.69997531	Surface Detention Facility	
344	DP.J02.00005	HOA - West Winds	Cattail Creek		-111.0768535	45.6932343	Surface Detention Facility	
345	DP.K05.00048	Private	N/A		-111.0823376	45.67207168	Surface Retention Facility	
346	DP.H01.00022	Private	N/A		-111.0617818	45.70094619	Surface Retention Facility	
347	DP.D05.00001	Private - Bozeman Health	Rocky Creek Tributary		-111.0179788	45.67135509	Surface Detention Facility	
348	DP.I50.00080	Private	N/A		-111.0668775	45.7147608	Surface Retention Facility	
349	DP.H06.00400	Public - Montana State University	Mandeville Creek	2019	-111.0534235	45.66780924	Surface Detention Facility	
350	DP.H05.00401	Private	Mandeville Creek Tributary		-111.0596872	45.6746274	Surface Detention Facility	
351	DP.H03.00403	HOA - Oak Meadows Subdivision	Mandeville Creek		-111.0526335	45.69275011	Surface Detention Facility	
352	DP.J00.00404	Private	N/A		-111.0762444	45.71245566	Surface Detention Facility	
353	DP.J05.00405	HOA - Babcock Meadows Subdivision	Cattail Creek		-111.0768594	45.67682221	Surface Detention Facility	
354	DP.I02.00406	Private - Bozeman Chamber of Commerce	Catron Creek		-111.064587	45.69970424	Surface Detention Facility	
355	DP.I04.00407	Private	N/A		-111.0620134	45.68045102	Surface Retention Facility	

2020 Outfall Inventory

Object ID	FacilityID	Owner Name	Diameter	Pipe Material	Easting	Northing	Terminus Type	Waterway	Discharge Type	Last Inspection	Last Flow	Last Determinatio	Comment
						Outfalls							
24	OF.E08.00406	City of Bozeman	18	CMP	-111.025954	45.65594066	Outfall	Bozeman Creek	Direct	7/11/2019	No	Unlikely	Major scour below outfall
116	OF.F05.00424	City of Bozeman	8	VCP	-111.032683	45.67830263	Outfall	Bozeman Creek	Direct	8/30/2019	No	Unlikely	
118	OF.F05.00412	City of Bozeman	8	VCP	-111.032092	45.67395175	Outfall	Bozeman Creek	Direct	7/24/2019	No	Unlikely	
119	OF.F05.00095	City of Bozeman	32	Concrete	-111.032255	45.67260757	Outfall	Bozeman Creek	Direct	7/24/2019	No	Unlikely	Open swale
121	OF.F05.00413	City of Bozeman	4	PVC	-111.032147	45.67413985	Outfall	Bozeman Creek	Direct	7/24/2019	No	Unlikely	11:40 am
122	OF.F05.00414	City of Bozeman	12	CMP	-111.032111	45.67465258	Outfall	Bozeman Creek	Direct	7/24/2019	No	Unlikely	
216	OF.E03.00450	City of Bozeman	30	RCP	-111.029862	45.68864044	Outfall	Bozeman Creek	Direct	7/7/2020	No	Unlikely	
217	OF.E03.00453	City of Bozeman	30	RCP	-111.030032	45.69156325	Outfall	Bozeman Creek	Direct	7/9/2020	No	Unlikely	
221	OF.F03.00446	City of Bozeman	43	RCP	-111.03117	45.68574985	Outfall	Bozeman Creek	Direct	7/7/2020	No	Unlikely	Added in 2020 as part of Rouse Ave. Reconstruction
222	OF.F03.00445	City of Bozeman	12	RCP	-111.031117	45.68568283	Outfall	Bozeman Creek	Direct	7/7/2020	No	Unlikely	
396	OF.E07.00097	City of Bozeman	15	RCP	-111.028492	45.6570649	Outfall	Bozeman Creek	Direct	7/11/2019	No	Unlikely	
519	OF.F04.00426	Private	12	PVC	-111.03276	45.67869234	Outfall	Bozeman Creek	Indirect	8/21/2019	No	Unlikely	
520	OF.F04.00441	City of Bozeman	42	RCP	-111.031997	45.6830849	Outfall	Bozeman Creek	Direct	7/7/2020	No	Unlikely	Replaced in 2020 during Rouse Reconstruction
956	OF.F05.00097	City of Bozeman	18	Steel	-111.032145	45.67395551	Outfall	Bozeman Creek	Direct	7/24/2019	No	Unlikely	
523	OF.F04.00439	City of Bozeman	15	RCP	-111.032144	45.68194126	Outfall	Bozeman Creek	Direct	8/6/2019	No	Unlikely	
526	OF.F04.00427	City of Bozeman	15	RCP	-111.032681	45.67882441	Outfall	Bozeman Creek	Direct	8/21/2019	No	Unlikely	Unknown origin
5772	OF.E03.00454	City of Bozeman	30	RCP	-111.029768	45.68870954	Outfall	Bozeman Creek	Direct	7/7/2020	No	Unlikely	
6974	OF.F03.00449	MDT	30	RCP	-111.031211	45.69269743	Outfall	Bozeman Creek	Direct	7/9/2020	No	Unlikely	Discharges to degraded swale.
7374	OF.F05.00426	City of Bozeman	15	PVC	-111.032032	45.67730013	Outfall	Bozeman Creek	Direct	8/21/2019	No	Unlikely	Installed during Olive St. Reconstruction
318	OF.I00.00155	Private	24	RCP	-111.068702	45.71067101	Outfall	Catron Creek	Indirect	8/6/2020	Trickle	Unlikely	
2156	OF.I51.00054	City of Bozeman	36	RCP	-111.072249	45.72350921	Outfall	Catron Creek	Direct	8/6/2020	No	Unlikely	WRF
319	OF.I00.00132	City of Bozeman	24	Ditch	-111.06886	45.71408242	Outfall	Catron Creek	Direct	8/6/2020	No	Unlikely	
320	OF.I00.00130	City of Bozeman	18	RCP	-111.068687	45.70777462	Outfall	Catron Creek	Direct	8/6/2020	No	Unlikely	
394	OF.J50.00240	Private	10	PVC	-111.078384	45.71458194	Outfall	Cattail Creek	Indirect	8/12/2020	No	Unlikely	
392	OF.J50.00239	Private	10	PVC	-111.078195	45.71459748	Outfall	Cattail Creek	Indirect	8/12/2020	No	Unlikely	
328	OF.K50.00483	City of Bozeman	12	PVC	-111.082206	45.71912668	Outfall	Cattail Creek	Indirect	8/12/2020	No	Unlikely	
321	OF.J00.00466	Private	16	RCP	-111.078024	45.70909841	Outfall	Cattail Creek	Indirect	8/12/2020	No	Unlikely	
322	OF.J00.00235	Private	10	PVC	-111.078042	45.71011069	Outfall	Cattail Creek	Indirect	8/12/2020	No	Unlikely	
323	OF.J00.00236	Private	18	RCP	-111.077642	45.71050344	Outfall	Cattail Creek	Indirect	8/12/2020	No	Unlikely	
312	OF.J01.00234	Private	12	PVC	-111.076229	45.70169996	Outfall	Cattail Creek	Indirect	8/18/2020	No	Unlikely	Pipe is completely buried and submerged
313	OF.J01.00233	Private	15	PVC	-111.076089	45.70055656	Outfall	Cattail Creek	Indirect	8/16/2020	No	Unlikely	
290	OF.J02.00232	Private	24	PVC	-111.075988	45.70009463	Outfall	Cattail Creek	Indirect	8/18/2020	Trickle	Unlikely	Sump flow
296	OF.J02.00648	Private	15	RCP	-111.076122	45.70005699	Outfall	Cattail Creek	Indirect	8/18/2020	No	Unlikely	
293	OF.J02.00228	Private	18	RCP	-111.076842	45.69559458	Outfall	Cattail Creek	Indirect	8/18/2020	No	Unlikely	
292	OF.J02.00230	Private	15	PVC	-111.076819	45.6965772	Outfall	Cattail Creek	Indirect	8/18/2020	No	Unlikely	
291	OF.J02.00231	Private	15	PVC	-111.077149	45.69841933	Outfall	Cattail Creek	Indirect	8/18/2020	No	Unlikely	
327	OF.J00.00238	Private	6	PVC	-111.078112	45.71248215	Outfall	Cattail Creek	Indirect	8/12/2020	No	Unlikely	Did not located in 2020. Buried.
324	OF.J00.00237	Private	Swale	Concrete	-111.077893	45.7124514	Outfall	Cattail Creek	Indirect	8/12/2020	No	Unlikely	
499	OF.I03.00139	Private	12	RCP	-111.064753	45.69287314	Outfall	East Fork Catron Creek	Indirect	12/10/2020	No	Unlikely	Buried
498	OF.I03.00138	Private	12	HDPE	-111.064658	45.69262577	Outfall	East Fork Catron Creek	Indirect	12/10/2020	No	Unlikely	
497	OF.I03.00140	Private	12	HDPE	-111.064583	45.69233514	Outfall	East Fork Catron Creek	Indirect	12/10/2020	No	Unlikely	
514	OF.I03.00141	Private	12	RCP	-111.064565	45.69194176	Outfall	East Fork Catron Creek	Indirect	12/10/2020	No	Unlikely	Buried
11382	OF.I03.00636	Private	6	PVC	-111.064487	45.6919123	Outfall	East Fork Catron Creek	Indirect	12/10/2020	No	Unlikely	
508	OF.I03.00484	Private	6	HDPE	-111.064299	45.69123105	Outfall	East Fork Catron Creek	Indirect	12/10/2020	No	Unlikely	Buried
496	OF.I03.00142	Private	8	PVC	-111.064282	45.69099367	Outfall	East Fork Catron Creek	Indirect	12/10/2020	No	Unlikely	
495	OF.I03.00143	Private	8	PVC	-111.064235	45.6908174	Outfall	East Fork Catron Creek	Indirect	12/10/2020	No	Unlikely	
494	OF.I03.00144	Private	8	PVC	-111.064166	45.69049893	Outfall	East Fork Catron Creek	Indirect	12/10/2020	No	Unlikely	
493	OF.I03.00145	Private	8	PVC	-111.064097	45.69027671	Outfall	East Fork Catron Creek	Indirect	12/10/2020	No	Unlikely	
515	OF.I03.00147	Private	12	RCP	-111.06395	45.68970075	Outfall	East Fork Catron Creek	Indirect	12/10/2020	No	Unlikely	Buried
492	OF.I03.00146	Private	10	HDPE	-111.063819	45.68942944	Outfall	East Fork Catron Creek	Indirect	12/10/2020	No	Unlikely	
491	OF.I03.00148	Private	8	PVC	-111.063784	45.68901755	Outfall	East Fork Catron Creek	Indirect	12/10/2020	No	Unlikely	
510	OF.I03.00149	Private	6	PVC	-111.063827	45.68868212	Outfall	East Fork Catron Creek	Indirect	12/10/2020	No	Unlikely	Major erosion below pipe
511	OF.I03.00150	Private	8	PVC	-111.063834	45.68851487	Outfall	East Fork Catron Creek	Indirect	12/10/2020	No	Unlikely	
516	OF.I03.00151	City of Bozeman	8	UNK	-111.063791	45.688427	Outfall	East Fork Catron Creek	Indirect	12/10/2020	No	Unlikely	Digitized. Not located.
13384	OF.E01.00062	City of Bozeman	30	RCP	-111.030553	45.70167105	Outfall	East Gallatin River	Direct	7/9/2020	No	Unlikely	
7776	OF.F02.00002	City of Bozeman	40	RCP	-111.030475	45.70001183	Outfall	East Gallatin River	Direct	7/9/2020	No	Unlikely	Added with Rouse Reconstruction
6174	OF.F01.00500	Private	8	PVC	-111.031062	45.70600595	Outfall	East Gallatin River	Indirect	7/9/2020	Moderate	Unlikely	Flow is from community sump drain system
329	OF.I51.00497	City of Bozeman	12	PVC	-111.066925	45.72404433	Outfall	East Gallatin River	Indirect	8/6/2020	No	Unlikely	WRF. Discharges to field
330	OF.I51.00499	City of Bozeman	15	PVC	-111.069372	45.72442063	Outfall	East Gallatin River	Indirect	8/6/2020	No	Unlikely	WRF
331	OF.I51.00500	City of Bozeman	16	PVC	-111.070946	45.72535139	Outfall	East Gallatin River	Indirect	8/6/2020	No	Unlikely	WRF
332	OF.I51.00498	City of Bozeman	12	PVC	-111.06839	45.72433804	Outfall	East Gallatin River	Indirect	8/6/2020	No	Unlikely	WRF
316	OF.G00.00472	Private	24	RCP	-111.042305	45.70853994	Outfall	East Gallatin River	Indirect	7/30/2020	No	Unlikely	Discharges to Cherry Creek Wetlands
302	OF.E01.00050	City of Bozeman	24	CMP	-111.029674	45.70016461	Outfall	East Gallatin River	Indirect	7/9/2020	No	Unlikely	
303	OF.E01.00051	City of Bozeman	12	CMP	-111.030276	45.70195357	Outfall	East Gallatin River	Direct	7/9/2020	No	Unlikely	
307	OF.F01.00636	City of Bozeman	18	PVC	-111.03133	45.70400127	Outfall	Esat Gallatin River	Indirect	7/30/2020	No	Unlikely	Discharges to wetland adjacent to EGR
334	OF.F07.00041	Private	12	HDPE	-111.039406	45.66003605	Outfall	Figgins Creek	Indirect	7/12/2019	No	Unlikely	
335	OF.F07.00078	City of Bozeman	15	RCP	-111.041138	45.65908024	Outfall	Figgins Creek	Direct	7/18/2019	No	Unlikely	
336	OF.F07.00079	City of Bozeman	15	RCP	-111.039218	45.65981519	Outfall	Figgins Creek	Direct	7/12/2019	No	Unlikely	
340	OF.F07.00637	City of Bozeman	8	Steel	-111.037697	45.66049592	Outfall	Figgins Creek	Direct	7/12/2019	No	Unlikely	Direct from inlet
7	OF.F09.00479	Private	12	PVC	-111.033714	45.64490571	Outfall	Flat Creek	Indirect	4/18/2019	No	Unlikely	
343	OF.F07.00667	City of Bozeman	15	RCP	-111.033176	45.66091379	Outfall	Flat Creek	Direct	7/18/2019	No	Unlikely	
348	OF.F07.00672	City of Bozeman	12	RCP	-111.032501	45.66260938	Outfall	Flat Creek	Direct	7/18/2019	No	Unlikely	Direct from 2 inlets
9	OF.F09.00062	City of Bozeman	12	PVC	-111.038706	45.64856987	Outfall	Mathew Bird Creek	Direct	4/18/2019	Moderate	Unlikely	Groundwater discharge
10	OF.F09.00633	Private	10	PVC	-111.038218	45.64497852	Outfall	Mathew Bird Creek	Indirect	4/18/2019	No	Unlikely	
353	OF.F07.00081	City of Bozeman	12	RCP	-111.035785	45.66113578	Outfall	Mathew Bird Creek	Direct	7/12/2019	No	Unlikely	
354	OF.F07.00083	City of Bozeman	12	RCP	-111.037152	45.66325145	Outfall	Mathew Bird Creek	Direct	7/12/2019	No	Unlikely	
355	OF.F07.00084	City of Bozeman	15	RCP	-111.037127	45.66326742	Outfall	Mathew Bird Creek	Direct	7/12/2019	No	Unlikely	
358	OF.F07.00695	City of Bozeman	6	Steel	-111.035098	45.65996028	Outfall	Mathew Bird Creek	Direct	7/12/2019	No	Unlikely	Direct from 2 inlets
373	OF.F06.00090	City of Bozeman	17	Steel	-111.034972	45.66911183	Outfall	Mathew Bird Creek	Direct	7/7/2020	No	Unlikely	
374	OF.F06.00088	City of Bozeman	16	CMP	-111.036239	45.66723236	Outfall	Mathew Bird Creek	Direct	7/19/2019	No	Unlikely	Need muck boots and flashlight.

2020 Outfall Inventory

375	OF.F06.00683	City of Bozeman	24	CMP	-111.036519	45.66727444	Outfall	Mathew Bird Creek	Direct	7/19/2019	Moderate	Unlikely	Direct from 2 inlets and private pond overflow
376	OF.F06.00091	City of Bozeman	12	RCP	-111.035897	45.6680604	Outfall	Mathew Bird Creek	Direct	7/19/2019	No	Unlikely	
377	OF.F06.00089	City of Bozeman	18	RCP	-111.034906	45.66927725	Outfall	Mathew Bird Creek	Direct	7/7/2020	Moderate	Unlikely	Sump flow
380	OF.F06.00087	City of Bozeman	15	RCP	-111.03685	45.6662942	Outfall	Mathew Bird Creek	Direct	7/19/2019	No	Unlikely	Actual location (GPS'd)
1356	OF.L01.00003	Private	12	HDPE	-111.099213	45.70474792	Outfall	Maynard Border Ditch	Indirect	9/1/2020	No	Unlikely	Mostly buried
1357	OF.L01.00004	Private	12	HDPE	-111.099121	45.70406836	Outfall	Maynard Border Ditch	Indirect	9/1/2020	No	Unlikely	
362	OF.L01.00002	Private	10	PVC	-111.098597	45.70143608	Outfall	Maynard Border Ditch	Indirect	9/1/2020	No	Unlikely	
363	OF.L01.00001	Private	6	PVC	-111.098728	45.70297212	Outfall	Maynard Border Ditch	Indirect	9/1/2020	No	Unlikely	
365	OF.L01.00615	Private	6	PVC	-111.098386	45.7004432	Outfall	Maynard Border Ditch	Indirect	9/1/2020	No	Unlikely	
366	OF.L01.00634	City of Bozeman	16	PVC	-111.098439	45.70041481	Outfall	Maynard Border Ditch	Indirect	9/1/2020	No	Unlikely	Partially submerged. Broken Pipe
368	OF.L01.00664	Private	13	HDPE	-111.099144	45.70514667	Outfall	Maynard Border Ditch	Indirect	9/1/2020	No	Unlikely	
393	OF.J50.00241	City of Bozeman	12	PVC	-111.081197	45.71732182	Outfall	Pond	Indirect	8/12/2020	No	Unlikely	
111	OF.E05.00101	City of Bozeman	18	RCP	-111.026818	45.67817427	Outfall	Story Ditch	Indirect	6/4/2020	No	Unlikely	Library
454	OF.E04.00109	MDT	24		-111.02528	45.67937115	Outfall	Story Ditch	Direct			Unlikely	
455	OF.E04.00108	MDT	24		-111.025239	45.67935827	Outfall	Story Ditch	Direct			Unlikely	
456	OF.E04.00226	City of Bozeman	15	UNK	-111.025133	45.68033824	Outfall	Story Ditch	Direct	6/4/2020	No	Unlikely	
457	OF.E04.00102	Private	18	PVC	-111.024686	45.68081453	Outfall	Story Ditch	Indirect	6/4/2020	No	Unlikely	Snow/ice build up
458	OF.E04.00105	Private	12	HDPE	-111.021993	45.68397689	Outfall	Story Ditch	Indirect	6/4/2020	No	Unlikely	Detention basin has been filled in by Simkins Hallin
459	OF.E04.00104	City of Bozeman	15	RCP	-111.022157	45.68396221	Outfall	Story Ditch	Direct	6/4/2020	No	Unlikely	Buried. Did not located in 2020.
460	OF.E04.00103	City of Bozeman	15	RCP	-111.024156	45.68241201	Outfall	Story Ditch	Direct	6/4/2020	No	Unlikely	Digitized
461	OF.E04.00225	City of Bozeman	10	RCP	-111.024779	45.68122799	Outfall	Story Ditch	Direct	6/4/2020	No	Unlikely	
4172	OF.K01.00269	Private	18	HDPE	-111.089488	45.70636452	Outfall	SWWW_00012	Indirect	8/20/2020	No	Unlikely	
468	OF.K01.00267	Private	12	HDPE	-111.090303	45.70723454	Outfall	SWWW_00012	Indirect	8/20/2020	Trickle	Unlikely	Groundwater flow
469	OF.K01.00268	Private	12	HDPE	-111.088978	45.7068737	Outfall	SWWW_00012	Indirect	8/20/2020	No	Unlikely	
466	OF.K01.00266	Private	15	RCP	-111.08939	45.70456964	Outfall	SWWW_00012	Indirect	8/20/2020	No	Unlikely	
463	OF.K01.00265	Private	14	HDPE	-111.089286	45.7044165	Outfall	SWWW_00012	Indirect	8/20/2020	Moderate	Unlikely	Groundwater from sump. No pollution indicators.
464	OF.K01.00264	Private	15	RCP	-111.089713	45.70328968	Outfall	SWWW_00012	Indirect	8/20/2020	No	Unlikely	
467	OF.K01.00263	City of Bozeman	12	CMP	-111.089546	45.70143791	Outfall	SWWW_00012	Indirect	8/20/2020	No	Unlikely	Buried. Draining pond full of groundwater.
15385	OF.K02.00273	Private	6	HDPE	-111.089414	45.6992594	Outfall	SWWW_00012	Indirect	8/18/2020	No	Unlikely	
298	OF.K02.00465	Private	24	HDPE	-111.089417	45.70000104	Outfall	SWWW_00012	Indirect	8/18/2020	No	Unlikely	
297	OF.K02.00262	Private	15	HDPE	-111.088017	45.69919614	Outfall	SWWW_00012	Indirect	8/18/2020	No	Unlikely	
6172	OF.K02.00271	Private	12	HDPE	-111.08694	45.69804435	Outfall	SWWW_00012	Indirect	8/18/2020	No	Unlikely	
15386	OF.K02.00272	Private	6	PVC	-111.085526	45.69635271	Outfall	SWWW_00012	Indirect	8/18/2020	No	Unlikely	
300	OF.K02.00270	City of Bozeman	12	HDPE	-111.084566	45.69574619	Outfall	SWWW_00012	Indirect	8/18/2020	No	Unlikely	Fire Station 3
11383	OF.I50.00002	Private	18	PVC	-111.071328	45.71465767	Outfall	SWWW_00014	Indirect	8/6/2020	No	Unlikely	
326	OF.J00.00133	Private	6	HDPE	-111.072136	45.71202852	Outfall	SWWW_00014	Indirect	8/6/2020	No	Unlikely	
53	OF.D07.00320	City of Bozeman	15	RCP	-111.012887	45.66148883	Outfall	SWWW_00037	Direct	6/27/2019	No	Unlikely	
16987	OF.D07.00329	City of Bozeman			-111.017575	45.66011089	Outfall	SWWW_00037	Direct				
16988	OF.D07.00328	City of Bozeman			-111.016828	45.66056959	Outfall	SWWW_00037	Direct				
52	OF.D07.00323	City of Bozeman	15	RCP	-111.017379	45.66193392	Outfall	SWWW_00039	Direct	6/27/2019	No	Unlikely	
54	OF.D07.00321	City of Bozeman	12	UNK	-111.012902	45.6632749	Outfall	SWWW_00039	Direct	6/27/2019	No	Unlikely	Buried
383	OF.D05.00327	City of Bozeman	21	RCP	-111.016106	45.67190819	Outfall	SWWW_00040	Indirect	6/27/2019	No	Unlikely	
356	OF.F07.00042	City of Bozeman	24	CMP	-111.040228	45.66090201	Outfall	SWWW_00046	Direct	7/19/2019	No	Unlikely	
357	OF.F07.00085	City of Bozeman	15	RCP	-111.037953	45.6639392	Outfall	SWWW_00046	Direct	7/12/2019	No	Unlikely	
364	OF.L01.00269	Private	36	RCP	-111.095806	45.70473047	Outfall	SWWW_00047	Indirect	9/1/2020	No	Unlikely	Outfall is mapped at the wrong location
367	OF.L01.00456	City of Bozeman	12	HDPE	-111.096776	45.70529317	Outfall	SWWW_00047	Indirect	9/1/2020	No	Unlikely	
231	OF.G03.00677	City of Bozeman	15	RCP	-111.048286	45.68552289	Outfall	SWWW_00053	Direct	7/30/2020	No	Unlikely	Terminus type needs updating
232	OF.G03.00676	City of Bozeman	48	RCP	-111.048346	45.6856231	Outfall	SWWW_00053	Direct	7/30/2020	No	Unlikely	Terminus type needs updating
160	OF.G04.00398	City of Bozeman	24	RCP	-111.048236	45.68309022	Outfall	SWWW_00053	Direct	7/8/2020	No	Unlikely	Terminus type needs updating
465	OF.K01.00462	Private	12	HDPE	-111.085647	45.70613442	Outfall	SWWW_00060	Indirect	8/20/2020	No	Unlikely	
361	OF.F07.00098	City of Bozeman	24	RCP	-111.031475	45.65753409	Outfall	SWWW_00064	Direct	7/11/2019	No	Unlikely	Direct to inlet
109	OF.C05.00333	Private	6	PVC	-111.010617	45.67260217	Outfall	SWWW_00065	Indirect	6/19/2019	No	Unlikely	Buried. Did not locate
110	OF.C05.00331	City of Bozeman	6	PVC	-111.01078	45.6725199	Outfall	SWWW_00065	Indirect	6/19/2019	No	Unlikely	Buried. Did not locate
104	OF.C05.00329	City of Bozeman	25	RCP	-111.010899	45.67219657	Outfall	SWWW_00065	Direct	6/19/2019	No	Unlikely	
106	OF.C05.00332	City of Bozeman	21	RCP	-111.010404	45.67191758	Outfall	SWWW_00065	Direct	6/19/2019	No	Unlikely	Direct from 2 inlets
107	OF.C05.00330	City of Bozeman	6	PVC	-111.01079	45.67248696	Outfall	SWWW_00065	Indirect	6/19/2019	No	Unlikely	Buried. Did not locate
384	OF.D05.00338	MDT	15	UNK	-111.016275	45.67753424	Outfall	SWWW_00065	Direct				
14184	OF.D05.00340	City of Bozeman	24	RCP	-111.016333	45.67745981	Outfall	SWWW_00065	Indirect	6/19/2019	Moderate	Unlikely	Flow is from sump
11381	OF.B06.00001	Private	8	PVC	-110.995771	45.67102819	Outfall	Unnamed Rocky Creek Tributary	Indirect	6/19/2019	No	Unlikely	
11380	OF.B05.00479	Private	10	PVC	-110.99578	45.67141042	Outfall	Unnamed Rocky Creek Tributary	Indirect	6/19/2019	No	Unlikely	
102	OF.B05.00477	City of Bozeman	6	UNK	-110.997293	45.67270033	Outfall	Unnamed Rocky Creek Tributary	Indirect				
20989	OF.B05.00480						Outfall	Unnamed Rocky Creek Tributary					
1	OF.F10.00475	City of Bozeman	12		-111.039241	45.63837696	Outfall						
2	OF.F10.00476	City of Bozeman	12		-111.039387	45.63893003	Outfall						
3	OF.F10.00044	City of Bozeman	18		-111.03363	45.6387045	Outfall						
6	OF.G10.00452	City of Bozeman	15		-111.044289	45.6369518	Outfall						
8	OF.F09.00481	Private	6		-111.033685	45.64490599	Outfall						
11	OF.F09.00065	City of Bozeman	12		-111.039541	45.64650326	Outfall						
14	OF.F09.00064	City of Bozeman	14		-111.03923	45.64748421	Outfall						Digitized, Nobody home ever
15	OF.G09.00029	City of Bozeman	24		-111.051519	45.64733469	Outfall						
16	OF.G09.00030	City of Bozeman	14		-111.051136	45.64805782	Outfall						
17	OF.G09.00031	City of Bozeman	14		-111.05104	45.6481347	Outfall						
18	OF.G09.00032	City of Bozeman	24		-111.050749	45.64856876	Outfall						
19	OF.G09.00033	City of Bozeman	14		-111.050754	45.64869693	Outfall						
20	OF.H09.00459	City of Bozeman	17		-111.0523	45.64773237	Outfall						
26	OF.F08.00063	City of Bozeman	24		-111.037538	45.65015466	Outfall						
27	OF.F08.00069	City of Bozeman	24		-111.037462	45.65298195	Outfall						
28	OF.F08.00067	City of Bozeman	14		-111.037998	45.6524299	Outfall						
29	OF.F08.00068	City of Bozeman	6		-111.037296	45.65511435	Outfall						Digitized because inside structure
34	OF.G08.00037	City of Bozeman	4		-111.044001	45.65643203	Outfall						
35	OF.G08.00451	City of Bozeman	14		-111.049442	45.65656452	Outfall						
38	OF.G08.00036	City of Bozeman	4		-111.044054	45.6562162	Outfall						
39	OF.G08.00040	City of Bozeman	2		-111.044038	45.65626928	Outfall						

2020 Outfall Inventory

40	OF.G08.00035	City of Bozeman	30		-111.043537	45.65678491	Outfall						
41	OF.G08.00034	City of Bozeman	4		-111.044877	45.65596918	Outfall						Digitized because buried
42	OF.G08.00039	City of Bozeman	4		-111.043728	45.65646314	Outfall						Digitized because buried
43	OF.G08.00038	City of Bozeman	4		-111.044405	45.65619269	Outfall						
44	OF.I08.00182	City of Bozeman	12		-111.069708	45.65099521	Outfall						.
45	OF.I08.00181	City of Bozeman	13		-111.069023	45.6528855	Outfall						
46	OF.I08.00180	Oracle	6		-111.068433	45.65421443	Outfall						
47	OF.I08.00179	Oracle	6		-111.068559	45.65466534	Outfall						.
48	OF.I08.00178	City of Bozeman	10		-111.065257	45.65626328	Outfall						
49	OF.D07.00322	City of Bozeman	6		-111.016897	45.66206573	Outfall						
66	OF.H06.00189	City of Bozeman	12		-111.055268	45.66510278	Outfall						
68	OF.H06.00016	City of Bozeman	18		-111.054675	45.66560515	Outfall						Digitized
70	OF.H06.00018	City of Bozeman	24		-111.053979	45.66714947	Outfall						Digitized
71	OF.H06.00019	City of Bozeman	4		-111.053922	45.66716323	Outfall						Digitized
72	OF.H06.00020	City of Bozeman	10		-111.054068	45.66743875	Outfall						Digitized
73	OF.H06.00021	City of Bozeman	8		-111.054128	45.66795915	Outfall						Digitized
75	OF.H06.00023	City of Bozeman	16		-111.053761	45.66905381	Outfall						Digitized
77	OF.H06.00025	City of Bozeman	16		-111.053506	45.67015073	Outfall						Digitized
78	OF.H06.00026	City of Bozeman	16		-111.053445	45.67028909	Outfall						Digitized
80	OF.H06.00028	City of Bozeman	16		-111.053141	45.67090436	Outfall						Digitized
81	OF.I06.00200	City of Bozeman	14		-111.070024	45.66789728	Outfall						
82	OF.I06.00199	City of Bozeman	14		-111.064524	45.6677315	Outfall						
83	OF.I06.00160	City of Bozeman	8		-111.064615	45.6687217	Outfall						
84	OF.I06.00163	City of Bozeman	15		-111.064707	45.67125885	Outfall						
86	OF.I06.00698	City of Bozeman			-111.064545	45.66916257	Outfall						
87	OF.I06.00162	City of Bozeman	8		-111.064596	45.6707878	Outfall						
88	OF.I06.00161	City of Bozeman	24		-111.064555	45.66911317	Outfall						Digitized
89	OF.J06.00201	City of Bozeman	15		-111.08095	45.66783888	Outfall						
90	OF.J06.00203	City of Bozeman	12		-111.080251	45.67039915	Outfall						
92	OF.J06.00205	City of Bozeman	12		-111.079744	45.6706587	Outfall						
93	OF.K06.00202	City of Bozeman	14		-111.083115	45.66861409	Outfall						
94	OF.K06.00243	City of Bozeman	22		-111.083775	45.67084611	Outfall						
95	OF.K06.00242	City of Bozeman	15		-111.083794	45.67082128	Outfall						15 inch pvc
96	OF.M06.00013	City of Bozeman	12		-111.105401	45.66853169	Outfall						
97	OF.M06.00014	City of Bozeman	12		-111.10507	45.66770271	Outfall						
98	OF.M06.00009	City of Bozeman	12		-111.106155	45.67092423	Outfall						
99	OF.M06.00011	City of Bozeman	12		-111.106115	45.67038076	Outfall						
100	OF.M06.00012	City of Bozeman	12		-111.106145	45.6703897	Outfall						
129	OF.H05.00371	City of Bozeman	15		-111.052006	45.67237417	Outfall						
130	OF.H05.00378	City of Bozeman	12		-111.051963	45.67330816	Outfall						
131	OF.H05.00381	City of Bozeman	12		-111.051925	45.67429502	Outfall						
132	OF.H05.00384	City of Bozeman	12		-111.051888	45.67528184	Outfall						
138	OF.H05.00377	City of Bozeman	15		-111.051963	45.67330816	Outfall						
139	OF.K05.00246	City of Bozeman	24		-111.086179	45.67814434	Outfall						
140	OF.K05.00245	City of Bozeman	14		-111.085871	45.67809937	Outfall						
141	OF.K05.00244	City of Bozeman	6		-111.085163	45.67204642	Outfall						
142	OF.K05.00482	City of Bozeman	12		-111.083243	45.67172753	Outfall						
143	OF.K05.00655	City of Bozeman			-111.08618	45.6783253	Outfall						
144	OF.K05.00656	City of Bozeman			-111.086211	45.67844214	Outfall						
146	OF.L05.00489	City of Bozeman	12		-111.098934	45.67504509	Outfall						
147	OF.L05.00488	City of Bozeman	12		-111.103053	45.67389155	Outfall						
148	OF.L05.00487	City of Bozeman	12		-111.103837	45.67803345	Outfall						
150	OF.L05.00485	City of Bozeman	6		-111.103511	45.67478515	Outfall						Digitized because buried
151	OF.M05.00614	City of Bozeman			-111.113605	45.67704671	Outfall						
153	OF.M05.00289	City of Bozeman	14		-111.104426	45.67831902	Outfall						
154	OF.M05.00004	City of Bozeman	14		-111.107909	45.6782815	Outfall						
155	OF.M05.00005	City of Bozeman	14		-111.108126	45.67827498	Outfall						
156	OF.M05.00006	City of Bozeman	14		-111.107707	45.67508606	Outfall						
157	OF.M05.00008	City of Bozeman	10		-111.106834	45.67285281	Outfall						
158	OF.M05.00474	City of Bozeman	14		-111.113572	45.67820853	Outfall						
159	OF.G04.00045	City of Bozeman	18		-111.051609	45.68468207	Outfall						
162	OF.H04.00454	City of Bozeman	48		-111.051689	45.68202987	Outfall						.
164	OF.H04.00455	City of Bozeman	12		-111.051805	45.67953905	Outfall						
165	OF.H04.00696	City of Bozeman			-111.051668	45.68147307	Outfall						
167	OF.I04.00661	City of Bozeman			-111.064743	45.68227966	Outfall						
171	OF.I04.00473	City of Bozeman	12		-111.069719	45.68204269	Outfall						Snow/ice build up
172	OF.I04.00686	City of Bozeman			-111.070145	45.68063027	Outfall						Digitized
175	OF.I04.00115	City of Bozeman	12		-111.070057	45.67991256	Outfall						
176	OF.I04.00688	City of Bozeman			-111.070293	45.68023815	Outfall						
177	OF.I04.00117	City of Bozeman	15		-111.069305	45.68228628	Outfall						
178	OF.I04.00701	City of Bozeman			-111.062233	45.68129819	Outfall						
180	OF.J04.00214	City of Bozeman	14		-111.073919	45.68519917	Outfall						
181	OF.K04.00457	City of Bozeman	12		-111.093406	45.67942102	Outfall						
182	OF.K04.00272	City of Bozeman	8		-111.093332	45.68174724	Outfall						
183	OF.K04.00274	City of Bozeman	8		-111.0933	45.68380641	Outfall						
184	OF.K04.00275	City of Bozeman	8		-111.09328	45.68547083	Outfall						
185	OF.K04.00397	City of Bozeman	18		-111.087713	45.68399563	Outfall						
186	OF.K04.00271	City of Bozeman	27		-111.093444	45.67865965	Outfall						
187	OF.K04.00396	City of Bozeman	24		-111.083242	45.68300503	Outfall						
188	OF.K04.00248	City of Bozeman	15		-111.087699	45.685636	Outfall						
190	OF.K04.00650	City of Bozeman			-111.088327	45.68563699	Outfall						
191	OF.K04.00651	City of Bozeman			-111.089403	45.68564133	Outfall						
193	OF.K04.00653	City of Bozeman			-111.090399	45.68563629	Outfall						

2020 Outfall Inventory

194	OF.K04.00654	City of Bozeman			-111.090399	45.68563629	Outfall						
195	OF.K04.00273	City of Bozeman	18		-111.093304	45.68374785	Outfall						
196	OF.L04.00460	City of Bozeman	10		-111.098148	45.67977063	Outfall						
197	OF.L04.00461	City of Bozeman	10		-111.098497	45.6797294	Outfall						
198	OF.L04.00003	City of Bozeman	14		-111.09838	45.68120492	Outfall						
199	OF.L04.00469	City of Bozeman	12		-111.098751	45.68322112	Outfall						12 inch
200	OF.L04.00277	City of Bozeman	14		-111.094847	45.68545494	Outfall						
201	OF.L04.00278	City of Bozeman	14		-111.095952	45.68551163	Outfall						
202	OF.L04.00276	City of Bozeman	36		-111.093783	45.68538934	Outfall						
203	OF.L04.00279	City of Bozeman	24		-111.096313	45.68556789	Outfall						
207	OF.M04.00285	City of Bozeman	10		-111.108518	45.684292	Outfall						
208	OF.M04.00284	City of Bozeman	14		-111.108034	45.68381966	Outfall						
209	OF.M04.00467	City of Bozeman	24		-111.104211	45.68454183	Outfall						
210	OF.M04.00287	City of Bozeman	15		-111.104346	45.67865057	Outfall						
211	OF.M04.00290	City of Bozeman	24		-111.114099	45.67923396	Outfall						
212	OF.M04.00468	City of Bozeman	24		-111.104306	45.6816826	Outfall						
214	OF.E03.00447	City of Bozeman	15		-111.030671	45.68664936	Outfall						
233	OF.G03.00046	City of Bozeman	16		-111.051247	45.68571423	Outfall						
234	OF.G03.00687	City of Bozeman			-111.049334	45.69243223	Outfall						
237	OF.K03.00256	City of Bozeman	21		-111.089766	45.69044652	Outfall						
238	OF.K03.00250	City of Bozeman	15		-111.090406	45.68768275	Outfall						
239	OF.K03.00249	City of Bozeman	15		-111.090431	45.68615275	Outfall						
240	OF.K03.00251	City of Bozeman	15		-111.090287	45.68838817	Outfall						
241	OF.K03.00252	City of Bozeman	15		-111.090228	45.68870214	Outfall						
242	OF.K03.00253	City of Bozeman	14		-111.090132	45.68910511	Outfall						
243	OF.K03.00254	City of Bozeman	17		-111.090032	45.68943108	Outfall						
244	OF.K03.00255	City of Bozeman	15		-111.089925	45.68981043	Outfall						
245	OF.K03.00258	City of Bozeman	16		-111.08989	45.69082615	Outfall						
246	OF.K03.00259	City of Bozeman	23		-111.090813	45.69270449	Outfall						
247	OF.K03.00260	City of Bozeman	12		-111.090985	45.69264069	Outfall						
249	OF.K03.00257	City of Bozeman	14		-111.089802	45.69044949	Outfall						
251	OF.L03.00280	City of Bozeman	8		-111.096888	45.68740085	Outfall						
253	OF.M03.00293	City of Bozeman	15		-111.108548	45.6908557	Outfall						
254	OF.M03.00294	City of Bozeman	14		-111.108558	45.69084899	Outfall						
255	OF.M03.00292	City of Bozeman	14		-111.108037	45.6897476	Outfall						
256	OF.M03.00464	City of Bozeman	18		-111.106866	45.68800487	Outfall						
257	OF.M03.00007	City of Bozeman	15		-111.112962	45.6903552	Outfall						
259	OF.M03.00291	City of Bozeman	6		-111.107112	45.68868835	Outfall						
260	OF.N03.00299	City of Bozeman	14		-111.119114	45.68855279	Outfall						
261	OF.N03.00297	City of Bozeman	14		-111.118663	45.68759335	Outfall						
262	OF.N03.00296	City of Bozeman	14		-111.118149	45.68601777	Outfall						
263	OF.N03.00298	City of Bozeman	14		-111.119086	45.6891027	Outfall						
264	OF.N03.00300	City of Bozeman	22		-111.115736	45.69288544	Outfall						
275	OF.H02.00054	City of Bozeman	16		-111.05689	45.69653448	Outfall						
276	OF.H02.00056	City of Bozeman	12		-111.056751	45.69947859	Outfall						
277	OF.G08.00066	City of Bozeman			-111.057602	45.70006309	Outfall						
278	OF.H02.00641	City of Bozeman			-111.051587	45.69596233	Outfall						
279	OF.H02.00369	City of Bozeman	30		-111.057878	45.69322778	Outfall						
280	OF.H02.00049	City of Bozeman	8		-111.051927	45.69765048	Outfall						
281	OF.H02.00055	City of Bozeman	14		-111.056095	45.69747471	Outfall						
282	OF.H02.00490	City of Bozeman	12		-111.057142	45.69508567	Outfall						
283	OF.I02.00137	City of Bozeman	12		-111.065383	45.69411246	Outfall						
284	OF.I02.00124	City of Bozeman	16		-111.067848	45.69363939	Outfall						
285	OF.I02.00126	City of Bozeman	12		-111.066642	45.69637437	Outfall						
287	OF.I02.00127	City of Bozeman	15		-111.066249	45.69778113	Outfall						
288	OF.I02.00125	City of Bozeman	12		-111.067515	45.69414204	Outfall						
289	OF.I02.00301	City of Bozeman	24		-111.066055	45.70007823	Outfall						
295	OF.J02.00227	City of Bozeman	14		-111.076679	45.69337168	Outfall						
299	OF.K02.00261	City of Bozeman	6		-111.092691	45.69997899	Outfall						
309	OF.I01.00128	City of Bozeman	15		-111.068719	45.70753613	Outfall						
311	OF.I01.00624	City of Bozeman			-111.069553	45.7002378	Outfall						
317	OF.I00.00131	City of Bozeman	12		-111.068709	45.70838233	Outfall						
370	OF.I07.00175	City of Bozeman	12		-111.065556	45.6625566	Outfall						
371	OF.I07.00176	City of Bozeman	8		-111.065541	45.66287193	Outfall						
372	OF.I07.00177	City of Bozeman	8		-111.065552	45.66299775	Outfall						
406	OF.I05.00114	City of Bozeman	18		-111.06994	45.67838297	Outfall						
407	OF.I05.00111	City of Bozeman	18		-111.069965	45.67836471	Outfall						
408	OF.I05.00342	City of Bozeman	12		-111.062505	45.67249277	Outfall						
409	OF.I05.00340	City of Bozeman	12		-111.062505	45.67249277	Outfall						
410	OF.I05.00341	City of Bozeman	32X24		-111.062505	45.67249277	Outfall						
411	OF.I05.00343	City of Bozeman	12		-111.062502	45.67291733	Outfall						
412	OF.I05.00344	City of Bozeman	32X24		-111.062502	45.67291733	Outfall						
413	OF.I05.00347	City of Bozeman	12		-111.0625	45.67318235	Outfall						
414	OF.I05.00345	City of Bozeman	12		-111.0625	45.67318235	Outfall						
415	OF.I05.00346	City of Bozeman	32X24		-111.0625	45.67318235	Outfall						
416	OF.I05.00348	City of Bozeman	12		-111.062491	45.67442854	Outfall						
417	OF.I05.00349	City of Bozeman	32X24		-111.062491	45.67442854	Outfall						
418	OF.I05.00350	City of Bozeman	12		-111.062486	45.67514493	Outfall						
419	OF.I05.00351	City of Bozeman	32X24		-111.062486	45.67514493	Outfall						
420	OF.I05.00352	City of Bozeman	12		-111.062478	45.6762749	Outfall						
421	OF.I05.00353	City of Bozeman	32X24		-111.062478	45.6762749	Outfall						
422	OF.I05.00354	City of Bozeman	12		-111.062472	45.67717286	Outfall						
423	OF.I05.00355	City of Bozeman	32X24		-111.062472	45.67717286	Outfall						

2020 Outfall Inventory

424	OF.I05.00356	City of Bozeman	15		-111.062476	45.67737605	Outfall						
425	OF.I05.00359	City of Bozeman	6		-111.062469	45.67769563	Outfall						
426	OF.I05.00358	City of Bozeman	32X24		-111.062469	45.67769563	Outfall						
427	OF.I05.00357	City of Bozeman	12		-111.062469	45.67769563	Outfall						
428	OF.I05.00360	City of Bozeman	12		-111.062479	45.6783533	Outfall						
429	OF.I05.00361	City of Bozeman	12		-111.062479	45.6783533	Outfall						
430	OF.I05.00170	City of Bozeman	12		-111.065185	45.67851064	Outfall						
431	OF.I05.00678	City of Bozeman			-111.065185	45.67851064	Outfall						
433	OF.I05.00685	MDT			-111.069065	45.67654617	Outfall						
434	OF.I05.00156	City of Bozeman	4		-111.068992	45.67574643	Outfall						
435	OF.I05.00112	City of Bozeman	18		-111.069965	45.67836471	Outfall						digitized
439	OF.J05.00211	City of Bozeman	12		-111.076439	45.67816006	Outfall						
440	OF.J05.00208	City of Bozeman	20		-111.077124	45.67606085	Outfall						
441	OF.J05.00626	City of Bozeman			-111.081931	45.67848691	Outfall						
442	OF.J05.00213	City of Bozeman	15		-111.07565	45.67851371	Outfall						
443	OF.J05.00212	City of Bozeman	15		-111.075795	45.67846429	Outfall						
444	OF.J05.00395	City of Bozeman	6		-111.081839	45.6783082	Outfall						
445	OF.J05.00658	City of Bozeman			-111.08194	45.67844013	Outfall						
446	OF.J05.00659	City of Bozeman			-111.075841	45.67826923	Outfall						
447	OF.J05.00660	City of Bozeman			-111.0758	45.67844046	Outfall						
448	OF.J05.00207	City of Bozeman	24		-111.077844	45.67471599	Outfall						
449	OF.J05.00206	City of Bozeman	20		-111.077829	45.67471287	Outfall						
450	OF.J05.00209	City of Bozeman	12		-111.076638	45.67696519	Outfall						
451	OF.J05.00210	City of Bozeman	12		-111.076712	45.67687518	Outfall						
452	OF.D04.00106	City of Bozeman	18		-111.019584	45.68295427	Outfall						
453	OF.D04.00319	City of Bozeman	15		-111.018257	45.67919676	Outfall						Digitized because buried
471	OF.F07.00084	City of Bozeman			-111.054955	45.66404988	Outfall						
474	OF.H06.00189	City of Bozeman	12		-111.05493	45.66405025	Outfall						
475	OF.H07.00190	City of Bozeman	24		-111.05493	45.66405025	Outfall						
476	OF.J03.00224	City of Bozeman	8		-111.076386	45.69273838	Outfall						
477	OF.J03.00223	City of Bozeman	8		-111.076369	45.69269248	Outfall						
478	OF.J03.00219	City of Bozeman	8		-111.075373	45.68927382	Outfall						
479	OF.J03.00221	City of Bozeman	8		-111.076104	45.69117675	Outfall						
480	OF.J03.00220	City of Bozeman	7		-111.075754	45.69115157	Outfall						
481	OF.J03.00217	City of Bozeman	8		-111.074687	45.68787837	Outfall						
482	OF.J03.00216	City of Bozeman	8		-111.074583	45.68727379	Outfall						
483	OF.J03.00215	City of Bozeman	18		-111.074528	45.68616247	Outfall						
484	OF.J03.00222	City of Bozeman	27		-111.076302	45.69124617	Outfall						
485	OF.J03.00218	City of Bozeman	8		-111.075167	45.68894486	Outfall						
486	OF.J03.00691	City of Bozeman			-111.076299	45.69299563	Outfall						
487	OF.I03.00120	City of Bozeman	15		-111.067652	45.68888027	Outfall						
488	OF.I03.00123	City of Bozeman	12		-111.068079	45.69115792	Outfall						
490	OF.I03.00153	City of Bozeman	12		-111.063439	45.68668768	Outfall						
500	OF.I03.00635	City of Bozeman			-111.06342	45.68595741	Outfall						
501	OF.I03.00154	City of Bozeman	15		-111.06345	45.68595521	Outfall						
502	OF.I03.00367	MDT	12		-111.062223	45.6928969	Outfall						
503	OF.I03.00366	MDT	12		-111.062223	45.6928969	Outfall						
504	OF.I03.00365	City of Bozeman	12		-111.062101	45.69008448	Outfall						
506	OF.I03.00363	City of Bozeman	24		-111.062033	45.68871429	Outfall						
509	OF.I03.00152	City of Bozeman	6		-111.063805	45.68796863	Outfall						
512	OF.I03.00118	City of Bozeman	15		-111.067189	45.68581808	Outfall						digitized
513	OF.I03.00119	City of Bozeman	24		-111.067211	45.68581774	Outfall						digitized
537	OF.I09.00186	City of Bozeman	12		-111.07108	45.64356956	Outfall						
538	OF.I09.00183	City of Bozeman	12		-111.068509	45.64594277	Outfall						
539	OF.I09.00184	City of Bozeman	12		-111.068388	45.64549192	Outfall						
540	OF.I09.00193	City of Bozeman	13		-111.068087	45.64507833	Outfall						
541	OF.I09.00471	City of Bozeman	12		-111.069389	45.64740338	Outfall						
542	OF.I09.00470	City of Bozeman	12		-111.070016	45.6480098	Outfall						
543	OF.I09.00185	City of Bozeman	12		-111.068991	45.64744832	Outfall						
544	OF.I09.00191	City of Bozeman	18		-111.064195	45.64896186	Outfall						
545	OF.I09.00198	City of Bozeman	12		-111.06415	45.64751187	Outfall						
546	OF.I09.00196	City of Bozeman	12		-111.064148	45.64314662	Outfall						
547	OF.I09.00195	City of Bozeman	12		-111.063565	45.64505419	Outfall						
548	OF.I09.00194	City of Bozeman	12		-111.063779	45.64555247	Outfall						
549	OF.I09.00197	City of Bozeman	12		-111.063978	45.64674372	Outfall						
550	OF.I09.00192	City of Bozeman	12		-111.064445	45.64238391	Outfall						
553	OF.H02.00708	City of Bozeman			-111.05783	45.69326051	Outfall						Digitized
957	OF.I09.00001	City of Bozeman			-111.071563	45.64699428	Outfall						
1756	OF.G08.00033				-111.049941	45.65037403	Outfall						
2571	OF.H04.00002	MDT			-111.059925	45.67937329	Outfall						
2572	OF.I04.00001	MDT			-111.062329	45.68009241	Outfall						
2573	OF.I04.00002	MDT			-111.062184	45.68210527	Outfall						
2956	OF.L03.00001				-111.096707	45.69034523	Outfall						
2957	OF.M05.00009	City of Bozeman			-111.114839	45.6786804	Outfall						
2958	OF.M05.00010	City of Bozeman			-111.114	45.67653067	Outfall						
2962	OF.L04.00005				-111.104157	45.68560355	Outfall						
2963	OF.L04.00004				-111.104175	45.68557157	Outfall						
2964	OF.M04.00292				-111.105913	45.68559956	Outfall						
2965	OF.M04.00293				-111.111009	45.6855164	Outfall						
2966	OF.M04.00291				-111.109479	45.68560955	Outfall						
2967	OF.H07.00192				-111.05349	45.66142777	Outfall						
2968	OF.H07.00191				-111.053502	45.6614146	Outfall						
2969	OF.L05.00490				-111.103838	45.67505072	Outfall						

2020 Outfall Inventory

2970	OF.E15.00001	City of Bozeman			-111.026409	45.59956688	Outfall						Digitized
4173	OF.F09.00480	Private	6	PVC	-111.033724	45.64491017	Outfall						
5372	OF.L03.00002				-111.095611	45.69178413	Outfall						
5373	OF.M03.00008				-111.108771	45.6926865	Outfall						
6573	OF.I09.00200				-111.06421	45.64332689	Outfall						
6574	OF.L02.00001	City of Bozeman			-111.093792	45.69998574	Outfall						
7375	OF.L02.00010				-111.094924	45.69617442	Outfall						
7376	OF.L02.00011				-111.094955	45.69708221	Outfall						
8175	OF.L02.00013				-111.094718	45.69999992	Outfall						
8176	OF.L02.00014				-111.096099	45.69996186	Outfall						
8177	OF.L02.00015				-111.095288	45.69867845	Outfall						
8178	OF.M03.00012				-111.112731	45.69269559	Outfall						
8578	OF.M03.00013				-111.112494	45.69268583	Outfall						
8579	OF.M03.00014				-111.110463	45.68850261	Outfall						
8580	OF.M03.00465				-111.108891	45.69301396	Outfall						
8980	OF.L02.00016				-111.098446	45.69950438	Outfall						
9381	OF.H02.00064				-111.055228	45.69909772	Outfall						
10183	OF.H02.00072				-111.053223	45.69820615	Outfall						
10980	OF.L03.00005				-111.098196	45.69253445	Outfall						
12183	OF.M05.00618				-111.106751	45.67442879	Outfall						
14584	OF.J06.00206	Private			-111.080795	45.66918586	Outfall						
14585	OF.J06.00207	Private			-111.079696	45.67067134	Outfall						
14984	OF.N04.00001				-111.11717	45.68343489	Outfall						
15384	OF.I02.00128				-111.06804	45.69633311	Outfall						
16185	OF.M03.00020	City of Bozeman			-111.112448	45.6909882	Outfall						
16585	OF.L04.00008	City of Bozeman			-111.104201	45.68547522	Outfall						
16985	OF.I04.00005				-111.065114	45.68110001	Outfall						
16986	OF.I01.00135	Private			-111.067644	45.70536459	Outfall						
17787	OF.L03.00281	City of Bozeman			-111.09629	45.68593515	Outfall						
18587	OF.J00.00620						Outfall						
18588	OF.D05.00341						Outfall						
18988	OF.M03.00467						Outfall						
18989	OF.L06.00001						Outfall						
19390	OF.M04.00469						Outfall						
19789	OF.I00.00156						Outfall						
19790	OF.I00.00157						Outfall						
20590	OF.D04.00109						Outfall						
21389	OF.L02.00017	Private					Outfall						
21789	OF.G08.00685	City of Bozeman					Outfall						
21790	OF.G08.00686	City of Bozeman					Outfall						
21791	OF.G08.00687	City of Bozeman					Outfall						
337	OF.F07.00076	City of Bozeman	12	UNK	-111.037913	45.66039989	Outfall		Direct				Could not access. Manhole sealed from chip-seal operation
338	OF.F07.00080	City of Bozeman	12	UNK	-111.037913	45.66039989	Outfall		Direct				Could not access. Manhole sealed from chip-seal operation
2561	OF.H05.00001	City of Bozeman			-111.051814	45.67844976	Outfall						
2562	OF.H04.00060	City of Bozeman			-111.051789	45.6792075	Outfall						
2570	OF.H04.00001	City of Bozeman			-111.059922	45.67854178	Outfall						
2564	OF.H05.00002	City of Bozeman			-111.057562	45.67476924	Outfall						
2565	OF.H05.00003	City of Bozeman			-111.058739	45.67528067	Outfall						
2567	OF.H05.00005	City of Bozeman			-111.059419	45.67727308	Outfall						
2563	OF.H06.00029	City of Bozeman			-111.059529	45.66936671	Outfall						
2578	OF.G02.00049	City of Bozeman			-111.051336	45.69760225	Outfall						
							Pipe Ends						
117	OF.F05.00421	City of Bozeman	8	VCP	-111.03273	45.67834916	Pipe End	Bozeman Creek	Direct	8/21/2019	No	Unlikely	Direct from inlet
125	OF.F05.00422	City of Bozeman			-111.032705	45.67832391	Pipe End	Bozeman Creek		8/30/2019	No	Unlikely	Abondoned
126	OF.F05.00420	City of Bozeman	8	PVC	-111.032665	45.67828461	Pipe End	Bozeman Creek	Direct	8/30/2019	No	Unlikely	Direct from inlet
530	OF.F04.00432	City of Bozeman	12	PVC	-111.032737	45.67989322	Pipe End	Bozeman Creek	Direct	8/30/2019	No	Unlikely	Direct from inlet
531	OF.F04.00433	City of Bozeman	4	PVC	-111.032682	45.679891	Pipe End	Bozeman Creek	Direct	8/30/2019	No	Unlikely	Direct from inlet
532	OF.F04.00434	City of Bozeman	6	PVC	-111.032707	45.68037083	Pipe End	Bozeman Creek	Direct	8/30/2019	No	Unlikely	Direct from inlet
533	OF.F04.00435	City of Bozeman	10	VCP	-111.032722	45.68046947	Pipe End	Bozeman Creek	Direct	8/30/2019	No	Unlikely	Direct from inlet
534	OF.F04.00437	City of Bozeman	8	PVC	-111.032719	45.68091339	Pipe End	Bozeman Creek	Direct	8/6/2019	No	Unlikely	Potential roof drain
524	OF.F04.00697	MDT			-111.03168	45.68404575	Pipe End	Bozeman Creek	Direct				Direct from inlet
4575	OF.F04.00699	Private	6	Steel	-111.032661	45.6797223	Pipe End	Bozeman Creek	Direct	8/21/2019	No	Unlikely	Roof drain from Bozeman Hotel
4972	OF.F04.00442	City of Bozeman	8	PVC	-111.032782	45.68037577	Pipe End	Bozeman Creek	Direct	8/30/2019	No	Unlikely	Direct from inlet
528	OF.F04.00429	MDT	6		-111.032662	45.67925795	Pipe End	Bozeman Creek	Direct		No	Unlikely	Direct from inlet
527	OF.F04.00431	MDT	10		-111.032651	45.67941643	Pipe End	Bozeman Creek	Direct			Unlikely	Direct from inlet
522	OF.F04.00644	City of Bozeman	UNK	UNK	-111.032705	45.67882834	Pipe End	Bozeman Creek		8/21/2019	No	Unlikely	Direct from inlet.
314	OF.E00.00052	Private	18	CMP	-111.028224	45.70948913	Pipe End	Bridger Creek		7/9/2020	Trickle	Unlikely	Overflow pipe from golf course pond
7775	OF.F02.00001	City of Bozeman	14	RCP	-111.030431	45.69999792	Pipe End	East Gallatin River	Direct	7/9/2020	No	Unlikely	Direct from inlet
2579	OF.E01.00052	MDT			-111.030272	45.70052426	Pipe End	East Gallatin River	Direct			Unlikely	Direct from inlet
2580	OF.E01.00053	MDT			-111.030224	45.70055323	Pipe End	East Gallatin River	Direct			Unlikely	Direct from inlet
2581	OF.E01.00054	MDT			-111.030111	45.70061347	Pipe End	East Gallatin River	Direct			Unlikely	Direct from inlet
2582	OF.E01.00055	MDT			-111.030063	45.70064015	Pipe End	East Gallatin River	Direct			Unlikely	Direct from inlet
2583	OF.E01.00056	MDT			-111.030098	45.70042371	Pipe End	East Gallatin River	Direct			Unlikely	Direct from inlet
2584	OF.E01.00057	MDT			-111.030049	45.70045269	Pipe End	East Gallatin River	Direct			Unlikely	Direct from inlet
2585	OF.E01.00058	MDT			-111.029926	45.70051902	Pipe End	East Gallatin River	Direct			Unlikely	Direct from inlet
2586	OF.E01.00059	MDT			-111.029879	45.70054494	Pipe End	East Gallatin River	Direct			Unlikely	Direct from inlet
389	OF.D05.00693	City of Bozeman	UNK	UNK	-111.018458	45.67477083	Pipe End	Field	Direct	6/27/2016	No	Unlikely	Buried. Discharges to open field.
388	OF.D05.00692	City of Bozeman	10	RCP	-111.017492	45.67324692	Pipe End	Field	Direct	6/27/2019	No	Unlikely	Direct to open field
60	OF.E06.00630	City of Bozeman	18	RCP	-111.026721	45.66641545	Pipe End	Field	Indirect	6/27/2019	No	Unlikely	Discharges to open field
59	OF.E06.00621	City of Bozeman	12	CMP	-111.026263	45.66662709	Pipe End	Field	Indirect	6/27/2019	No	Unlikely	Discharges to open field
108	OF.C05.00694	City of Bozeman	12	HDPE	-111.009429	45.67264447	Pipe End	Field	Direct	6/18/2019	No	Unlikely	Discharges to open field
12184	OF.C06.00001	City of Bozeman	24	RCP	-111.007433	45.67036683	Pipe End	Field	Indirect	6/19/2019	No	Unlikely	Discharges to detention basin
12584	OF.C06.00003	Private	18	RCP	-111.008011	45.6709995	Pipe End	Field	Indirect	6/19/2019	No	Unlikely	Discharges to open field

2020 Outfall Inventory

12185	OF.C06.00002	Private	10	HDPE	-111.007469	45.67036278	Pipe End	Field	Direct	6/19/2019	No	Unlikely	Discharges to detention basin
369	OF.L01.00463	Private	24	HDPE	-111.093612	45.70735171	Pipe End	Field	Indirect	9/1/2020	No	Unlikely	Discharges to open field
339	OF.F07.00075	City of Bozeman	12	RCP	-111.038242	45.66024988	Pipe End	Figgins Creek	Direct	7/19/2019	No	Unlikely	Direct from inlet
341	OF.F07.00647	City of Bozeman	Inlet	RCP	-111.033831	45.65863076	Pipe End	Flat Creek	Direct	7/11/2019	No	Unlikely	Direct from inlet
342	OF.F07.00646	City of Bozeman	Inlet	RCP	-111.033874	45.65832035	Pipe End	Flat Creek	Direct	7/11/2019	No	Unlikely	Direct from inlet
344	OF.F07.00668	City of Bozeman	12	RCP	-111.032497	45.66091156	Pipe End	Flat Creek	Direct	7/18/2019	No	Unlikely	Direct from inlet
345	OF.F07.00669	City of Bozeman	12	RCP	-111.032495	45.66091232	Pipe End	Flat Creek	Direct	7/18/2019	No	Unlikely	Direct from inlet
346	OF.F07.00670	City of Bozeman	12	RCP	-111.032498	45.66184777	Pipe End	Flat Creek	Direct	7/18/2019	No	Unlikely	Direct from 2 inlets
351	OF.F07.00675	City of Bozeman	12	RCP	-111.032507	45.66376162	Pipe End	Flat Creek	Direct	7/18/2019	No	Unlikely	Direct from inlet
552	OF.G01.00707	Private	24	CMP	-111.042606	45.70332782	Pipe End	SWWW_00034	Indirect	7/14/2020	No	Unlikely	Digitized
399	OF.G01.00316	Private	18	RCP	-111.043613	45.70175362	Pipe End	SWWW_00034	Indirect	7/14/2020	No	Unlikely	Does not discharge to state/surface waters.
401	OF.G01.00317	City of Bozeman	36	RCP	-111.043011	45.70203549	Pipe End	SWWW_00034	Direct	7/14/2020	Trickle	Unlikely	Does not discharge to state/surface waters. Groundwater flow.
226	OF.G03.00308	City of Bozeman	12	UNK	-111.04314	45.69283013	Pipe End	SWWW_00034	Direct	7/15/2020	No	Unlikely	Could not locate safely due to traffic.
227	OF.G03.00306	City of Bozeman	12	RCP	-111.043144	45.69051088	Pipe End	SWWW_00034	Direct	7/15/2020	No	Unlikely	Does not discharge to state/surface water.
228	OF.G03.00303	City of Bozeman	12	RCP	-111.043798	45.69051761	Pipe End	SWWW_00034	Direct	7/15/2020	No	Unlikely	Does not discharge to state/surface water.
229	OF.G03.00400	City of Bozeman	22	RCP	-111.04379	45.68858779	Pipe End	SWWW_00034	Direct	7/8/2020	No	Unlikely	Does not discharge to state/surface water.
230	OF.G03.00401	City of Bozeman	12	RCP	-111.04379	45.68856195	Pipe End	SWWW_00034	Direct	7/15/2020	No	Unlikely	Does not discharge to state/surface water.
235	OF.G03.00307	City of Bozeman	12	RCP	-111.043161	45.6916568	Pipe End	SWWW_00034	Direct	7/15/2020	No	Unlikely	Does not discharge to state/surface water. Buried.
267	OF.G02.00309	Private	30	RCP	-111.043056	45.69591062	Pipe End	SWWW_00034	Indirect	7/15/2020	No	Unlikely	Does not discahrge to state/surface water.
268	OF.G02.00311	City of Bozeman	16		-111.043627	45.69783394	Pipe End	SWWW_00034	Direct	7/14/2020	No	Unlikely	Direct from inlet. Does not discahrge to state/surface water.
269	OF.G02.00312	City of Bozeman	16		-111.043628	45.69793471	Pipe End	SWWW_00034	Direct	7/14/2020	No	Unlikely	Direct from inlet. Does not discharge to state/surface water.
271	OF.G02.00310	Private	12	HDPE	-111.043445	45.69749302	Pipe End	SWWW_00034	Indirect	7/14/2020	No	Unlikely	Does not discharge to state/surface water.
272	OF.G02.00314	City of Bozeman	15	CMP	-111.042978	45.69995593	Pipe End	SWWW_00034	Direct	7/14/2020	No	Unlikely	Does not discharge to state/surface water.
273	OF.G02.00313	Private	32	UNK	-111.043648	45.69914844	Pipe End	SWWW_00034	Indirect	7/14/2020	No	Unlikely	Does not discharge to state/surface water.
50	OF.D07.00324	City of Bozeman	18	RCP	-111.016673	45.66237713	Pipe End	SWWW_00039	Direct	6/27/2019	No	Unlikely	Inlet direct to ditch
51	OF.D07.00325	City of Bozeman	18	RCP	-111.016555	45.66245586	Pipe End	SWWW_00039	Direct	6/27/2019	No	Unlikely	
55	OF.D06.00493	City of Bozeman	12	UNK	-111.019951	45.6676924	Pipe End	SWWW_00040	Direct	6/27/2019	No	Unlikely	Buried
56	OF.D06.00492	City of Bozeman	12	UNK	-111.018581	45.66817632	Pipe End	SWWW_00040	Direct	6/27/2019	No	Unlikely	Buried
57	OF.D06.00491	City of Bozeman	12	RCP	-111.017087	45.66951434	Pipe End	SWWW_00040	Direct	6/27/2019	No	Unlikely	
58	OF.E06.00495	City of Bozeman	24	RCP	-111.021502	45.66625669	Pipe End	SWWW_00040	Direct	6/27/2019	No	Unlikely	
61	OF.E06.00496	City of Bozeman	15	RCP	-111.021514	45.66558078	Pipe End	SWWW_00040	Direct	6/27/2019	No	Unlikely	
62	OF.E06.00494	City of Bozeman	12	UNK	-111.021226	45.66693146	Pipe End	SWWW_00040	Direct	6/27/2019	No	Unlikely	Pipe not located during inspection
390	OF.D05.00326	City of Bozeman	24	RCP	-111.016589	45.67162252	Pipe End	SWWW_00040	Indirect	6/27/2019	No	Unlikely	Indirect and direct
105	OF.C05.00334	City of Bozeman	12	RCP	-111.010405	45.67306092	Pipe End	SWWW_00065	Direct	6/18/2019	No	Unlikely	Direct from inlet
385	OF.D05.00336	City of Bozeman	15	RCP	-111.012388	45.67406859	Pipe End	SWWW_00065	Direct	6/18/2019	No	Unlikely	Direct from 2 inlets
386	OF.D05.00335	City of Bozeman	15	RCP	-111.011241	45.67347542	Pipe End	SWWW_00065	Direct	6/18/2019	No	Unlikely	Direct from 2 inlets
387	OF.D05.00337	City of Bozeman	15	RCP	-111.015659	45.67655826	Pipe End	SWWW_00065	Direct	6/19/2019	No	Unlikely	Direct from inlet
103	OF.B05.00478	City of Bozeman	24	UNK	-110.996907	45.67262404	Pipe End	Unnamed Rocky Creek Tributary	Direct				Digitized
4	OF.F10.00639	City of Bozeman			-111.037128	45.64192646	Pipe End						
5	OF.F10.00640	City of Bozeman			-111.036011	45.64198543	Pipe End						
37	OF.G08.00684	City of Bozeman			-111.045161	45.65573396	Pipe End						
85	OF.I06.00164	City of Bozeman	15		-111.063898	45.67125674	Pipe End						
128	OF.H05.00370	City of Bozeman	18		-111.052014	45.67186946	Pipe End						
133	OF.H05.00386	City of Bozeman	12		-111.051853	45.67626676	Pipe End						
134	OF.H05.00387	City of Bozeman	12		-111.051881	45.67640329	Pipe End						
135	OF.H05.00388	City of Bozeman	12		-111.05188	45.67718751	Pipe End						
136	OF.H05.00390	City of Bozeman	12		-111.051836	45.67833817	Pipe End						
137	OF.H05.00391	City of Bozeman	12		-111.051836	45.67833817	Pipe End						
149	OF.L05.00622	City of Bozeman			-111.093859	45.67728089	Pipe End						
152	OF.M05.00617	City of Bozeman			-111.105489	45.67478543	Pipe End						
170	OF.I04.00169	City of Bozeman	30		-111.065766	45.67910237	Pipe End						
173	OF.I04.00690	City of Bozeman			-111.062474	45.67908841	Pipe End						
206	OF.L04.00283	City of Bozeman	12		-111.104187	45.68385459	Pipe End						Digitized
213	OF.M04.00286	City of Bozeman	12		-111.104287	45.6813972	Pipe End						
236	OF.H03.00643	City of Bozeman			-111.057424	45.69207583	Pipe End						
248	OF.K03.00616	City of Bozeman			-111.085237	45.68929703	Pipe End						
250	OF.K03.00699	City of Bozeman			-111.08292	45.68588141	Pipe End						
266	OF.G02.00048	City of Bozeman	12		-111.051157	45.69644154	Pipe End						
274	OF.G02.00047	City of Bozeman	8		-111.051111	45.69620214	Pipe End						
286	OF.I02.00368	MDT	32X24		-111.062205	45.69323933	Pipe End						
308	OF.H01.00679	City of Bozeman			-111.059702	45.70301991	Pipe End						
403	OF.I05.00172	City of Bozeman	26		-111.064744	45.6753713	Pipe End						
404	OF.I05.00173	City of Bozeman	26		-111.064744	45.67527681	Pipe End						
405	OF.I05.00113	City of Bozeman	18		-111.069967	45.67848143	Pipe End						
489	OF.I03.00620	City of Bozeman			-111.070899	45.69125084	Pipe End						
505	OF.I03.00364	MDT	12		-111.062089	45.68985614	Pipe End						
507	OF.I03.00362	MDT	12		-111.062002	45.68823153	Pipe End						
517	OF.I03.00121	City of Bozeman	12		-111.067645	45.68899835	Pipe End						
518	OF.I03.00122	City of Bozeman	12		-111.067654	45.68909865	Pipe End						
554	OF.I04.00709	City of Bozeman			-111.065102	45.68283366	Pipe End						
2574	OF.I04.00003	MDT			-111.061945	45.68554684	Pipe End						
2577	OF.H02.00050	MDT			-111.051974	45.69836899	Pipe End						
2971	OF.E15.00002	City of Bozeman			-111.024806	45.60052456	Pipe End						Digitized
9380	OF.H02.00063				-111.054779	45.69890773	Pipe End						
9382	OF.H02.00065				-111.055617	45.69965503	Pipe End						
9780	OF.G02.00321				-111.046524	45.69455772	Pipe End						
10180	OF.G02.00320				-111.051512	45.69756428	Pipe End						
10181	OF.H02.00060				-111.052975	45.69812226	Pipe End						
10182	OF.H02.00061				-111.052844	45.69837145	Pipe End						
11783	OF.H02.00062				-111.054575	45.69912551	Pipe End						
11784	OF.H02.00066				-111.055813	45.69945498	Pipe End						
12984	OF.K03.00700	City of Bozeman			-111.090795	45.69321851	Pipe End						
15785	OF.H03.00644	Private			-111.057402	45.69216112	Pipe End						

2020 Outfall Inventory

15786	OF.H03.00645	Private			-111.057443	45.69283071	Pipe End						
16586	OF.L04.00009	City of Bozeman			-111.104167	45.68558635	Pipe End						
16587	OF.G08.00068				-111.042961	45.65660025	Pipe End						
17387	OF.K01.00270	City of Bozeman			-111.082635	45.70178789	Pipe End						
19389	OF.M03.00466						Pipe End						
20189	OF.L05.00490						Pipe End						
20589	OF.D04.00108						Pipe End						
395	OF.E07.00632	City of Bozeman	8	PVC	-111.02625	45.66303364	Pipe End		Indirect	7/11/2019	No	Unlikely	Discharges to open field
18187	OF.E01.00064	Private			-111.028963	45.70543212	Pipe End		Direct		Trickle	Unlikely	Discharges to swale that leads to detention basin
10580	OF.E01.00060	MDT			-111.022715	45.70264732	Pipe End					Unlikely	Direct from 2 inlets
6173	OF.E00.00054	Private	Swale		-111.025965	45.70795007	Pipe End			7/9/2020	No	Unlikely	Discharges to golf course
2587	OF.D04.00107	MDT			-111.012274	45.67880141	Pipe End					Unlikely	Direct from inlet
2556	OF.C05.00001	MDT	Inlet		-111.008277	45.67505653	Pipe End					Unlikely	
2557	OF.C05.00002	MDT	Inlet		-111.008944	45.6750638	Pipe End					Unlikely	
2558	OF.C05.00003	MDT	Inlet		-111.009521	45.6750581	Pipe End					Unlikely	
2559	OF.D05.00001	MDT			-111.014171	45.67641051	Pipe End					Unlikely	Direct from inlet
2560	OF.D05.00002	MDT			-111.013368	45.67610306	Pipe End					Unlikely	Direct from inlet
315	OF.E00.00706	Private	UNK	UNK	-111.030685	45.71088935	Pipe End		Direct	7/9/2020	No	Unlikely	Pipe is buried. Discharges to golf course
2569	OF.H05.00006	City of Bozeman			-111.059392	45.67839884	Pipe End						
Sump Pumps													
123	OF.F05.00415	City of Bozeman	2	PVC	-111.031963	45.67557643	Sump Pump	Bozeman Creek	Direct	7/24/2019	No	Unlikely	Anti-freeze groundwater pump
127	OF.F05.00423	City of Bozeman	4	PVC	-111.032649	45.67826869	Sump Pump	Bozeman Creek	Direct	8/30/2019	No	Unlikely	Sump pump from Klare Building
63	OF.E06.00411	Private	4	PVC	-111.030452	45.67105546	Sump Pump	Bozeman Creek	Direct	7/23/2019	No	Unlikely	Digitized
64	OF.E06.00410	Private	4	PVC	-111.030435	45.67105235	Sump Pump	Bozeman Creek	Direct	7/23/2019	No	Unlikely	Digitized
65	OF.E06.00409	City of Bozeman	1.25	PVC	-111.030386	45.67104839	Sump Pump	Bozeman Creek	Direct	7/23/219	No	Unlikely	Digitized
535	OF.F04.00436	City of Bozeman	4	Steel	-111.032728	45.68085804	Sump Pump	Bozeman Creek	Direct	8/6/2019	No	Unlikely	Potential sump drain
525	OF.F04.00428	City of Bozeman	15	CMP	-111.032685	45.67885754	Sump Pump	Bozeman Creek	Direct	8/21/2019	Moderate	Unlikely	Sump with unknown origin
4574	OF.F04.00698	Private	4	PVC	-111.031629	45.68405045	Sump Pump	Bozeman Creek	Direct	8/6/2019	No	Unlikely	Sump drain from residence to the south
359	OF.F07.00043	Private	4	PVC	-111.03657	45.66093722	Sump Pump	Figgins Creek	Direct	7/12/2019	No	Unlikely	Digitized
33	OF.F08.00073	Private	12	CMP	-111.036483	45.65658409	Sump Pump	Mathew Bird Creek	Direct	7/12/2019	Moderate	Unlikely	Digitized. Fenced off. Sump.
360	OF.F07.00082	City of Bozeman	4	PVC	-111.036622	45.66214528	Sump Pump	Mathew Bird Creek	Direct			Unlikely	Digitized. Can't find.
379	OF.F06.00100	Private	6	HDPE	-111.032853	45.67106118	Sump Pump	Mathew Bird Creek	Direct	7/23/2019	Moderate	Unlikely	
4576	OF.F06.00101	Private	2	PVC	-111.035114	45.66895945	Sump Pump	Mathew Bird Creek	Direct	7/19/2019	Trickle	Unlikely	Digitized
12	OF.F09.00060	City of Bozeman	18		-111.039409	45.64369419	Sump Pump						Digitized
13	OF.F09.00061	City of Bozeman	2.5		-111.039272	45.64438229	Sump Pump						Digitized
67	OF.H06.00015	City of Bozeman	8		-111.05467	45.6655722	Sump Pump						Digitized
79	OF.H06.00027	City of Bozeman	4		-111.053414	45.67045955	Sump Pump						Digitized
91	OF.J06.00204	City of Bozeman	4		-111.080258	45.67049054	Sump Pump						Digitized
Unknown													
218	OF.E03.00448	City of Bozeman	4	Cast iron	-111.03073	45.6866804	Unknown	Bozeman Creek	Direct	7/7/2020	No	Unlikely	Abandoned sump. Pipe is broken off.
462	OF.E04.00442	Private	4	PVC	-111.031032	45.68532216	Unknown	Bozeman Creek	Direct	7/8/2020	No	Unlikely	Possible abandoned sump. No signs of pollution or discharge
529	OF.F04.00430	City of Bozeman	4	Steel	-111.03266	45.67974651	Unknown	Bozeman Creek	Direct	8/21/2019	No	Potential	Unknown orgin from Bozeman Hotel
4572	OF.F03.00447	Private	UNK	Cast Iron	-111.031096	45.68595259	Unknown	Bozeman Creek	Direct	7/7/2020	No	Unlikely	Not located. Buried roof drain.
4573	OF.F03.00448	Private	UNK	PVC	-111.03115	45.68551843	Unknown	Bozeman Creek	Direct	7/7/2020	No	Unlikely	Not located in 2020. Possible abandoned sump.
378	OF.F06.00094	Private	12	UNK	-111.032423	45.6711716	Unknown	Mathew Bird Creek	Direct	7/24/2019	No	Unlikely	Buried. Not located.
74	OF.H06.00022	City of Bozeman	12		-111.054113	45.66866067	Unknown						Digitized
76	OF.H06.00024	City of Bozeman	8		-111.053494	45.67008661	Unknown						Digitized
166	OF.H04.00057	City of Bozeman	18		-111.051671	45.68270979	Unknown						Digitized
265	OF.D02.00318	City of Bozeman	14		-111.019326	45.69498224	Unknown						Digitized
436	OF.I05.00157	City of Bozeman	8		-111.068888	45.67448364	Unknown						Digitized
437	OF.I05.00158	City of Bozeman	4		-111.068911	45.67182197	Unknown						Digitized
438	OF.I05.00159	City of Bozeman	4		-111.068916	45.6717527	Unknown						Digitized
472	OF.H07.00187	City of Bozeman	6		-111.054733	45.66258952	Unknown						Digitized
473	OF.H07.00188	City of Bozeman	8		-111.054732	45.66284442	Unknown						Digitized
161	OF.H04.00058	City of Bozeman	4		-111.051686	45.68156463	Unknown						Roof drain?
Other, Unclassified, or Abandoned													
124	OF.F05.00110	City of Bozeman	4	PVC	-111.031947	45.67645602	Other	Bozeman Creek	Direct	7/24/2019	No	Unlikely	Bogert Pavilion floor drain. Pipe capped on 7/1/2020
398	OF.E07.00407	County	6		-111.029989	45.65968365	Other	Bozeman Creek	Direct				
521	OF.F04.00440	City of Bozeman	6	Steel	-111.032136	45.68198088	Other	Bozeman Creek		8/6/2019	No	Unlikely	Abandoned in 1955
536	OF.F04.00438	City of Bozeman	12	Steel	-111.032139	45.68190064	Other	Bozeman Creek		8/6/2019	No	Unlikely	Abandoned in 1955.
333	OF.I51.00053	Private	12		-111.061693	45.72222568	Other	East Gallatin River	Direct				Private property located in the County
381	OF.F06.00093	Private	8	PVC	-111.034007	45.67126402	Other	Mathew Bird Creek	Direct	7/19/2019	Trickle	Unlikely	Private pond over flow
382	OF.F06.00092	Private	10	HDPE	-111.034073	45.67124393	Other	Mathew Bird Creek	Direct	7/19/2019	No	Unlikely	Private pond overflow
555	OF.F01.00637	Private	8-10	PVC	-111.036166	45.70285552	Other	Pond	Indirect	7/30/2020	No	Unlikely	Terminated in 2021
325	OF.J00.00619	Private	12	PVC	-111.071944	45.70966599	Other	SWWW_00014	Indirect	8/6/2020	No	Unlikely	Discharges to retention pond
30	OF.F08.00070	City of Bozeman	18		-111.037194	45.65457482	Other						Digitized.
31	OF.F08.00072	City of Bozeman	30		-111.036948	45.65572523	Other						Digitized
32	OF.F08.00071	City of Bozeman	7		-111.036818	45.65574216	Other						Digitized
391	OF.D05.00339	MDT	48		-111.016229	45.67747418	Other						Digitized
402	OF.I05.00174	City of Bozeman	15		-111.064751	45.67432646	Other						
432	OF.I05.00171	City of Bozeman	26		-111.064729	45.67718608	Other						
397	OF.E07.00408	County	6		-111.030651	45.66269785	Other						Digitized
223	OF.F03.00444	City of Bozeman	12		-111.031159	45.68560879		Bozeman Creek		7/7/2020		Unlikely	Abandoned as part of Rouse Ave. Reconstruction
224	OF.F03.00443	City of Bozeman			-111.031225	45.68560641		Bozeman Creek		7/7/2020		Unlikely	Abandoned as part of Rouse Ave. Reconstruction
112	OF.F05.00416	City of Bozeman	12		-111.031935	45.67731275				8/21/2019			Abandoned during Olive St. Reconstruction
113	OF.F05.00417	City of Bozeman	8		-111.032015	45.67731816				8/21/2019			Abandoned during Olive St. Reconstruction
114	OF.F05.00419	City of Bozeman	6		-111.032029	45.67736582				8/21/2019			Abandoned during Olive St. Reconstruction
115	OF.F05.00418	City of Bozeman			-111.032002	45.67727485				8/21/2019			Abandoned during Olive St. reconstruction

DESIGN STANDARDS

AND

SPECIFICATIONS POLICY

CITY OF BOZEMAN, MONTANA

CITY ENGINEERING DIVISION

MARCH 2004

ADOPTED: April 5, 2004, Ordinance 1611

Including: Addendum No. 1 approved 7/19/05
Addendum No. 2 approved 6/28/06
Addendum No. 3 approved 2/20/08
Addendum No. 4 approved 3/31/11
Addendum No. 5 approved 8/26/13
Addendum No. 6 approved 5/1/17
Addendum No. 7 approved 3/13/20

CITY OF BOZEMAN

DESIGN STANDARDS AND SPECIFICATIONS POLICY

Prepared by

City Engineering Department

March 2004

Revised: 7/19/05; 6/28/06; 2/20/08; 3/31/11; 8/26/13; 5/1/17; 3/11/20

****

Contents — Page

Foreword 3

City of Bozeman Plan and Specification Review Policy
- A. Standard Process 4-5
- B. Self-Certification Process 6-7
- C. Construction Coordination 8-16

Design Standards

I Construction Plans and Specifications Requirements
- A. General 17
- B. Specification Requirements 18
- C. Drawing Scales 18
- D. Plan Requirements 18-19
- E. Utility Plan Requirements 19-20
- F. Roadway Plan Requirements 20-21

II Drainage Policy
- A. General Design Criteria 22
- B. Storm Drainage Plan 23
- C. Storage/Treatment Facilities 23-25
- D. Discharge Structures 25-26
- E. Estimation of Runoff 26-32

III Floodplain Regulations 33

Contents (cont.) Page

IV Roadway Design and Technical Criteria
A. General 34
B. Sidewalks, Curbs and Gutters, and Driveways 34-35
C. Drainage 35-36
D. Horizontal Alignment 36-39
E. Vertical Alignment 39-41
F. Median Treatments 41
G. Roadway Specifications 41-42
H. Signs and Markings 42-43
I. Monumentation 43
J. Lighting 43
K. Bike Lanes/Paths 44

V Utility Design Criteria
A. Water Distribution Lines Design Criteria 45-47
B. Sanitary Sewer System Design Criteria 47-52
C. Storm Sewers 52-55
D. Alignment, Depth, and Easements 55-57

Appendix 58

Tables

Table I-1: Runoff Coefficients (C) For Use in the Rational Formula 27
Table I-2: Manning Equation - Typical "n" Values 28
Table I-3: Rainfall Frequency For Use in the Rational Formula 28
Table IV-1: Curb Return Radius at Intersections 37
Table IV-2: Alignment Controls 38
Table V-1: Wastewater flow Rate for Zoned Undeveloped Areas 49
Table V-2: Wastewater Flow Rate by Land Use Designation 50
Table V-3: Wastewater Flow Rates for Undefined Land Use Designations 50

Figures

Figure I-1: Time of Concentration (Rational Formula) 30
Figure I-2: Rainfall Intensity - Duration in Minutes 31
Figure I-3: Rainfall Intensity - Duration in Hours 32
Figure A-1: Typical Roadway Sections Appendix
Figure A-2: Typical Concrete Outlet Structure for Stormwater Detention Ponds Appendix

FOREWORD

This document has been prepared to assist design engineers, architects, developers, contractors, or other interested individuals with the preparation of plans and specifications for public infrastructure improvements so that they will meet the requirements of the City of Bozeman (COB). The requirements specified herein have been established through the subdivision regulations, municipal code, or City policies.

It is the intent of the COB to revise this document on an as-needed basis as regulations and policies are modified. Written comments on this "Design Standards and Specifications Policy" are encouraged and may be submitted to the City Engineer.

If any portion of this document is found to conflict with the Bozeman Municipal Code (BMC), the provisions of the BMC shall supersede this Guide.

Abbreviations Used

AASHTO - American Association of State Highway and Transportation Officials
ADA - Americans with Disabilities Act
ASTM - American Society for Testing and Materials
AWWA - American Water Works Association
BMC - Bozeman Municipal Code
BUDO – Bozeman Unified Development Ordinance
COB - City of Bozeman
DEQ - Department of Environmental Quality
ESAL - Equivalent Single Axle Load
FSP - Final Site Plan
MPWSS - Montana Public Works Standard Specifications
MUTCD - Manual of Uniform Traffic Control Devices
PUD - Planned Unit Development
RCP - Reinforced Concrete Pipe
WQB - Water Quality Bureau

CITY OF BOZEMAN

PLANS AND SPECIFICATIONS REVIEW POLICY

A. Standard Process

1. Initial submittal of plans and specifications, and all subsequent correspondence and submittals for public infrastructure improvements including, but not limited to, sanitary sewer and water mains, storm sewer mains, street and transportation improvements, are to be made to the City Engineer's Office, 20 E. Olive Street, P.O. Box 1230, Bozeman, Montana, 59771-1230. Prior to submission of infrastructure plans and specifications, project approval (preliminary plat, Planned Unit Developments (PUD's), and in some cases Final Site Plans (FSP's)) from the City Commission must be obtained.

2. The minimum number of complete sets of plans and specifications which must be submitted for each review are as follows:

Type of Project	Number*	Reviewers
Water and Sewer Main Extensions	4 Sets	Eng., W/S
Fire Service Lines	2 Sets	Eng., W/S
Streets and/or Storm Sewers	4 Sets	Eng., W/S, ST
Water & Sewer Mains with Streets and/or Storm Sewers	4 Sets	Eng., W/S, ST

Eng. = Engineering Department
W/S = Water and Sewer Department
ST = Street Department

* See Paragraph 8 below

3. The COB shall attempt to complete the initial review and provide written comments to the Engineer/Owner within thirty (30) calendar days of receiving the initial submittal. A review meeting may be scheduled with the design Engineer and City representatives to discuss review comments if the design Engineer desires. Pre-design and interim meetings with the design Engineer and City Engineering staff are encouraged.

4. To expedite the review process each submittal of revised plans and specifications shall be accompanied by a written response from the Design Engineer which addresses each item in the COB review comment letter. The revised documents will be distributed and reviewed as described above in item 2. Generally, "red-lined" copies of the plans and specifications will be provided to the Design Engineer to facilitate revisions of the documents. Red-lines must be returned with each subsequent re-submittal.

5. The COB shall attempt to complete each review of revised plans and specifications within fourteen (14) calendar days of receiving the revisions. A review comment letter may be mailed to the Engineer/Owner at the completion of each review.

6. All COB review comments must be adequately addressed and resolved before the final plans and specifications are approved by the City Engineer for construction.

7. The plans and specifications for water or sewer projects will not be considered for approval by the City Engineer without written approval of the final plans and specifications from the Superintendent of Water and Sewer or his designated representative.

8. Once all COB review comments have been adequately addressed and resolved the City Engineer must be supplied with four (4) complete sets of the final plans and specifications, signed and stamped by a Professional Engineer licensed in the State of Montana, and one half-size set of plans. Specification manuals are to be bound and contain the most current version of the revised documents and plan sheets are to be the most current version. The four (4) final full-size sets and one ½ size set of plans and specifications submitted for City approval will be reviewed by the City Engineer to ensure that all requested modifications are included. An electronic version of the approved plans shall also be provided in either Autocad or PDF format.

9. For projects subject to Department of Environmental Quality (DEQ) review and approval, a copy of the project approval letter from DEQ must be submitted to the City Engineer prior to the preconstruction meeting.

10. The City Engineer will either approve or disapprove the submitted documents. An approval or disapproval letter will be sent to the Engineer/Owner.

11. Final stamped and approved plans and specifications will be distributed as follows:
    a. One set returned to the Engineer/Owner.
    b. One set and ½ size set to the COB Water/Sewer Department.
    c. One set for the COB Engineering Department.
    d. One set for the COB Engineering Department Field Inspector.

12. No work is to begin on the project prior to obtaining the COB's and DEQ's written approval of the plans and specifications, and the completion of a preconstruction meeting conducted by the Owner's Engineer and attended by the Contractor(s) and COB

representative(s). A "Pre-construction Meeting Checklist" will typically be included with the approval letter specifying additional documents which must be submitted prior to scheduling a pre-construction meeting.

B. Self-certification Process

1. Introduction/Intent

A. Plans and specifications submitted using this process will not be reviewed in detail by the City Engineering Department. **Fire service lines and domestic service lines are specifically excluded from this process**. The City's existing review process will remain in place, and will be used unless the submittal conforms with the self-certification process and is accompanied by a completed self-certification Checklist.

B. The intention of this policy is that plans and specifications stamped and signed by a Professional Engineer registered in the State of Montana, submitted in conformance with this policy, and accompanied by the required checklists and certifications, will be acceptable to the City.

C. The following are specifically excluded from the self-certification process: force mains, lift stations, booster stations, pressure reducing valves, and traffic signals.

2 Applicable Standards

All infrastructure projects shall comply with the following design standards in order of precedence:

A. COB Design Standards and Specifications Policy
B. COB Modifications to Montana Public Works Standard Specifications (MPWSS)
C. Bozeman Unified Development Ordinance
D. DEQ Circulars 1 and 2
E. City Adopted MPWSS and Adopted Addenda

The most recently adopted versions of the City Water and Wastewater Facilities Plans shall govern sewer and water trunk main design and sizing. The Storm Water Master Plan and Transportation Plan shall govern their respective service area issues.

3. Submittal Requirements

Prior to submission of infrastructure plans and specifications, project approval (preliminary plat, Planned Unit Developments (PUD's), and in some cases Final Site Plans (FSP's)) from the City

Commission must be obtained.

The following shall be submitted to the City Engineering Department and approved by the Public Service Department (through the City Engineer):

Prior to Plan and Specification Submittal;

A. Water and Sewer Utilities Design Report as detailed in the project conditions of approval. Subsequent to receipt and approval of this report, the City will issue a water/sewer capacity letter if warranted.

B. Pavement Design Report and Traffic Impact Analysis (if required).

C. Stormwater Facilities Design Report.

D. A schematic signage plan for the subdivision, noting any proposed traffic calming measures.

With plans and specifications;

E. Four (4) sets of plans and specifications (24" x 36" sheets only) stamped and signed by a P.E., registered in the State of Montana, one ½ size set of plans, and an electronic version of the plans in either Autocad or PDF format.
F. A completed and signed COB Plan and Specification Checklist.
G. Any easements which may be required. Easements must be properly executed.

4. City Review and Disposition

A. Upon receipt of the plans and specifications and checklist, one complete set will be sent to the City Water/Sewer Superintendent and one set to the City Street Superintendent.
B. Upon review and approval of the Checklist, Plans, and Specifications, the City Engineering Department will provide the engineer with a letter of approval and one set of plans and specifications stamped "Approved For One Year From This Date".
C. *Estimated* time frames for City approval:

With Deviations requested on City Checklist	*2 weeks; this is a guideline only*
Without Deviations or with pre-approved variance	*1 week*

D. No construction may begin prior to a pre-construction meeting which must be

attended by the applicant's engineer, the contractor and the City. All preconstruction meeting requirements currently in place will remain in place.

E. Any changes to the approved plans must be reviewed and approved by the City Engineering Department and the Water/Sewer Superintendent.

5. Project Audits

A. The intent of the self certification process is to place upon the design engineer the sole and significant burden and expectation that Public infrastructure plans and work completed within Bozeman fully comply with the City's infrastructure standards and requirements. The process necessitates a high degree of trust by the City and certainty by the design engineer that the plans and specifications fully meet the City's requirements.

B. Deficiencies in plans which are discovered during project construction are inherently much more costly to the project schedule and budget than design deficiencies or issues resolved and addressed prior to construction. Subsequent to the City's approval of self certified plans and specifications, selected project plans will undergo audit review to assure compliance. Deficiencies discovered during the audit review or during construction may require revised plans to be submitted and approved, and may further require untimely and expensive correction or replacement of noncompliant work installed on the project. Project design self certification falsely or indiscriminately provided may be referred to the Montana Board of Professional Licensing.

C. Project engineers with a history of design deficiencies or whose track record demonstrates repeated problems in their ability to design and complete projects adequately meeting the City's design standards will be more frequently audited, and may be prohibited from utilizing the self-certification process until adequate proficiency is demonstrated. As such, engineers are strongly encouraged to work closely with the City's engineering, field and operations staff throughout the pre-design, design and construction phases of a project. Engineers without adequate experience with the City's design and infrastructure standards and who have not previous successfully completed infrastructure projects within the City are advised to utilize the City's full design review process in lieu of the self certification process.

C. CONSTRUCTION COORDINATION

1. Pre-construction Meeting

Following approval of infrastructure plans and specifications, the Engineer shall schedule a pre-construction meeting with the City of Bozeman, Contractor(s), and if applicable, other affected utilities or governmental agencies. A "Preconstruction Meeting Checklist" will be included with the letter of approval which lists submittals that must be received by the City of Bozeman prior to scheduling a preconstruction meeting.

2. Shop/Fabrication Drawings

Any required shop/fabrication drawings shall be submitted by the Contractor to the Engineer. Upon approval, the Engineer shall submit four sets of the shop/fabrication drawings to the City Engineer a minimum of two days prior to the preconstruction meeting.

3. Bonding

All new infrastructure that will be publicly maintained shall be bonded. Prior to initiation of construction, copies of the Contractor's Performance and Payment Bonds, each in an amount equal to 100% of the contract amount, in favor of the Owner, shall be filed with the Owner and the City of Bozeman. Prior to acceptance of the publicly maintained infrastructure, the Contractor shall post a Maintenance Bond with the Owner equal to 20% of the actual cost of the improvements to correct any deficiencies in workmanship and/or materials which are found within the two-year warranty period. The City of Bozeman shall be named as a dual oblige on the bond. The City of Bozeman expressly reserves the right to draft the Maintenance Bond for repairs not completed by the Property Owner, Developer, or Contractor within thirty calendar days of being advised that repairs are required. The Commencement Date for the Maintenance Bond shall be the date of acceptance by the City of Bozeman on the Certificate of Completion and Acceptance. The Maintenance Bond shall remain in full force for the two-year period following this date, however if the expiration date of the Maintenance Bond falls after November 16, the expiration date of the Maintenance Bond shall be June 30 of the following year. Maintenance Bonds may be in the form of a Surety Bond or a Certified Check.

4. Engineer's Status/Responsibility During Construction

The Engineer will furnish a qualified Resident Project Representative (RPR) and other field staff to assist the Engineer in observing the performance of the work. The RPR will act as directed by and under the supervision of the Engineer, and will confer with the Engineer regarding the RPR's actions. The RPR shall not authorize any deviation from the approved plans and specifications or substitution of materials or equipment, unless authorized by the Engineer.

Duties of RPR. The RPR and/or other field staff of the Engineer will:

- Conduct extensive on-site observations of the work in progress and field checks of materials and equipment to provide protection against defects and deficiencies in the work of the Contractor.
- Perform construction observation, documentation, and required testing of all critical construction work including, but not limited to: all underground or buried work including placement and connection of utility lines and appurtenances, trench backfill and compaction, placement of geotextile fabric membranes, placement of fill or embankments; placement of curb and gutter and other surface drainage improvements; placement of pavement base and surface courses; and placement of sidewalks.
- Advise the Engineer and Contractor of the commencement of any work requiring Shop Drawings or sample if the submittal has not been approved by the

Engineer.

- Report to the Engineer whenever RPR believes that any work is unsatisfactory, faulty, or defective or does not conform to the approved plans and specifications, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made.
- Advise the Engineer of work that the RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection, or approval.
- Verify that all tests are conducted in the presence of appropriate personnel, and observe, record and report to the Engineer appropriate details relative to testing procedures.
- Accompany visiting inspectors representing the City of Bozeman or other public agencies having jurisdiction over the project.
- Maintain at the job site orderly files for correspondence, reports of job conferences, Shop Drawings and samples, reproductions of original Contract Documents including all Work Directive Changes, Addenda, Change Orders, Field Orders, additional Drawings issued subsequent to the execution of the contract or beginning of work, Engineer's clarifications and interpretations of the Contract Documents, and other Project related documents.
- Keep a detailed and accurate diary or log book, recording Contractor hours on the job site, weather conditions, prime and subcontractor daily work force, daily log of equipment onsite or standby, data relative to questions of Work Directive Changes, Change Orders, or changed conditions, list of job site visitors, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures.
- Furnish Engineer with periodic reports of progress of the work.
- Furnish Engineer and Contractor a list of observed items requiring completion or correction before Engineer may issue a Certificate of Substantial Completion, assess completion or correction of said items, advising Engineer on their status, and make recommendation to Engineer regarding issuance of a Certificate of Substantial Completion.
- Conduct final inspection of the project in the company of Engineer, Owner, Contractor, and City of Bozeman, and prepare final list of items to be completed or corrected.
- Verify that all items on final list have been completed or corrected and make recommendations to Engineer concerning final acceptance.

Duties of Engineer: The Engineer will:

- Issue written clarifications or interpretations of the requirements of the Contract Documents (i.e. plans and specifications).
- Disapprove or reject work which Engineer believes to be defective, and require special inspection or testing of the work whether or not the work is fabricated, installed, or completed.
- Review Shop Drawings and samples for compliance with the Contract Documents.

- Review proposed changes in work and submit such changes to the City of Bozeman or other public agencies having jurisdiction for review.
- Issue Certificate of Substantial Completion and Certificate of Completion and Acceptance.

5. Testing and Documentation Requirements for Infrastructure Improvements

In order to better document the inspection and certification of public infrastructure improvements, the City Engineering Division shall require the following information for all projects approved for construction. This documentation shall be required prior to final acceptance of sanitary sewer, water main, storm drain, Portland cement concrete, and bituminous pavement improvements within City right-of-way or easements.
THE FOLLOWING DOCUMENTATION SHALL BE REQUIRED ON ALL PROJECTS APPROVED BY THE CITY ENGINEERING DIVISION:

A. The Engineer shall submit a letter to the City certifying that the public improvements (i.e. sanitary sewers, water mains, drainage structures and streets) were installed in accordance with the approved plans and specifications and shall be accompanied by Record Drawings for the project.

B. Dates of acceptable tests for sanitary sewer, which shall include TV inspection by the City of Bozeman, cleaning, exfiltration by air or water, and manhole testing, shall be included in the certification letter. This information shall be required for all public sewer main extensions.

C. Dates of acceptable tests for water mains, which shall include hydrostatic and leakage testing, bacteriological testing, and continuity testing shall be included in the certification letter. This information shall be required for all public water main extensions.

D. Benchmark elevations shall be established for all new hydrants on the project. Benchmarks shall be set on the hydrant bonnet bolt closest to the point of the operating arrow on Mueller hydrants and on the bury depth tag on Waterous hydrants. Said elevations shall be certified by either a P.E. or L.S. registered in the state of Montana. Elevations shall also be provided for the top of the water main at 50' intervals. The datum used as the basis for the elevations shall be clearly identified.

E. Verification that all thrust blocking was installed in accordance with the approved plans and specifications shall be included in the certification letter. If mechanical restraints are used in lieu of thrust blocks, verification that the restrained length as installed meets or exceeds the manufacturers recommendations shall be included.

F. An accurate record of the location of all sanitary sewer service connections as installed, and the length and slope of all service lines installed must be provided

by the Engineer. Elevations at the end of dry service line stub-ins is required. Sanitary sewer service connections shall be tied to manholes. This information shall be required for all public sewer main extensions and service connections to existing mains.

G. The Engineer shall furnish documentation of tests in accordance with methods prescribed by AASHTO for theoretical maximum density, optimum moisture content, and sieve analysis for the sub-base course, crushed base course, pit run, and native backfill and subgrade material within the right-of-way. This information shall be required for all public sewer main, water main, storm drain and street extensions.

H. The Engineer shall furnish documentation of in-place field density tests. In-place density tests for trenches and embankments shall, as a minimum, be required for the first lift of backfill to set a pattern of compaction, shall be provided daily, and as backfill material changes. In-place density tests for roadways shall, as a minimum, be required at intervals of 50 feet. Tests for roadways shall be provided for subgrade, sub-base course and/or pit run, and crushed base course materials. A minimum of the top 6 inches of subgrade which are to be paved or covered with curb, gutter, or sidewalk, shall be field density tested. All trench backfill material in improved areas and all embankments shall be compacted for the full depth and shall be compacted to 95% of the theoretical maximum proctor density as determined by AASHTO-T-99. This information shall be required for all public sewer main, water main, storm drain, and street extensions.

I. The Engineer shall furnish a dated job-mix formula for hot plant mix bituminous pavement which conforms to the procedures of the Asphalt Institute's MS-2 manual. The job mix formula shall be no older than one year, and shall have the same aggregate and asphalt sources and grades as the mix used for the public improvements. The Engineer shall furnish certified results of a Marshall Test showing the bulk specific gravity determination, stability and flow data, and density and void analysis. The engineer shall furnish a minimum of one "field Marshall Test" per 2000 tons of mixture placed to check for variations from the job-mix formula. In addition, test results of ASTM D 1075 for the effect of water on cohesion of compacted bituminous material shall be provided by the Engineer. This information shall be required for all public street extensions.

J. The Engineer shall furnish asphalt core samples for bituminous pavement in the public right-of-way. Four core sample shall be required for every 1000 tons of mixture placed, with a minimum of three samples for projects that use less than 1000 tons. The location of the core samples shall be determined on a random basis using a system of random numbers, so that each ton of material has the same probability of being selected. For random locations falling near the pavement joints, obtain the core as close to the location as possible without having any part of the core circumference coming closer than 12 inches to the pavement edge or

joint. The Engineer may take additional core samples at locations where he/she has, based on observations of the paving process and/or the results of nuclear density tests, reasonable belief that the in-place material is unsatisfactory. The Engineer shall submit the sampling plan to the City Engineer upon completion of the paving, prior to taking cores. (An example for one method of determining random sample locations is included in the appendix of these Design Standards). The Engineer shall provide a certified laboratory report from the samples taken as to thickness and actual density. Testing laboratories shall meet the requirements of ASTM D3666 (Evaluating and Qualifying Agencies Testing and Inspecting Bituminous Paving Materials). The engineer shall certify that the core holes have been patched with hot plant mix asphalt. This information shall be required for all public street extensions.

K. The Engineer shall furnish Portland cement concrete tests for concrete placed in the public right-of-way and concrete incorporated into public infrastructure improvements. One set of tests shall be required for every 50 cubic yards of concrete placed with a minimum of one set of tests per project. The concrete shall be sampled, specimens made, and compliance determined in accordance with the following:

Sampling Fresh Concrete	ASTM C-172
Slump	ASTM C-143 or AASHTO T119
Air Content	ASTM C-231 or C-173 or C-138 or AASHTO T152
Compressive Strength	ASTM C-39 or AASHTO T22
Making and Curing Test Specimens in the Field	ASTM C-31 or AASHTO T23

Sampling and testing shall be done by persons that are currently certified as ACI Concrete Field Testing Technicians, Grade 1. This information shall be required for all public street extensions.

6. Pre-Paving Inspection

The Engineer shall conduct a pre-paving inspection for any projects that have paved streets as part of the improvements. The Contractor and a representative from the City shall attend the inspection.

7. Acceptance/Correction of Deficient Pavement Improvements

Acceptance tests shall be evaluated by the Engineer for conformance with the specifications. Any results that indicate the in-place material does not conform with the specifications shall be immediately reported to the City Engineer, along with a recommendation of corrective action to bring the material into compliance with the specifications. The City Engineer shall determine what corrective action is necessary in order for the improvements to be accepted by the City of Bozeman. Corrective action may include total removal and replacement of the deficient

material, partial removal and replacement, placing additional material, or in lieu of corrective action, payment of a penalty to the City of Bozeman in certain instances.

A. Portland Cement Concrete

If an individual strength test (average of two cylinders tested at 28 days) falls below the specified strength by more than 500 psi, the in-place material represented by the failed test shall immediately be randomly cored for acceptance testing. A minimum of three and maximum of six cores shall be taken. If the average strength tests of the acceptance cores are deficient in strength by more than 500 psi but not more than 1000 psi, the Contractor shall remove and replace the deficient concrete or pay the City of Bozeman 0.25 times the unit price bid times the area determined to be deficient in strength; if the average strength tests are deficient by more than 1000 psi, the area of the concrete determined to be deficient shall be removed and replaced.

B. Asphaltic Concrete Pavement

The asphaltic concrete pavement shall be tested and evaluated for acceptance on a lot basis, with one lot being 1000 tons of material.

1. Thickness. If the average thickness of the pavement cores is more than¼" below the plan thickness, or if any one individual core is more than ½" below the plan thickness, corrective action or payment of a penalty will be required.

a. Average Thickness Deficiencies. If the average thickness deficiency is between ¼" and½", corrective action such as placement of additional material (i.e. overlay or chip seal), as determined by the City Engineer, will be required. In lieu of placing additional material, the City Engineer may allow the payment of a penalty to the City of Bozeman in the amount of 0.25 times the unit price bid of the asphalt pavement times the amount of pavement determined to be deficient. If the average thickness deficiency is more than ½", an overlay will be required, along with cold milling of the existing pavement to provide for a minimum overlay thickness of 1.5".

b. Individual Core Thickness Deficiency. If any one core thickness is determined to be more than ½" below plan thickness, additional cores shall be taken at 10 foot intervals parallel to the centerline in each direction from the affected location until, in each direction, a core is found which is not deficient by more than¼", in order to determine the extent of the deficient pavement. If the thickness deficiency is more than ¾", the area that is deficient shall be removed from pavement edge to pavement edge and replaced to bring the non-complying areas to planned thickness. If the thickness deficiency is not more than ¾", the deficient area will either be removed and replaced to the planned thickness, or a penalty will be paid to the City of Bozeman in the amount of 1.5 times the unit price bid times the amount of pavement that is deficient in thickness.

2. Density. The average density of the pavement cores shall equal or exceed 93% of the maximum density as determined by ASTM D2041 (Rice's density). If the average density is less than 93% but more than 90.9%, the pavement that has

deficient compaction shall be milled and overlaid (1.5" minimum depth), or a penalty in the amount of 0.10 times the unit price bid for the pavement material times the amount of pavement that has deficient compaction shall be paid to the City of Bozeman. If the average density is 90.9% or less, the pavement area affected will be removed and replaced or overlaid as determined by the City Engineer. If any one core is determined to have a density of less than 86%, additional cores shall be taken at 10 foot intervals parallel to the centerline in each direction from the affected location until, in each direction, a core is found which has a density of at least 91%. The area that is determined to have deficient compaction shall be removed from pavement edge to pavement edge and replaced, or a penalty will be paid to the City of Bozeman in the amount of 1.5 times the unit price bid times the amount of pavement that is deficient in density.

C. Unit Prices

If unit prices for the project are unavailable, unit prices shall be as determined from time to time by the City Engineer for the various items of work.

8. Project Close-out and Acceptance

Upon completion of the work, the following documentation shall be submitted to the City Engineer:

A. An executed "Certificate of Completion and Acceptance" (included in the Appendix of this Policy).

B. Project Inspection Diary and Testing Records.

C. Certified Checklist for Testing and Documentation Requirements.

Within 90-days of project completion, the Engineer shall sign and submit record drawings to the City Engineer. The drawings shall be full-size and consist of one reproducible set, two blueprint sets, and one digital (Autocad) copy.
Failure to provide all of the necessary close-out documentation within the 90-day period may result in delaying approval for future projects submitted by the Engineer until such time as the necessary documents are provided.

9. Two-Year Warranty Inspection

The Project Engineer, or his designated representative, shall conduct a two-year warranty inspection to be attended by a least one representative from the Public Works Department. The inspection shall take place not less than seventy-five (75) or more than one hundred and twenty (120) days prior to the expiration date of the Maintenance Bond. The Maintenance Bond will be released when all deficiencies have been corrected to the satisfaction of the City Engineer.

The City Engineer, the Project Engineer, or the designated representative shall notify the Principal and Bonding Company as listed in the Maintenance Bond of any work found to be deficient. The Principal shall restore the work to meet the requirements of the approved construction documents prior to release of the Maintenance Bond. The City of Bozeman expressly reserves the right to draft the Maintenance Bond for repairs not completed by the Owner, Developer, or Contractor within thirty calendar days of being advised that repairs are required.

I. CONSTRUCTION PLANS AND SPECIFICATIONS REQUIREMENTS

A. GENERAL REQUIREMENTS

1. Any required design reports must be submitted and approved prior to submittal of plans and specifications when the self-certification process is utilized. If the standard review process is utilized, design reports may be submitted prior to or along with submittal of the plans and specifications.

2. Project plans and specifications will not be accepted until the project has been approved by the City of Bozeman.

3. All project infrastructure plans must be submitted at the same time. Separate approval of infrastructure elements may be provided if necessary.

4. Where existing infrastructure is being extended, existing material, size, elevation, horizontal alignment, and grade shall be field verified, and all critical utility crossings shall be field verified, prior to plan and specification submittal.

5. All full-sized plans shall be on 24-inch by 36-inch plan sheets or 22-inch by 34-inch plan sheets. Reduced scale plans may be submitted for review if approved by the City Engineer, but all plans for final approval (excepting the one required ½ size set) and all record drawings shall be full-sized. All plans submitted for review and approval will be stamped, signed, and dated by a professional engineer licensed in the State of Montana.

6. Separate plans shall be submitted for water facilities and sanitary sewer facilities. Plans for storm sewer facilities may be included with plans for street facilities.

7. All plans will have both plan and profile views of the proposed improvements. A general location map shall be provided showing the relationship of each page to the overall development.

8. Project datum and benchmarks shall be clearly identified on the plans.

9. English units are required.

B. SPECIFICATIONS REQUIREMENTS

1. The City of Bozeman has adopted "Montana Public Works Standard Specifications" (MPWSS) as the standard specifications for new construction. A separate document, "City of Bozeman Modifications to MPWSS" has been adopted which supplements and supercedes MPWSS. All project manuals must incorporate, preferably by reference, MPWSS (latest adopted edition) and the "City of Bozeman Modifications to MPWSS", including any addenda.

2. Additions or changes to the above standard specifications must be done through Special Provisions or similar supplemental sections in the project manual.

C. DRAWING SCALES

The following scales are required. Other scales will be considered on a case by case basis if all information can be clearly shown.

1.	Plan View:	1" = 50'
2.	Profile View, Horizontal:	1" = 50' (or match plan view scale)
	Profile View, Vertical:	1" = 5'
3.	Stationing interval:	100 feet or 50 feet

D. PLAN REQUIREMENTS

The following items will be required on all plans. Existing features should be shown dashed or with a lighter shading than proposed new features. All construction will be tied to the centerline of a City right-of-way, to the centerline of a City easement, to a platted property line, or to section lines.

1. Plan View
   - North Arrow.
   - Legend of Symbols.
   - Property lines and ownership or subdivision information.
   - Street names and easements with width dimensions.
   - Project Stationing.
   - Limits of existing paved or graveled surfaces.
   - Monument boxes.
   - Culverts.

- Existing and proposed utilities and structures, including:
  Line size and material where appropriate;

Water lines (main lines and service lines), valves, and hydrants;
Sanitary sewer lines (main lines and service lines) and manholes;
Storm sewer lines, manholes, and inlets;
Gas lines;
Electric lines, poles, transformers;
Telephone lines, manholes, junction boxes;
Cable T.V. lines, junction boxes;
Irrigation ditches and structures;
Irrigation systems;
Fiber optic lines, manholes, junction boxes;
Street lights;
Proposed method of restoration of all areas disturbed during construction.

2. Profile View
   - Vertical and horizontal grids to scales.
   - Final grade (solid).
   - Existing grade (dashed).
   - Existing utility lines where crossed.
   - Project Stationing
   - Utility crossings

E. UTILITY PLAN REQUIREMENTS

1. The following general notes must appear on all plan sets:

   a. All construction will conform to MPWSS, (Latest) Edition, and COB Modifications to MPWSS.

   b. Any existing or new valves which control the COB's water supply shall be operated by COB personnel only.

   c. The Contractor shall notify the Water Department a minimum of 24-hours prior to beginning any work.

   d. Contractor shall field-verify line and grade of existing connections.

2. Plans for water facilities shall show the following:
   -Size, type and structural class of proposed new water line(s), including AWWA specifications.
   -Bedding class.
   -Type of excavation and backfill.
   -Existing water lines including size and material.
   -Proposed valves, fittings, fire hydrants, and service lines, with stationing.
   -Depth of cover from finish grade to proposed water line(s).

-Requirements for pipe deflection, if necessary.
-Type of joint restraint, if required.
-Size of gravity thrust blocks based on calculated design.
-Existing or proposed pressure reducing valves.

3. Plans for sanitary sewer facilities shall show the following:
-Size, type, and structural class of proposed new sewer line(s), including American Society for Testing and Materials (ASTM) specifications.
-Slope of each proposed pipeline segment.
-Bedding class.
-Type of excavation and backfill.
-Existing sewer lines and manholes including size, material, field-verified invert elevations, and field-verified slopes.
-Proposed manholes with stationing and rim and invert elevations.
-Existing and proposed sewer service lines with size and stationing.
-Existing and proposed cleanouts.

4. Plans for storm sewer facilities shall show the following:
-Size, type, and structural class of proposed new storm sewer line(s), including ASTM specifications.
-Slope of each proposed pipeline segment.
-Bedding class.
-Type of excavation and backfill.
-Proposed manholes with stationing and rim and invert elevations.
-Proposed inlets and inlet service lines with stationing and invert elevations.
-Points of stormwater discharge.

F. ROADWAY PLAN REQUIREMENTS

1. Plans for streets or roadways shall show the following:
-Limit of cut or fill.
-Existing and proposed utilities, including manholes and valves.
-Proposed new construction, including paving width and limits, curb and gutter, crosspans, sidewalks, and pedestrian ramps.
-Existing and finished grades, with finished grade slopes.
-Vertical and horizontal curves, with curve data:
Horizontal curves - R, Δ, L, PC and PT Stationing
Vertical curves - K, L, Station of PT's
-Profile of centerline.
-Profiles of left and right curb lines, if they are not the same.
-Any required utility adjustments.
-Existing and proposed signs and pavement markings.
-Existing and proposed storm drainage facilities, including culverts, pipes, inlets, sidewalk chases, ditches and detention/retention ponds, with

invert and/or spot elevations.

-Top of curb elevations at P.C.s, P.T.s, and inlets.

-Existing and proposed street monuments.

-Typical roadway section(s), dimensioned and drawn to scale, showing:

- -Right-of-way
- -Backslopes
- -Sidewalks
- -Curb and gutter
- -Pavement thickness
- -Base and sub-base thickness
- -Compaction requirements
- -Cross-slopes

II. DRAINAGE POLICY

A. GENERAL DESIGN CRITERIA

A Stormwater Drainage Plan is required for all new developments. The following criteria shall be used in the design of all Drainage Plans:

1. The stormwater drainage plan shall be designed to limit stormwater runoff from the development site to the pre-development runoff rates. The pre-developed rate calculations shall be included as part of the required facility design calculations. Adequate on-site stormwater detention shall be provided for design storm runoff exceeding the pre-development rate.

2. The stormwater storage and treatment facilities shall be designed to remove solids, silt, oils, grease, and other pollutants. Where required, oil/water separators shall be provided in the facility design.

3. Where the storm drainage plan includes storm sewers they shall meet the following minimum requirements:

    a. Alignment between manholes shall be straight.

    b. The sewers shall be uniformly sloped to maintain a minimum velocity of 3-fps at the design storm depth of flow, or when flowing full, to prevent sediment deposits.

    c. Pond inlet and outlet piping shall be protected and designed to prevent erosion (i.e. splash pads, rip rap, etc.).

    d. Publicly maintained storm sewers located in the public right-of-way shall be constructed of reinforced concrete pipe (RCP) or solid-wall or corrugated PVC pipe, complying and installed in accordance with the current edition of MPWSS as modified by the COB. PVC pipe may only be used for pipe sizes of 36" diameter or less. Other pipe materials may be considered for private storm sewer facilities. Use 12-inch minimum pipe size for inlet structures and 15-inch minimum pipe size within the storm drain system.

    e. Storm sewer facilities shall be designed to handle a 25-year storm event.

    f. Inlets and manholes shall have 9-inch sumps for sediment collection unless otherwise approved by the City Engineer.

4. For all new development or redevelopment projects greater than or equal to

one acre, the drainage plan shall include, to the greatest extent feasible, low impact development practices that infiltrate, evapotranspire, or capture for reuse the runoff generated from the first 0.5 inches of rainfall from a 24-hour storm preceded by 48 hours of no measurable precipitation.

B. STORM DRAINAGE PLAN

A Storm Drainage Plan shall be submitted to the City Engineer for all new developments. The plan shall include the following:

1. A map or plat showing building site(s), open areas, drainage ways, ditches, culverts, bridges, storm sewers, inlets, storage ponds, roads, streets, and any other drainage improvements. The map shall also include identification and square foot coverage of the various ground surfaces (i.e. vegetation, gravel, pavement, structures).

2. Topographic contours (one-foot intervals) and sufficient spot elevation data.

3. Description of the ultimate destination of stormwater runoff from the project and an evaluation of its impact on downslope drainage facilities and water quality.

4. Design calculations determining runoff quantities and storage requirements.

5. A storm drainage facilities maintenance plan. The plan shall:

    a. Identify ownership of all facilities.

    b. Establish a schedule for maintenance activities necessary to keep the system operationally effective.

    c. Identify the responsible party in charge of the specific maintenance duties.

6. Details and specifications (including invert and other pertinent elevation information) for all storm drainage improvements, such as storm sewers, manholes, inlets, discharge structures; and retention/detention pond dimensions and volume, side slope, and top, bottom, and maximum water surface elevations.

C. STORAGE/TREATMENT FACILITIES

Detention is the storage and gradual release of runoff to a storm sewer system, waterway, or a soil of high porosity. Detention facilities dampen peak runoff rates and provide treatment of runoff flows. For new development, on-site detention with release rates limited to pre-development runoff rates is required. Complete retention facilities may be

provided or required where discharge is not feasible or desirable. Retention ponds shall be sized based on a 10-year, 2-hour storm intensity.

1. Detention Basins: Detention basins utilize natural or manmade depressions or ponds for storage. Release of water is controlled by specially designed outlet structures (Figure A-2 in the Appendix of this Guide).

2. Basin Sizing: A minimum basin area of 145-square feet per 1-cfs release rate is required for sediment control. The controlling basin volume is determined by subtracting the total basin release volume from the runoff volume at different storm durations. The release rate is equivalent to the pre-development runoff rate at the piping system design frequency (Table I-3). The runoff rate is determined at the piping system design frequency using development runoff coefficients. Where the potential for major property damage exists due to downstream flooding and the terrain and availability of land permit the construction of a large detention basin, a 100-year design frequency should be used for sizing the pond. Basins located in areas accessible to the public shall have a maximum water depth of 1½-feet and a maximum basin depth of 2½- feet. Deep basins designed only for stormwater detention shall be placed in remote areas and fenced. A sample problem for sizing detention basins is included in the Appendix of this Policy.

3. Basin Location: Basins serving multiple lots shall be located in common open space owned by a Homeowners or Property Owners Association. Locating a basin within an easement on a lot will not be permitted unless approved by the governing body. Public park land shall not be used for storm water detention or retention ponds unless approved by the Superintendent of Facilities and Lands.

4. Additional Requirements: The following additional requirements apply to the design of above ground earth formed detention basins:

    a. To prevent short circuiting, basin length shall be at least three times the width and inlet velocities should be dissipated.

    b. Basin slopes shall be 4:1 or flatter. (UDO 18.48.050)

    c. Vegetative channels shall be utilized wherever possible to remove wastewater contaminants.

    d. Basins in floodplains shall have adequate erosion protection on the embankments.

    e. Overflows shall be provided to prevent overtopping of dike walls.

5. Retention volumes shall be calculated using the following formulas:

$$Q = CIA$$

$$V = 7200Q \text{ (cf)}$$

Wheren C = Weighted C Factor
I = 0.41 in/hr (see figure I-2, I-3 for 10 year 2 hr storm)
A = Area (acres)
Q = runoff (cfs)
V = volume (cf)

D. DISCHARGE STRUCTURES

1. A design detail shall be provided including adequate elevation information. Discharge structures shall be adequately protected from damage. A typical discharge structure is shown in Figure A-2 in the Appendix of this Policy.

2. Orifice or weir calculations shall be provided for controlling the discharge to the pre-development rate. For discharge structures similar to that in Figure A-2 of the Appendix, the slot width shall be sized using the equation:

$$Q = CLH^{3/2}$$

Where: Q = Discharge (cfs)
C = Weir Coefficient = 3.33
L = Horizontal Length (feet)
H = Head (feet)

3. Failsafe features shall be provided including:

   a. An emergency free-flowing overflow for rates exceeding design storm events.

b. Discharge piping shall be a minimum of six (6) inches in diameter for maintenance, and capable of conveying a 25-year storm event.

c. Ponds shall be designed so as to avoid long-term standing water in the pond.

E. ESTIMATION OF RUNOFF

1. GENERAL

The rational method shall be used to determine peak runoff rates with a slight modification of the method to determine runoff volumes. The basic assumptions that apply to the rational method are:

a. Rainfall is uniformly distributed over the area for the duration of the storm.

b. The peak runoff rate occurs when the duration of the storm equals the time of concentration.

c. The runoff coefficient for a particular watershed is constant for a similar land use.

The method is based on the Rational Formula:

$$Q = CiA$$

Q - Peak runoff rate (cfs)
C - Runoff coefficient
i - Average rainfall intensity (in./hr.)
A - Drainage area (acres)

2. RUNOFF COEFFICIENTS

The runoff coefficients shown in Table I-1 are recommended for design. Coefficients from other engineering texts may be considered for specific applications such as concrete, asphalt, roofs, etc..

TABLE I-1
RUNOFF COEFFICIENTS (C) FOR USE IN THE RATIONAL FORMULA

LAND USE	RUNOFF COEFFICIENTS (C)
Open Land	0.20
Low to Medium Density Residential	0.35
Dense Residential	0.50
Commercial Neighborhood	0.60
Commercial Downtown	0.80
Industrial	0.80

Source: City of Bozeman Stormwater Master Plan, Thomas Dean & Hoskins, Inc., 1982

3. TIME OF CONCENTRATION

A basic assumption of the rational method is that the peak runoff rate occurs when the duration of the storm equals the time of concentration. The time of concentration is the flow time from the most remote point in the drainage to the point in question. It generally consists of overland flow time and channel flow time. Overland flow time may be estimated from the nomograph in Figure I-1.

Channel flow time in gutters, ditches, or pipes may be determined by estimating velocities with the Manning equation:

$$V = \frac{1.486}{n} R^{2/3} S^{1/2}$$

V - Mean velocity (ft/sec.)

n - Manning roughness coefficient (typical values in Table I-2)

R - Hydraulic radius* = $\frac{\text{cross sectional area}}{\text{wetted perimeter}}$

TABLE I-2
MANNING EQUATION - TYPICAL "n" VALUES

Channel Type	"n" Factor
Open Unlined Channels	0.035
Concrete and RCP Pipe	0.013
Corrugated Steel Pipe	0.024
PVC pipe	0.013

4. STORM INTENSITY

The intensity of the storm is determined from Figure I-2 or I-3. Duration is assumed to be equal to the time of concentration. The values in Table I-3 are the City of Bozeman design frequencies.

TABLE I-3
RAINFALL FREQUENCY FOR USE IN THE RATIONAL FORMULA

Land Use	Design Rainfall Frequency
Open Land	2-year
Residential	10-year
Commercial or Industrial	10-year

5. RUNOFF RATES AND VOLUMES

The rational formula provides a peak runoff rate which occurs at the time of concentration. The modified rational method approach shall be used to compute runoff volume for storm durations equal to or greater than the time of concentration. This method assumes the maximum runoff rate begins at the time of concentration and continues to the end of the storm. Maximum runoff rates for durations greater than the time of concentration are less than the peak runoff rate because average storm intensity decreases as duration increases. Total runoff volume is computed by multiplying the duration of the storm by the runoff rate.

6. RAINFALL INTENSITY DURATION CURVE

In order to use the rainfall intensity duration curve, the time of concentration must be known. This can be determined either by the following equation or Figure I-1e

$$Tc = \frac{1.87\,(1.1 - CC_f)\,D^{1/2}}{S^{1/3}}$$

Where Tc= Time of concentration, minutes
S = Slope of Basin, %
C = Rational Method Runoff Coefficient
D = Length of Basin, feet
C_f= Frequency Adjustment Factor[1]

Time of concentration calculations should reflect channel and storm sewer velocities as well as overland flow times.

---

[1]RATIONAL METHOD FREQUENCY ADJUSTMENT FACTORS

Storm Return Period (years)	Frequency Factors C_f
2 to 10	1.00
11to 25	1.10
26 to 50	1.20
51 to 100	1.25

Note: The product of C times C_f shall not exceed 1.00.

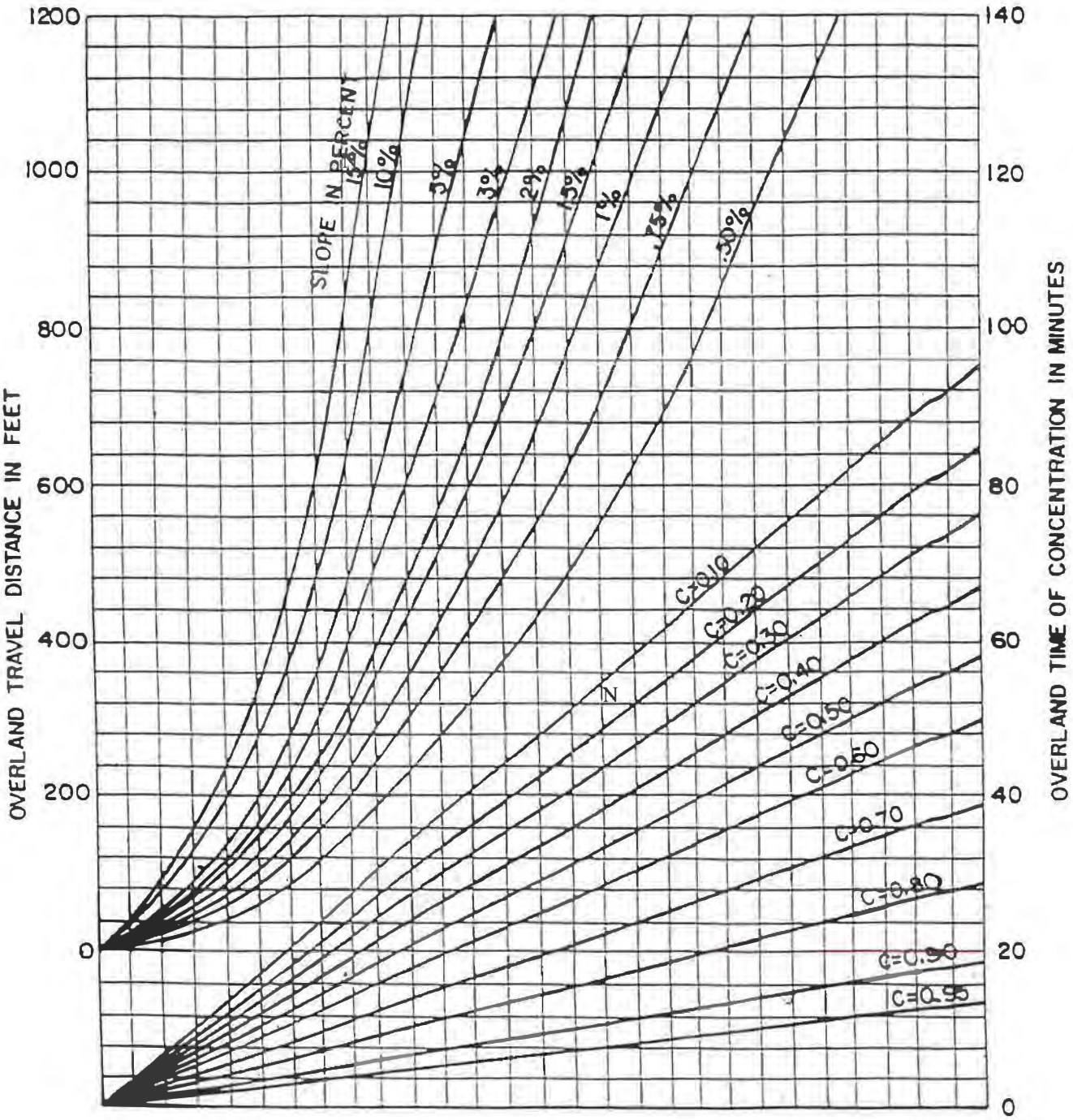


FIGURE I-1 TIME OF CONCENTRATION (Rational Formula)

RAINFALL INTENSITY - DURATION CURVES
BOZEMAN, MONTANA

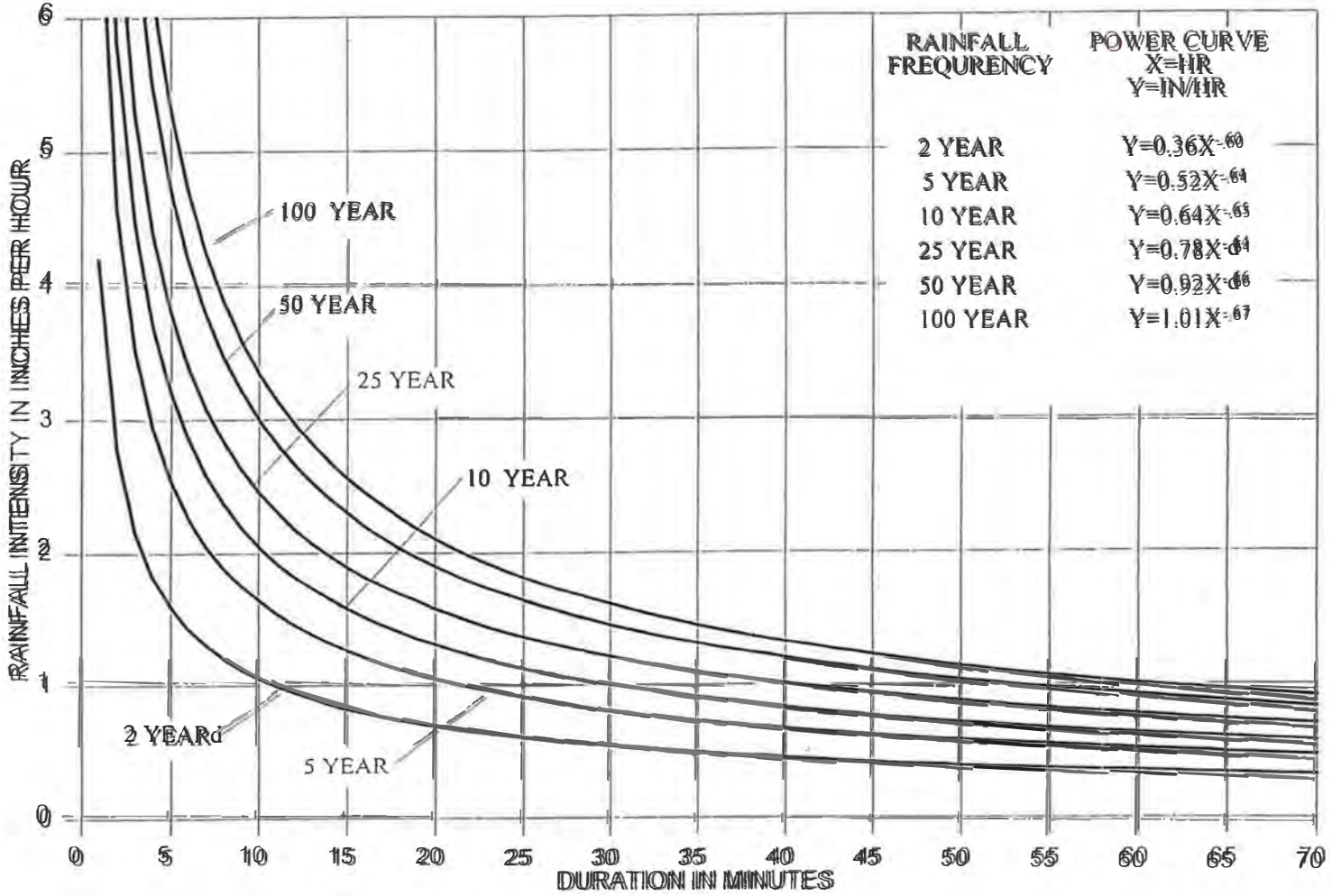


FIGURE II-2 RAINFALL INTENSITY – DURATION IN MINUTES

RAINFALL INTENSITY - DURATION CURVES
BOZEMAN, MONTANA

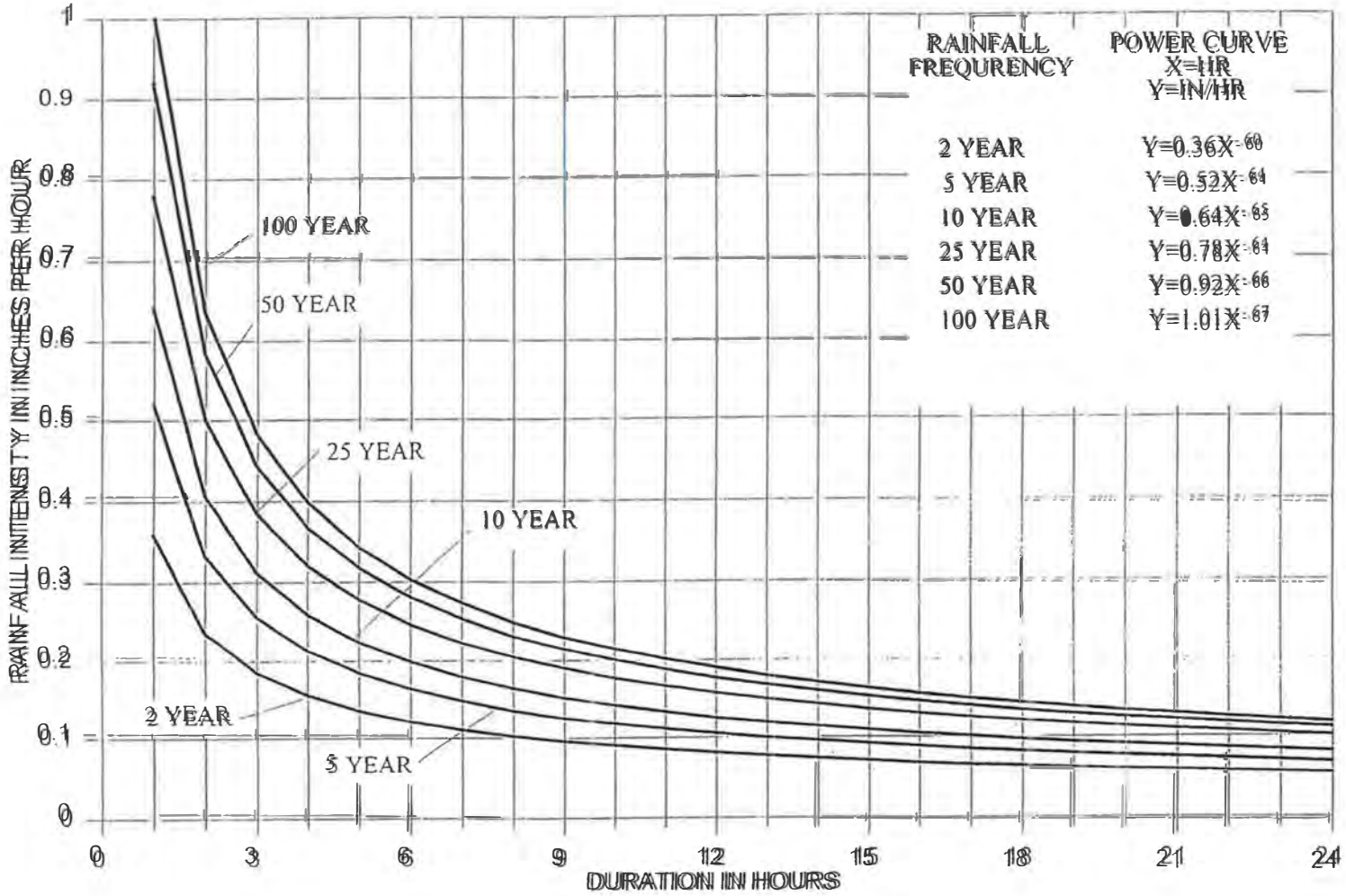


FIGURE I-3 RAINFALL INTENSITY – DURATION IN HOURS

III. FLOODPLAIN REGULATIONS

A. GENERAL

Floodplain regulations are detailed in Chapter 18.58 of the BUDO. These regulations are intended to protect the public health, welfare and safety in order that citizens and property owners can remain under the national flood insurance program. All proposed developments shall conform to the requirements of Chapter 18.58 of the BUDO.

IV. ROADWAY DESIGN AND TECHNICAL CRITERIA

A. GENERAL.

This section sets forth the minimum design and technical criteria and specifications to be used in the preparation of all roadway plans. All roadway plans should also be designed in conformance with MPWSS; City of Bozeman Modifications to MPWSS; Americans With Disabilities Act; and City of Bozeman Sidewalk Policy.

B. SIDEWALKS, CURBS AND GUTTERS AND DRIVEWAYS

1. Roadway typical sections are detailed in Figure A-1 in the Appendix of this Policy. Roadway typical sections shall conform to conditions of approval for the project.

2. Concrete sidewalks shall be constructed on both sides of all roadways unless otherwise approved by action of City Commission. Sidewalks shall be 6-inches thick across driveways, and 4-inches thick elsewhere. Sidewalk design and construction shall be in accordance with the "City of Bozeman Sidewalk Policy".

3. All sidewalks shall have a minimum width of five (5) feet, except the minimum width shall be ten (10) feet in the central business district. All sidewalks that are to be publicly-maintained and all sidewalks along arterial streets shall have a minimum width of six (6) feet and shall be 6-inches thick reinforced concrete. Publicly-maintained sidewalks are sidewalks along all parks, and any public facilities or city-owned structures which are anticipated to be maintained by the City of Bozeman.

4. Integral curb and gutter shall be used on all roadways.

5. Pedestrian ramps shall be installed at all intersections and at certain mid-block locations for all new construction or reconstruction of curb and sidewalk. Pedestrian ramps shall be constructed in accordance with City of Bozeman Standard Drawings and Americans with Disabilities Act (ADA) requirements. Pedestrian ramps may be shown at all curb returns or called out by a general note on the development plans.

6. Guardrails may be required in certain situations. Guardrails shall be designed and constructed in accordance with AASHTO Standards or as directed by the City Engineer.

7. Drop-curbs for driveways may only be installed with the initial curb construction when the final building locations have been determined. Driveway locations shall conform to Section 18.44.090, BUDO.

8. Curb transitions for curb bulbs shall be accomplished using 35' minimum radius curves to achieve the desired pavement narrowing. All curb bulbs shall be adequately marked with flexible roadway delineators and yellow curb paint as necessary. The minimum curb bulb throat width is 24 feet (back of curb to back of curb).

C. DRAINAGE

Drainage systems shall be designed in accordance with these Design Standards and Specifications, Section II, Drainage Policy. Development plans, including a drainage report, for the drainage system are required for concurrent review with, and shall be considered part of roadway design.

1. Crosspans. Crosspans (valley gutters) shall be constructed in accordance with City of Bozeman Standard Drawings. Crosspans are not allowed across collector or arterial roadways, nor are they allowed on roadways with storm sewer systems.

   Crosspans may be used parallel with collector or arterial roadways to convey storm runoff across residential roadways. The use of crosspans elsewhere is discouraged, and will only be allowed after all other alternatives have been investigated.

2. Inlets:

   a. Inlets shall be located to intercept the major curb flow at intervals sufficient to ensure the depth of flow in the curb line is a maximum of 0.15' below the top of curb. This will result in a maximum spread width of approximately 9.5'. Inlets should be aligned with lot lines wherever possible.

   b. Inlets shall also be installed to intercept cross-pavement flows at points of transition in super elevation. Due to the presence of pedestrian ramps, inlets are not allowed in the curb return, but will be located at the tangent points of the curb returns.

   c. All inlets within the public right-of-way, or to be maintained by the City of Bozeman, shall be constructed in accordance with City of Bozeman Standard Drawings.

3. Cross Slope: Except at intersections, or where super-elevation is required, roadways shall be level from top of curb to top of curb and shall have a three (3)percent crown as measured from centerline to lip of curb, or lip of median curb to lip of outside curb on roadways with raised center islands. Parabolic or curve crowns are not allowed. Maximum pavement cross slope allowed is

five (5) percent at warped intersections, as measured above. In no case shall the pavement cross slope at warped intersections exceed the grade of the through street. When warping side streets at intersections, the crown transition should be completed within 75-feet horizontally for local streets, 100-feet horizontally for collector streets, and 150-feet horizontally for arterial streets. The crown of the through street shall be decreased to 1.5% through intersections, with the crown transitions being accomplished within 100 feet on either side of the intersections. Quarter crowning may be accepted on a case by case basis needing prior approval from the City Engineer.

4. Temporary Erosion Control: Temporary erosion control is required at the ends of all roadways that are not completed due to project phasing, subdivision boundaries, etc. Prevention of erosion at the roadway terminus shall be by methods approved by the City Engineer.

5. Sidewalk Chases:

   a. Storm waters from concentrated points of discharge shall not be allowed to flow over sidewalks, but shall drain to the roadway by the use of chase sections. The use of sidewalk chases is discouraged, and their use is limited to situations where it is not possible to use standard storm inlets and piping.

   b. Chase sections shall not be located within a curb cut of driveway. Chase sections shall be identified by station and elevation.

   c. Sidewalk chase sections are to be constructed in accordance with the City of Bozeman Standard Drawings.

D. HORIZONTAL ALIGNMENT

1. Turning Radius: All roadways shall intersect at right angles as nearly as possible. In no case shall the angle of intersection be less than seventy-five degrees (75°).

2. Curb Return Radius: Minimum curb returns shall be as shown in Table IV-1 of these specifications. A larger radius may be used with the approval of the City Engineer.

3. Design Speed: Design speed shall be as shown in Table IV-2 of these specifications.

4. Horizontal Curves: The minimum centerline radius for horizontal curves shall be as shown in Table IV-2 of these specifications. Variances from the requirements of Table IV-2 for local streets only may be considered on a case by case basis.

5. Two streets meeting a third street from opposite sides shall meet at the same point, or their centerlines shall be off-set at least 125 feet.

TABLE IV-1
CURB RETURN RADIUS AT INTERSECTIONS*

	LOCAL	COLLECTOR	MINOR ARTERIAL	MAJOR ARTERIAL
LOCAL OR PRIVATE ST.	15'	15'	15'	15'
COLLECTOR	15'	25'	25'	25'
MINOR ARTERIAL	15'	25'	**	**
PRINCIPAL ARTERIAL	15'	25'	**	**

* Measured from back of curb
** Per AASHTO Standards

TABLE IV-2

MINIMUM STREET DESIGN STANDARDS FOR CITY STREETS

STREET TYPE	PRINCIPAL ARTERIAL	MINOR ARTERIAL	COLLECTOR	LOCAL	RURAL
Right-of-way width	110' - 120'[3]	100'	90'	60'	90' – 110'[3]
Centerline radius on curves	[1]	[1]	300'	150'	300'
Tangent length between reverse curves	[1]	[1]	100'	50'	100'
Stopping sight distance	[1]	[1]	300'	200'	300'
Angle at intersection centerline	[1]	[1]	>75°	>75°	>75°
Curb radius at intersections	[2]	[2]	[2]	[2]	N/A
Length of tangent at intersection	[1]	[1]	150'	100'	150'
Back of curb to back of curb	82'	50', 63', 71'[3]	45', 48', 52',62'[3]	31',[3]3',[3]5'[3]	33', 39', 62'[3,4]
Length of cul-de-sac[5]	N/A	N/A	N/A	500'	N/A
Outside radius on cul-de-sac right-of-way[5]	[5]	[5]	N/A	50'	N/A
Grade – maximum	[1]	[1]	7%	10%	10%
Grade – minimum	0.5%	0.5%	0.5%	0.5%	0.5%
Grade within 150 feet of intersecting centerlines	[1]	[1]	3%	3%	3%
Design Speed (MPH)	50	45	45	30	45
K Factor (minimum)					
Crest	[1]	[1]	105	50	105
Sag	[1]	[1]	65	35	65
Minimum VCL					
Crest	[1]	[1]	90	50	90
Sag	[1]	[1]	70	50	70

[1]All design criteria shall meet AASHTO standards.
[2]See Table IV-1
[3]The specific right-of-way and back of curb to back of curb street width will be determined on a case by case basis through the subdivision review process, and will be based on the specific needs, impacts and context of the development proposal.
[4]The rural street standard does not include curb and gutter. The street width is measured from the edge of pavement to the edge of pavement.
[5]Cul-de-sacs are generally not allowed. The City Engineer may consider and approve the installation of a cul-de-sac only when necessary due to topography, the presence of critical lands, access control, adjacency to parks or open space, or similar site constraints.

6. Super-elevation: Super-elevation may be required for arterial roadways and selected collector roadways. Horizontal curve radius and super-elevation shall be in accordance with the recommendations of AASHTO.

   Super-elevation shall not be used on local roadways.

7. Spiral Curves: Spiral curves shall not be used on road-ways within the COB (State highways excluded) except by written approval of the City Engineer.

8. Railroad Crossing: All railroad crossings on streets shall be steel reinforced rubber for the full width of the roadway.

9. Barricades: Whenever roadways terminate due to project phasing, subdivision boundaries, etc., barricades are required in accordance with the Manual of Uniform Traffic Control Devices (MUTCD) and City standards.

E. VERTICAL ALIGNMENT

Design controls for vertical alignment are shown in Table IV-2.

1. Permissible Roadway Grades: The minimum allowable grade for any roadway or alley is one-half (0.5) percent. The maximum allowable grade for any roadway is shown in Table IV-2 of this Policy. The maximum grade for an alley is subject to the approval of the City Engineer.

2. Changing Grades: Continuous grade changes or "roller-coastering" shall not be permitted. The use of grade breaks, in lieu of vertical curves, is not encouraged. Where the algebraic difference in grade (A) exceeds one percent (1.0%), a vertical curve is to be used.

3. Vertical Curves: All vertical curves shall be symmetrical. Design criteria for vertical curves are found in Table IV-2. The minimum grade within a sag (sump) vertical curve is five-tenths (0.50) of a percent. Minimum length of a vertical curve is shown in Table IV-2. All vertical curves shall be labeled, in the profile, with length of curve (L) and K (=L/A).

4. Intersections: The following additional criteria shall apply at intersections.

a. The grade of the "through" street shall take precedence at intersections. At intersections of roadways with the same classification, the more important roadway, as determined by the COB Engineering Department, shall have this precedence. Warp side streets to match through streets. See Section IV.C. 3 above.

b. The elevation at the point of tangency (PT) of the curb return on the through street is always set by the grade of the through street in conjunction with normal pavement cross slope.

c. Carrying the crown of the side street into the intersecting through street is not permitted.

d. At an arterial-arterial intersection, a more detailed review of the entire intersection's drive ability will be done.

5. Curb returns: Minimum fall around curb returns, when turning water, shall be three-tenths (0.3) of a foot for a fifteen (15) foot radius; four-tenths (0.4) of a foot for a twenty (20) foot radius; one-half (0.5) of a foot for a twenty-five (25) foot radius. For all other curb return radii use a grade of 1.25-percent within the return to establish minimum fall when turning water. The maximum fall around a curb return is 3.00-percent. Show and label high point location, elevation and intersection of flow line in plan view if applicable.

6. Connection with Existing Roadways: Connections with existing roadways shall be smooth transitions conforming to normal vertical curve criteria if the algebraic difference in grade (A) between the existing and proposed grade exceeds one percent (1.0%). When a vertical curve is used to make this transition, it shall be fully accomplished prior to the connection with the existing improvement. Field-verified slope and elevation of existing roadways shall be shown on the plans.

7. Offsite Design and Construction: The design grade, and existing ground at that design grade, of all roadways that dead end due to project phasing, subdivision boundaries, etc., shall be continued in the same plan and profile as the proposed design for at least three hundred (300) feet or to its intersection with an arterial roadway. This limit shall be extended to six hundred (600) feet when arterial roadways are being designed. If the offsite roadway adjacent to the proposed development is not fully improved, the developer is responsible for the design and construction of a transition with a 4-foot road base shoulder for the safe conveyance of traffic from his improved section to the existing roadway. The following formula shall be applied to the taper or land change necessary for this transition:

Speed Limit	
40 MPH or Less	$L = WS^2/60$
45 MPH or Greater	$L = WxS$

where

L = length of transition in feet
W = width of offset in feet
S = speed limit or 85th percentile speed

The City of Bozeman Engineering Department should be consulted for any unusual transition conditions. Grade breaks greater than 1-percent are not allowed when matching existing dirt or gravel streets.

8. The cost of offsite pavement transitions shall be borne by the developer.

F. MEDIAN TREATMENT

Median curbs should be integral curb and gutter (with spill curb) unless otherwise approved. Medians less than eight (8) feet wide should be capped with M-4000 concrete a minimum of three (3) inches thick. Wider medians should be top soiled and seeded with an approved seed mix. The minimum median width is 4 feet. All medians or raised islands should be made clearly visible at night through the use of adequate reflectorization and/or illumination. Flexible delineators shall be placed at the beginning and end of all medians, and at the point of any horizontal alignment change. All median curbs and island curbs shall be painted yellow with epoxy paint.

G. ROADWAY SPECIFICATIONS

Following are the requirements of the minimum roadway surfacing standards:

Surfacing. The pavement thickness design will be based on the current AASHTO Guide for Design of Pavement Structures, or the current Asphalt Institute Manual Series No. 1 (MS-1) for thickness design. A Pavement Design Report, based upon specific site soil data and design-year traffic loading conditions, prepared by a Professional Engineer, or other qualified professional approved by the City Engineer, shall be submitted to the City Engineer for approval prior to plan and specification submittal if using the self-certification process or with the plans and specifications if using the standard process. The design shall be based on at least a 20-year performance period traffic volume; however, the minimum design lane Equivalent 18,000-lb Single Axle Load (ESAL) used in the pavement design shall not be less than 50,000-ESAL. The minimum asphalt pavement thickness for any new local roadway shall be three (3) inches. The minimum asphalt pavement thickness for any new collector or arterial roadway shall be four (4) inches. A

minimum of six (6) inches of high quality untreated aggregate base shall be provided for designs utilizing asphalt pavement over untreated aggregate base. Where full-depth asphalt is designed, an adequate stabilizer lift shall be included, consistent with unpaved roadway design practices, to provide a suitable sub-base capable of withstanding the traffic required for the initial construction of the roadway. The City Engineer may require intersections with roundabouts or traffic circles to be constructed with Portland Cement Concrete surfacing.

H. SIGNS and MARKINGS

1. Street identification signs shall be installed at all new intersections in accordance with City of Bozeman Modifications to MPWSS. The design Engineer should consider, and the City Engineer may require, regulatory traffic control signs and pavement markings in accordance with the MUTCD. Stop signs shall be installed on local streets when they intersect with any collector or arterial streets.

2. Unless otherwise approved, all transverse markings, words and symbols, and 8" or larger lane line pavement markings shall be inlaid thermoplastic or pre-formed plastic tape. All other markings may be either inlaid or preformed thermoplastic or epoxy paint. The materials proposed for all markings shall be specified on the plans.

3. Crosswalk markings should not be used indiscriminately. An engineering study should be performed before they are installed at locations away from traffic signals or stop signs. Mid-block crosswalks are discouraged.

    a. All marked crosswalks for designated school crossings shall be longitudinal white bars ("City of Bozeman Type B" style). "School Crossing" signs and "School Advance Warning" signs shall be installed at all designated school crossings.

    b. At stop or signal controlled intersections, marked crosswalks shall be two 8" white lines, 8' apart typically, installed transverse to traffic and in-line with sidewalks, if any ("City of Bozeman Type A" style).

    c. Marked crosswalks at uncontrolled intersections, and all mid-block crosswalks shall be "Type B", with "Pedestrian Crossing" signs. "Pedestrian Crossing Advance Warning" signs should be installed if deemed warranted by engineering judgment.

    d. Parking shall be restricted by the use of signs and curb markings within 20 feet of crosswalks at a minimum, or longer based on engineering judgment.

e. All crosswalk signs and advance crosswalk signs shall have a fluorescent yellow green background.

4. All signs shall comply with the "Standard Highway Signs" book (FHWA).

5. Street name signs for publicly-maintained roadways shall consist of white letters on a green background. Street name signs for privately-maintained roadways shall consist of white letters on a blue background.

I. MONUMENTATION

1. Monuments in monument boxes shall be provided in new or reconstructed streets at all section corners, quarter corners, and sixteenth corners.

J. LIGHTING

The design engineer shall consider the need for roadway lighting in the development of plans for any new or reconstructed roadways.

Street lighting consists of street lighting and pathway intersection lighting, and shall comply with the following requirements:

1. General.

a. All street lighting shall be operated and maintained through the creation of a new SILD, through the annexation to an existing SILD or through some other equivalent means approved by the City of Bozeman. The application to create or annex to an existing SILD shall be submitted to the City within 2 months of preliminary approval of the development. The approval to create or annex to an SILD shall be granted prior to final plat for a subdivision or Occupancy if a final plat is not required.

b. Street lighting shall be installed per 38.39.030 B, BMC (in regards to completion time for improvements).

c. Individual yard lights on private property shall not be used for street lighting.

d. Unless otherwise specified herein, installation of equipment for lighting shall conform to the requirements of "Bozeman Lighting and Electrical Specifications" (see appendix).

K. BIKE LANES/PATHS

All bike lanes/paths shall be designed in accordance with the "Guide for the Development of Bicycle Facilities" (AASHTO, latest edition). Bike lanes shall be marked and signed in accordance with the MUTCD.

V. UTILITY DESIGN CRITERIA

A. WATER DISTRIBUTION LINES DESIGN CRITERIA

1. All additions or modifications to the COB water system will be designed in accordance with the criteria set forth in this and other sections of this Policy as approved by the City Engineer. Ductile Iron Pipe (DIP) shall be used exclusively unless special approval, in writing, of alternate materials is given by the City Engineer. All additions to the water system will be designed and installed in accordance with the Water Quality Bureau (WQB) Circular No. 1; MPWSS; COB Modifications to MPWSS; COB Water Facility Plan; and COB Fire Service Line Standard.

2. Master Water Plan: A master water plan shall be submitted for each subdivision or other major development prior to approval of any portion of the water system. An overall plan of the development, including all areas outside of the study area which would naturally be served through the study area shall be submitted.

3. A design report prepared by a professional engineer licensed in the State of Montana demonstrating compliance with these requirements shall be submitted to and approved by the City of Bozeman prior to plan and specification submittal if using the self-certification process or with the plans and specifications if using the standard process for any new development. Design parameters and the critical conditions shall be shown on a overall plan of the study area. An overall plan of the development, including all areas outside of the study area which would naturally be served through the study area shall be included.

4. Main Size: The water distribution system shall be designed to meet the maximum demand plus fire flow and the peak hour demand. The design shall be based on a maximum hour to average day ratio of 3:1 (maximum day to average day ratio of 2.3:1 for an average daily usage of 170-gallons per day per person), plus fire flow demand as determined by ISO (Insurance Services Office) criteria. A "C" Factor of 130 shall be used in modeling system designs. The working residual water pressure shall not be less than 20-psi at any point in the water distribution system under maximum day plus fire flow. The velocity of the water in the system shall not exceed 15-feet per second through a public main line. The minimum diameter for any new main is 8-inch, unless specific approval in writing is obtained from the City of Bozeman for smaller diameters.

5. Main Extensions: All main extensions shall be looped, where possible. All dead end 8" mains shall end with a fire hydrant or 2" blowoff. Larger diameter dead end mains shall end with a fire hydrant. Permanent dead-end

mains shall not exceed 500-feet long. Temporary dead-end mains scheduled for future extension may end with a blow-off in lieu of a fire hydrant.

6. Services

a. A water line is designated as either a service line or water main based on its use, not its size. Generally, a line serving a single building or facility is considered a service line; a line serving more than one building, or intended to serve more than one building or facility is generally designated a water main. The standard sizes of service lines are 3/4-, 1-, 1½-, 2-, 4-, 6-, or 8-inch. The minimum size of a fire service line is 1-inch. The minimum size of a service line stub is 1", to allow for the potential use of the domestic supply for a fire sprinkler system.

b. Service pipe shall be type "K" copper for sizes less than 4-inch, and ductile iron for services 4-inch and larger. Plans and specifications prepared by a Professional Engineer licensed in the State of Montana shall be submitted for 4-inch and larger service lines.

c. The service stubs shall be installed in accordance with the COB Standard Drawings for service lines. The service line stubs shall be installed at the center of each lot unless otherwise approved by the Water Superintendent.

d. No service line shall be extended into a building until an "Application for Service" has been completed and a Plumbing Permit has been obtained from the Building Department.

e. Backflow prevention devices as required by the Water Superintendent shall be installed on each fire and domestic service line. Meters will be installed inside the building by the Water Department on all service lines except for fire service lines. Meter pits shall not be used unless specifically approved by the Water Superintendent.

f. All service connections shall be uniform size from the service line tap to the building structure or structures unless otherwise approved or required by the Water Superintendent. The Water Department shall reserve the right to require a larger service connection to any building, structure or development if the water requirements when calculated by the fixture unit method, as specified in the Uniform Plumbing Code, cause the service line velocity to exceed ten (10) feet per second. Each service line and meter shall supply a specific building.

g. All service line stubs shall be sized to adequately serve the maximum anticipated demand for the property being served.

h. The Water Superintendent may require the termination of any existing service stubs (either for domestic or fire service) that are not utilized for service upon the development of the lot. Lines to be terminated shall be capped or plugged at the main, and any curb boxes or valve boxes on the line shall be removed.

7. Valves: Valves shall be installed in accordance with the following unless otherwise approved or required by the Water Superintendent:

a. All connections to an existing water main will begin with a new valve.

b. Valves shall be located at not more than 500-foot intervals in commercial districts and at not more than one block or 800-foot intervals in other districts.

c. Every leg of a main intersection shall have a valve.

d. Valves shall be placed so that main shut-downs can be accomplished with only one fire hydrant being out of service at a time.

8. Hydrants: Hydrants shall be provided at each street intersection and at intermediate points so that hydrants are spaced from 350- to 600-feet depending on the area being served. Mid-block hydrants shall be installed in line with lot lines.

9. Air Relief: Air relief shall be provided at all high points in the line where air can accumulate by means of hydrants, services, or air relief valves.

10. Pressure Reducing Valves: Pressure reducing valves shall be installed when the anticipated average-day line pressure exceeds 120 psi.

11. Thrust Restraint: All thrust restraint shall be designed to withstand the test pressure or the working pressure plus surge allowance, whichever is larger. Adequate factors of safety shall be employed in the design.

B. SANITARY SEWER SYSTEM DESIGN CRITERIA

1. All additions or modifications to the COB sanitary sewer system will be designed in accordance with the criteria set forth in this and other sections of

this Guide as approved by the City Engineer. All additions to the sewer system will be designed and installed in accordance with WQB Circular No. 2; MPWSS; COB Modifications to MPWSS; the Uniform Plumbing Code; and the COB Wastewater Facility Plan.

2. A design report prepared by a professional engineer licensed in the State of Montana demonstrating compliance with these requirements shall be submitted to and approved by the City of Bozeman prior to plan and specification submittal if using the self-certification process or with the plans and specifications if using the standard process for any new development. Design parameters and the critical conditions shall be shown on an overall plan of the study area. An overall plan of the development, including all areas outside of the study area which would naturally be served through the study area shall be included.

3. New sewer lines shall be sized to flow at no more than 75-percent of full capacity at peak hour conditions upon the full build-out of the development. The effects of the proposed development's sewer loading on existing downstream sewer lines shall be analyzed.

4. New sanitary sewer lines to serve residential areas shall be designed to accommodate an average daily flow rate of 2.11 people per dwelling unit and 89-gallons per capita per day. An infiltration rate of 150-gallons/acre/day shall be added to all flow calculations when designing new sewers.

5. New sanitary sewer lines shall be designed to accommodate the average daily flows as shown in Table V-1, V-2, and V-3 of this Policy.

6. A Manning's friction factor of 0.013 shall be used in designing new sewers. A peaking factor shall be calculated for each pipe segment based on the following formula;

$$\frac{Q_{max}}{Q_{Ave}} = \frac{18 + P^{1/2}}{4 + P^{1/2}} \quad (P = \text{Population/thousands})$$

For non-residential flows an equivalent population shall be calculated for use in the peaking factor formula.

To evaluate future collection needs, wastewater loading needs to be assigned to areas based on anticipated future land use characteristics. In areas within the City limits the assigned zoning provides the best tool to approximate future wastewater loadings. Table V-1 shows the recommended wastewater flow rates based on a per acre basis for zoned areas. Detailed information on how the flow rates were developed is located in Appendix 2A of the "City of Bozeman Wastewater Facilities Plan, 2007."

TABLE V-1 WASTEWATER FLOW RATE FOR ZONED UNDEVELOPED AREAS[1]

Designation	Dwelling Units per Acre	GAL./ACRE/DAY
R-S	6.5	1,220
R-1	3.9	730
R-2	5.2	980
R-3	6.5	1,220
R-4	10.4	1,950
R-O	5.2	980
R-MH	5.2	980
B-1		1,000
B-2		2,000
B-3		3,000
M-1		960
M-2		960
B-P		960
NEHMU	6.5	1,220
PLI		1,030

[1] The flow allocation in this table is based on gross area.

In areas within the 2020 Plan Boundary that have a defined land use, wastewater flows can be allocated on the land use designation. Table V-2 provides the recommended wastewater flow rate by land use designation.

TABLE V-2 WASTEWATER FLOW RATE BY LAND USE DESIGNATION[1]

Designation	Dwelling Units per Acre	GAL./ACRE/DAY
Industrial	-	960
Neighborhood Commercial	-	1,200
Community Commercial	-	2,400
Regional Commercial	-	1,600
Business Park	-	960
Public Institutions	-	1,030
Residential	5.5	1,030
Suburban Residential	1.3	240
Park and Open Space	-	25
Other Public Lands	-	1,030
Golf Course	-	30
MSU	-	2,780
MSUaWest	-	1,030

[1] The flow allocation in this table is based on gross area as land area.

Table V-3 identifies the recommended flow allocation for areas that are defiend as future urban by the 2020 Plan or are areas outside of the 2020 Plan Boundary. These areas are the least defined in terms of land use. As such, the projected flows are based on equivalent residential dwelling unit densities. Additional detail is provided in Appendix 2A of the "City of Bozeman Wastewater Facilities Plan, 2007".

TABLE V-3 WASTEWATER FLOW RATE FOR UNDEFINED LAND USE DESIGNATIONS[1]

Designation	Dwelling Units per Acre	GAL./ACRE/DAY
Future Urban	5.5	1,030
Future Expansion Area	5.5	1,030

[1]The flow allocation in this table is based on gross area.

7. Manhole Spacing: The maximum distance between manholes shall be as follows:

SANITARY SEWER

PIPE SIZE	MAXIMUM DISTANCE
8" to 15"	400'
18" to 30"	500'
larger than 30"	600'

8. Barrel Size: The alignment and number of pipes into the manhole will determine the barrel size for the size of pipe used. All 48-inch manholes will have eccentric cone top sections if total manhole height is greater than six feet. All other manholes will have flat tops. All drop manholes shall be "inside drop" with a minimum barrel diameter of 60-inch. The internal diameter of the manhole barrel shall be typically as follows:

SANITARY SEWER

PIPE SIZE	BARREL SIZE
12" or less	48"
15" to 27"	60"
30" to 48"	72"

Manholes larger than seventy-two (72) inches may be allowed with specific approval by the City Engineer.

9. Manhole Channels: All manholes shall have full-depth channels. When a smaller main is being connected to a larger main at a manhole, the manhole inverts shall be set so that the 8/10 depth of flow of each main is equal in elevation. The minimum drop across a manhole (invert in to invert out) is 0.2'(cut-in manholes excepted).

10. Sanitary Sewer Mains: The minimum diameter of a sewer main is 8-inches. Main lines shall be sized for design flow, not available slope. PVC pipe shall be used for all gravity flow main lines unless other materials are specifically approved.

11. Sanitary Sewer Services: The minimum diameter of a service is 4-inch. Services shall connect to the main with in-line gasketed wyes. The service line stub, from the main to the property line or easement line, shall be installed with a maximum slope of ½-inch per foot. The minimum slope of a 4-inch service line stub is 1/4-inch per foot. The minimum slope of a 6-inch service line stub is 1/8-inch per foot. Sewer service line stubs will typically be installed 15-feet from the downstream lot line. Services are to be installed perpendicular to the main.

Each building shall have a separate service line from the building to the sewer main, with the following exception: Accessory Dwelling Units (ADUs) may share sewer service with the service from the primary dwelling unit on the lot, provided that the service is television inspected at the owner's expense, and the Water/Sewer Superintendent determines that the service is in an acceptable condition for shared use.

12. Access Roads: A 12'-wide all-weather gravel access road, with turn-arounds if needed, shall be constructed to provide access to all sanitary sewer manholes not located within a paved public or private street or parking lot.

13. Cut-in Manholes: Pre-cast manhole bases are preferred for cut-in manholes. Poured-in-place cut-in manholes may be used if approved by the Sewer Superintendent.

C. STORM SEWERS

1. Materials: RCP (reinforced concrete pipe) or PVC pipe may be used, however PVC pipe may only be used for pipes sized 36" diameter and smaller. PVC pipe shall have a minimum stiffness of 46 PSI. Structural strength shall withstand HS-20 design load. If PVC pipe is used, all pipe exposed to sunlight shall be protected with concrete headwalls or prefabricated end sections in accordance with MPWSS Section 02725.

2. Minimum Sizes: Storm sewer mains shall not be less than 15-inch diameter. Privately owned storm sewers may be smaller, but shall still be designed in accordance with section C.5 below.

3. Manhole Spacing and Size:

Storm Sewer Pipe Diameter or Vertical Rise	Maximum Manhole Spacing (Ft.)
15" - 36"	400
42" - 60"	500
66" and Larger	750

Storm Sewer Pipe Diameter	Barrel Size* (Ft.)
15" - 18"	4
20" - 28"	5
30" - 48"	6

* Multiple pipe penetrations may require larger manhole barrels

4. Storm Inlets

   a. Publicly owned storm inlets shall comply with the applicable standard drawing in the COB Modifications to MPWSS. Where inadequate overflow paths are provided, inlets must be oversized 50-percent to accommodate plugging.

   b. The size of outlet pipes from storm water inlets shall be based upon the design capacity of the inlet, but shall not be less than 12-inches in diameter. The outlet pipes shall connect to the storm sewer main with a manhole.

   c. Computations for storm sewer design and storm inlet designs shall be submitted prior to plan and specification submittal if using the self-certification process or with the plans and specifications if using the standard process. Adequate details of inlets, manholes and other appurtenances shall be included in the overall drainage plan submitted for approval.

   d. Combination manhole/inlets may be used where approved as detailed in the City of Bozeman Modifications to MPWSS.

5. Hydraulic Design

Storm sewers shall be designed to convey the 25 year storm event with no surcharging (i.e. pipe full with no head). Inlets and sidewalk chases shall be designed to convey the 25 year storm flow with a maximum water surface elevation of 0.15' below the top of curb.

Drainage reports shall include hydraulic grade line calculations including losses from friction and transitions. Approved erosion control shall be designed and installed at all outlets.

6. Alignment

   a. Manholes are required wherever there is change in size, direction, elevation, grade or at sewer main junctions.
   b. The minimum vertical clearance between a potable water main and a storm sewer main is 1.5-feet. The minimum horizontal clearance between a potable water main and a storm sewer main is 10-feet.
   c. Horizontal alignment between manholes shall be straight.

7. Culverts

   a. A culvert is considered to be any structure which connects two

open channels. The culvert is to be designed to convey the 25-year frequency flow of the tributary drainage basin. The headwater depth will be limited by upstream conditions, but in no case shall exceed 1.5 times the culvert diameter. Excessive ponding above culvert entrances will not be acceptable if damage appears likely to surrounding property or to the roadway.

b. Culverts shall be designed with an emergency overflow path. The emergency overflow capacity shall be 100-percent of the whole culvert for the major storm for culverts with area less than twenty square feet and for culverts with area greater than or equal twenty square feet, the overflow capacity shall be 100-percent of the capacity provided by the first twenty square feet plus 20-percent of the capacity provided for the additional area as established by the formula:

% overflow= (110%) $\frac{20+(A-20).20}{A}$, where "A" is the area of the culvert opening.

If the culvert is located in a low point in the road the required overflow capacity can be provided by overtopping the road, as long as this does not result in more than 50 feet of street being flooded. Where the culvert is not in a low point, or where more than 50 feet will be flooded, the overflow capacity shall be provided by either increasing the culvert size, or additional culverts.

8. Culvert Hydraulics

a. The culvert including inlet and outlet structures shall convey water, sediment and debris at all stages of flow.

b. End Treatment: Flared end sections or headwalls with wingwalls are required. Inlets are to be designed to minimize head losses. Approved erosion control is to be provided at all culvert outlets and inlets. Trash racks should be used for culverts greater than 100-feet in length.

c. Slopes: Culvert slopes shall prevent silting, yet avoid excessive velocities. Generally, the minimum culvert slope is 0.50-percent. Minimum barrel velocity is 3-fps and maximum is 12-fps.

d. Hydraulic Analysis: Inlet and outlet control conditions shall be analyzed. Calculations shall be submitted with the design report.

e. Minimum Size: Culverts crossing a roadway shall not be smaller

than 24-inch equivalent diameter. Driveway approach culverts shall not be smaller than 15-inch equivalent diameter. Culvert length shall be adequate to provide back slopes of 4:1 or less from pipe inverts to finished street section, including existing or future sidewalks.

f. Materials: Culverts shall be RCP unless otherwise approved by the City.

g. All culverts shall be designed to withstand HS-20 loading in accordance with American Association of State Highway and Transportation Officials (AASHTO) "Standard Specifications for Highway Bridges" and with the pipe manufacturers recommendation.

9. Utility Culverts

a. Conduits placed in right-of-way to facilitate placement of future gas, electric, communication, or other utility lines shall have the structural strength to withstand HS-20 loading. Conduits shall have a minimum stiffness of 46 PSI. Conduits shall be adequately sized to accommodate all anticipated utility lines. HDPE utility culverts shall not be placed within any public right-of-way.

D. ALIGNMENT, DEPTH, AND EASEMENTS

1. General: Water mains, sanitary sewers, and storm sewers within the proposed development shall be arranged to allow the suitable development of any adjoining un-developed land, and shall be constructed to the boundary lines of the tract being developed, unless prevented by topography or other physical conditions, in which case a variance must be approved by the City of Bozeman. The alignment of all water, sanitary sewer, and storm sewer mains and services lines shall be arranged so that there is a minimum of ten (10) feet of horizontal separation between these lines and with any gas lines, power lines, communication lines, utility poles or other above-grade utility structures, and street lights.

2. Water Mains:

a. Water mains located in public street right-of-way shall be placed nineteen (19) feet off the north or west right-of-way lines for streets 35 feet in width or greater (back of curb to back of curb). For streets less than 35 feet in width, water mains shall be placed 5.5 feet west and north of the street centerline. On curvilinear street alignments, water mains will be a minimum of two (2) feet

from the edge of the concrete gutters at all locations.

b. A minimum depth of cover of six and one-half (6 ½) feet below final grade will be maintained over all water mains.

c. When water mains cross sanitary or storm sewer mains, the water line must have an eighteen (18) inch minimum vertical separation, with all water pipe joints no closer than ten (10) feet horizontal from the sewer pipe centerline, and the crossing will be perpendicular to the sewer line. A minimum of ten (10) feet horizontal separation shall be maintained between any water main and any sanitary or storm sewer main.

3. Sanitary Sewer Mains:

a. Sanitary sewer mains located in public street right-of-way shall be placed along the centerline of the street for streets 35 feet in width or greater (back of curb to back of curb). For streets less that 35 feet in width, sewer mains shall be located 5.5 feet east and south of the street centerline. On curvilinear street alignments, sewer mains will be a minimum of two (2) feet from the edge of the concrete gutters at all locations.

b. Sewer mains shall have a minimum depth of cover of four (4) feet below final grade. All sewer mains and services with less than five (5) feet of cover will be adequately insulated.

c. Where streets are curvilinear, manholes should be located in the center of the street wherever possible, however non-centerline locations that are not in vehicle wheel paths are acceptable if it will reduce the total number of manholes required.

4. Storm Sewer Mains

a. Storm sewer mains located in public street right-of-way shall typically be located on the opposite side of the street from the water main. Storm sewers may be located beneath curb and gutter if combination inlet/manholes are used.

b. Storm sewer mains shall have a minimum depth of cover of two (2) feet below final grade, provided that the pipe material shall withstand the design load. Storm sewers shall be placed to maintain a minimum horizontal clearance of five (5) feet and a vertical clearance of six (6) inches from any sanitary sewer main.

c. Manholes shall not be located in vehicle wheel paths.

5. Easements:

a. A "utility easement" granted to the public is required for all public utility mains not located within public street right-of-way. An easement shall be a minimum of thirty (30) feet wide for one or two utility mains. An additional ten (10) feet is required for each additional main that occupies the easement. Wider easements may be required at the discretion of the City of Bozeman for large utility lines. Easements not established by plat will be executed on standard forms available from the City Engineer.

b. At no time will the utility line in question be less than nine (9) feet from the edge of the easement or less than ten (10) feet from a parallel utility line. Utility easements will also be required for all meter pits and fire hydrants maintained by the City of Bozeman.

c. No permanent structures shall be placed within a utility easement unless an encroachment permit has been obtained. Trees or other significant landscaping features shall not be placed within ten (10) feet of any utility main or service lines.

d. All easements documents must conform to City of Bozeman requirements and must meet the formatting requirements of the Gallatin County Clerk and Recorder's office.

APPENDIX

City of Bozeman Fire Service Line Standard

Certificate of Completion and Acceptance

Figure A-1 Standard Roadway Typical Sections

Figure A-2 Typical Stormwater Detention Pond Concrete Outlet Structure

Sample Detention Basin Sizing Problem

Pre-construction Meeting Checklist

Plan and Specification Certified Checklist

Certified Checklist for Testing and Documentation Requirements

Random Sampling Example

City of Bozeman Street Naming and Addressing Policy

Bozeman Lighting and Electrical Specifications

CITY OF BOZEMAN
FIRE SERVICE LINE STANDARD
MARCH 31, 1997
Revised March 31, 2011

1. For all fire service lines (regardless of size) a City of Bozeman water service application must be completed prior to beginning work on the fire service line. Applications may be obtained at the City Building Department located at 20 E. Olive St..

2. Plans for all fire service lines will be reviewed by the City of Bozeman. The review and subsequent approval or denial will be for that portion of the proposed fire service line that starts at the point of connection to the City of Bozeman distribution system up to and including the backflow preventer and the flow detection device. The plans will be reviewed by the city of Bozeman Water Department, Fire Marshall, and Engineering Department. Upon satisfactory completion of the review process, the plans will be forwarded to the City Engineer with a recommendation for approval. The City Engineer will review the plans and either approve or deny the project. ***Installation of the fire service will not begin until the plans have been approved by the City of Bozeman and a City of Bozeman water service application has been completed.*** For maintenance of the fire service line after City of Bozeman final acceptance refer to Item 16 of this Standard. The Owner shall be completely responsible for assuring the fire service line is properly/adequately sized to provide the flows necessary for the fire protection system being serviced by the proposed fire service line.

3. Plans for all proposed fire service lines shall be drawn to scale on 24" x 36" plan sheet(s) and shall include all essential details such as:

   a. Size and location of all water supplies.
   b. Size and location of all piping indicating, where possible, the class, type and depth of existing pipe, the class and type of new pipe to be installed, and the depth to which it will be buried. For proposed fire service liens 4" in diameter and larger the plans must include a profile drawing of the proposed fire service line from the point of connection at the existing main up to and including the system riser. The profile drawing must show the finished grade, depth of cover for the line, and if applicable, all other utilities which the fire service line will cross or be adjacent to.
   c. Size, type and location of valves.
   d. Classification of the system (See Attachment A).
   e. Sprinkler and standpipe riser to be supplied by the system.
   f. Location of fire department connections.
   g. Size of orifice necessary to achieve the flushing flows required under NFPA 24.

4. All fire service lines not installed by the City of Bozeman Water Department shall be designed, inspected and certified by a Professional Engineer.

5. Fire service lines 4" in diameter and larger shall be installed, tested, and disinfected by a single Contractor from the point of connection at the City water main (or existing stub) to the first control valve (OS&Y) inside of the building. (Note Item 16 of this Standard for maintenance of the fire line.)

6. For all fire service lines 2" in diameter and smaller where no stub exists, a licensed contractor shall install the line from the main up to and including the first control valve (OS&Y) and double check valve inside the building. The Water Department shall tap the main at the owner's expense and inspect the line under line pressure before it is backfilled. A curb stop and box shall be installed at a point 8' past property line unless otherwise directed by the Water Superintendent. Installation of the fire service line will not begin until the plans for the project have received City of Bozeman approval and a City of Bozeman water service application has been completed.

7. The City of Bozeman will only accept fire service lines which are 1", 1 ½", 2", 4", 6", or 8" in diameter, unless specifically approved by the Engineering and Water Departments.

8. When tapping tees are used for the fire service line connection to the main, the Contractor shall install the tapping tee and valve and the City of Bozeman shall make the actual tap to the main at the Owner's expense.

   The fire service line connection to the City water main without the use of a tapping tee will be made by the Contractor installing the appropriate sized tee in the water main. The Water Department will operate all valves for the shut down of the line to install the tee and must be provided with a minimum of 24 hours advance notice before work is scheduled to begin. The Contractor shall notify all affected water customers of the water shut down a minimum of 24 hours before the work begins. Temporary water service shall be provided to all affected water customers if the shut down period is anticipated to exceed four hours. The City of Bozeman reserves the right to determine the likely extent of the main shut down based on the proposed work and Contractor experience, and require the installation of temporary water services by the Contractor.

9. Material and installation of fire service lines shall comply with the following standards:
   a. **Montana Public Works Standard Specifications, Fifth Edition, March 2003.**
   b. **City of Bozeman Modifications to the Montana Public Works Standard Specifications.**
   c. **City of Bozeman Standard Drawings 02660-13 and 02660-14.**
   d. **City of Bozeman Fire Service Line Standard.**
   e. **NFPA 24, Installation of Private Fire Service Mains and Their Appurtenances, (latest edition).**

10. The City of Bozeman's requirements for the installation of double check valve assemblies and reduced pressure backflow prevention assemblies are as follows:

    a. The first fitting inside of the building shall be a UL listed flanged American Flow

Control, Kennedy or Mueller OS&Y valve the same size as the fire service line, for lines 4" and larger. For lines 2" and smaller, the first fitting inside the building shall be a NIBCO T-104-0 OS&Y valve.

b. All double check valve assemblies and reduced pressure backflow prevention assemblies shall be:

1. UL or FM listed
2. Approved by the University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USCFCCCHR) for operation in the proposed position (vertical or horizontal) as shown on the approved plans.
3. Installed as shown on the approved plans.

c. A flow detection device shall be installed immediately following the double check valve assembly or the reduced pressure backflow prevention assembly (alarm check valve, flow/sensor alarm, meter, etc.) as shown on the approved plans.

d. A double detector check valve assembly may be used with a standard City of Bozeman meter (for Class I, II and III systems only). The meter loop of the double detector check valve shall have a double check valve assembly installed which meets the same installation criteria specified above in requirement b.

e. Horizontal installations must be a minimum of 2 feet clear above the finished floor.

f. The fire service riser must be a minimum of 2 feet clear from any outside wall.

g. The incoming fire service line shall be a minimum of 6.5 feet and a maximum of 7.5 feet below the finished grade.

h. All fire service lines appurtenances shall have a minimum pressure rating of 175 p.s.i.

i. All fire service lines 4" ands larger shall be Class 51 ductile iron pipe.

j. Line Sizing: The double check valve assembly or reduced pressure backflow prevention assembly shall be equal in size to the outgoing pipe diameter (downstream).

11. Prior the City of Bozeman's initial acceptance of the new fire service line (4" in diameter and larger) the line must be disinfected in accordance with Montana Public Works Specifications and City of Bozeman requirements. Flushing and pressure testing of the line shall be done in accordance with NFPA 24. Two (2) copies of the bacteriological tests results are to be submitted to the City Engineering Department, who will forward a

copy to the City Water Department.

12. Prior the City of Bozeman's initial acceptance of the new fire service line (4" in diameter and larger) the "Contractor's Material and Test Certificate for Underground Piping" (See Attachment B) must be completed and two (2) copies submitted to the City Engineering Department, who will forward a copy to the City Water Department.

13. Prior to the City of Bozeman's initial acceptance and activation of the fire service line (i.e., putting the line into service) a final inspection will be conducted by the City of Bozeman Water Superintendent, or his designated representative, to confirm that the installation is in accordance with the approved application and the approved plans. A Certificate of Inspection (see Attachment C) will be completed by the Water Superintendent, or his designated representative, upon completion of the final inspection, with copies of the Owner, Contractor, and Engineering Department. Installations that are in conformance with the approved plans for the project and have passed all required tests (see sections 11 and 12) will be initially accepted by the City of Bozeman as noted on the Certificate of Inspection. Installations that are not in conformance with the approved plans for the project will not be initially accepted by the City of Bozeman and the line will not be activated (i.e., placed in service) until the installation is in conformance with the approved plans and all required tests have been taken and passed.

14. The required two-year warranty period for the fire service line begins on the date of initial acceptance as noted on the Certificate of Inspection completed by the City of Bozeman Water Department.

15. Upon the City's initial acceptance (see Section 13) of the fire service line, the following must be submitted by the Project/Design Engineer to the City Engineer within thirty (30) days:

    a. Two (2) sets of accurate blue line record drawings signed by the Engineer.

    b. A letter of certification from the project Engineer stating that the fire service line was installed in accordance with the approved plans.

    The City of Bozeman's final acceptance of the fire service line will be based on the letter of certification, record drawings, and correction of any deficiencies noted during the two-year warranty period.

16. Following the expiration of the two-year warranty period, the City of Bozeman will maintain, at its expense, the fire service line from the main up to the curb stop or curb valve, or to the property line or easement line, whichever is more.
Any maintenance or repairs to the fire service line or its appurtenances beyond the point of City of Bozeman responsibility specified above shall be by a licensed contractor at the

Owner's expense. The building owner shall also be responsible for maintenance, repairs, and testing of all fire service line piping and appurtenances beyond the first control valve (OS&Y) inside the building.

17. The building owner may operate the first control valve (OS&Y) inside of the building when necessary for maintenance or repairs. When the first control valve (OS&Y) inside of the building is shut off for any reason, the City of Bozeman Fire Department must be notified immediately and informed of the shut down date, time and duration. **The building owner is completely responsible to ensure that this valve remains open at all times (except for maintenance or repairs) for the proper operation of the buildings fire protection system.**

18. Use of the fire service line shall be restricted to fire fighting use, emergency use and approved auxiliary (e.g., closed loop heating/cooling systems) including routine testing and flushing. Combined use lines (i.e., domestic and fire) are not acceptable for all buildings except single-family residences (SFRs). Separate service lines must be installed for individual domestic and fire services, except for SFRs. Fire sprinkler systems for SFRs may connect to the domestic supply inside the residence. Such connection must be made downstream of the backflow preventer. The backflow preventer must be a testable backflow preventer approved by the City of Bozeman's Backflow Prevention Specialist.

19. Bonding Requirements. The Owner shall require the Contractor to furnish Performance and Payment Bonds in favor of the Owner in an amount equal to one-hundred percent (100%) of the Agreement amount.

    The bonds shall be signed by a surety company authorized to do business in the State of Montana, and acceptable as a surety to the Owner and countersigned by a Montana Resident Agent.

    The bonds shall be filed with the Owner and the City of Bozeman and shall include a copy of Power of Attorney certified to include the date of the bonds.

20. Insurance Requirements. The Owner shall require the Contractor to secure and maintain such insurance from and insurance company (or companies) authorized to write insurance in the State of Montana, with a minimum "A.M. Best Rating" of B+, VI, as will protect himself, his subcontractors, the Owner, and the City of Bozeman and their respective agents and employees from claims for bodily injury, death, or property damage which may arise from operations and completed operations under the Agreement. The types and limits of coverage shall comply with the current edition of "Montana Public Works Standard Specifications". The Owner shall not authorize, nor shall the Contractor commence work under the Agreement until such insurance has been obtained and certificates of insurance, with binders, or certified copies of the insurance policy, have been filed with the Owner and the City of Bozeman.

All insurance coverages shall remain in effect throughout the life of the Agreement, except that the Contractor shall maintain the Commercial General Liability coverage for a period of at least one year following the substantial completion date for property damage resulting from occurrences during the Agreement period.

Each insurance policy shall contain a clause providing that it will not be cancelled by the insurance company without 30 days written notice to the Owner, and the City of Bozeman, of intention to cancel.

21. Warranty Period. If, within two years after initial acceptance of the work by the City of Bozeman, any of the work is found to be defective or not in accordance with the Contact Documents, and upon written notice from the City of Bozeman, the Owner shall cause the Contractor to correct any work within seven (7) calendar days of said written notice. Should the Owner or Contractor fail to the written notice within the designated time, the city of Bozeman may correct the work at the expense of the Owner/Contractor.

ATTACHMENT A

Backflow Prevention and System Classification

The City of Bozeman requires that the plans for the proposed fire service line include a description of the system including the "Class" of the system and the backflow prevention to be installed with the system. This Attachment provides standards for determining the Class of the proposed system and the required backflow protection to accompany the specific system. The standards in this Attachment are based on recommendations in American Water Works Association Manual M14, *Recommended Practice for Backflow Prevention and Cross-Connection Control,* and City of Bozeman requirements.

Classification for Backflow Protection

Class 1. Direct connections from public water mains only; no pumps, tanks, or reservoirs; no physical connection from other water supplies; no antifreeze or other additives of any kind; all sprinkler drains discharging to atmosphere, dry wells or other safe outlets.

Class 2. Same as Class 1 except that booster pumps may be installed in the building after the first interior control valve (OS&Y).

Class 3. Direct connection from public water supply mains, plus one or more of the following: elevated storage tanks, fire pumps taking suction from aboveground covered reservoir or tanks; and pressure tanks. (All storage facilities are filled or connected to public water only, the water in the tanks is to be maintained in a potable condition. Otherwise, Class 3 systems are the same as Class 1.)

Class 4. Directly supplied from public mains, similar to Class 1 and Class 2, with an auxiliary water supply dedicated to fire department use and available to the premises, such as an auxiliary supply located within 1700 feet of the pumper connection.

Class 5. Directly supplied from public mains and interconnected with auxiliary supplies, such as pumps taking suction from reservoirs exposed to contamination, or rivers and ponds; driven wells; mills or other industrial water systems; or where antifreeze or other additives are used.

Class 6. Combined industrial and fire protection systems supplied from the public water mains only, with or without gravity storage or pump suction tanks.

Required Protection

All systems regardless of Class require a means of flow detection which must be approved by the City of Bozeman.

Class 1. Minimum backflow protection requirement for a Class 1 system is an approved testable double check valve assembly to prevent water from backflowing into the public potable water system. The double check valve assembly should be the same size as the fire service line to the building and installed immediately following the first interior OS&Y control valve as shown on the approved plans. (Refer to City of Bozeman Standard Drawing 02660-13 for specific requirements.)

Exception: Special conditions may exist on the site of Class 1 fire systems such that actual or potential contamination hazards are presented to the domestic water supply. Under these conditions an approved reduced pressure backflow prevention assembly, or an appropriately sized air gap, may be warranted and/or required by the City of Bozeman.

Class 2. Minimum backflow protection requirement for a Class 2 system is an approved

testable double check valve assembly to prevent water from backflowing into the public potable water system. The double check valve assembly should be the same size as the fire service line to the building and installed immediately following the first interior OS&Y control valve as shown on the approved plans. (Refer to City of Bozeman Standard Drawing 02660-13 for specific requirements.)

Exception: Special conditions may exist on the site of Class 2 fire systems such that actual or potential contamination hazards are presented to the domestic water supply. Under these conditions an approved reduced pressure backflow prevention assembly, or an appropriately sized air gap, may be warranted and/or required by the City of Bozeman.

Class 3. Minimum backflow protection requirement for a Class 3 system is an approved testable double check valve assembly to prevent water from backflowing into the public potable water system. The double check valve assembly should be the same size as the fire service line to the building and installed immediately following the first interior OS&Y control valve as shown on the approved plan. (Refer to city of Bozeman Standard Drawing 02660-13 for specific requirements.)

Exception: Special conditions may exist on the site of Class 3 fire systems such that actual or potential contamination hazards are presented to the domestic water supply. Under these conditions an approved reduced pressure backflow prevention assembly, or an appropriately sized air gap, may be warranted and/or required by the City of Bozeman.

Class 4. The type of backflow protection for Class 4 systems will depend on the quality of the auxiliary supply. The type of backflow protection will be one of the following approved by the City of Bozeman: air gap or reduced-pressure backflow-prevention assembly. Reduced-pressure backflow-prevention assemblies should be the same size as the fire service line to the building and installed immediately following the first interior OS&Y control valve as shown on the approved plans. (Refer to city of Bozeman Standard Drawing 02660-14 for specific requirements.)

Class 5. The type of backflow protection for Class 5 systems will be either a reduced-pressure backflow-prevention assembly or an air gap. Reduced-pressure backflow-prevention assemblies should be the same size as the fire service line to the building and installed immediately following the first interior OS&Y control valve as shown on the approved plans. (Refer to City of Bozeman Standard Drawing 02660-14 for specific requirements.)

Class 6. Class 6 system protection would depend on the requirements of both industry and fire protection and could only be determined by a survey of the premises.

ATTACHMENTrB

Contractor's Material and Test Certificate for Underground Piping

Contractor's Material and Test Certificate for Underground Piping

PROCEDURE

Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

Property name		Date	
Property address			
Plans	Accepted by approving authorities (names)		
	Address		
	Installation conforms to accepted plans	❑ Yes	❑ No
	Equipment used is approved	❑ Yes	❑ No
	If no, state deviations		
Instructions	Has person in charge of fire equipment been instructed as to location of control valves and care and maintenance of this new equipment? If no, explain	❑ Yes	❑ No
	Have copies of appropriate instructions and care and maintenance charts been left on premises? If no, explain	❑ Yes	❑ No
Location	Supplies buildings		
Underground pipes and joints	Pipe types and class	Type joint	
	Pipe conforms to _____ standard	❑ Yes	❑ No
	Fittings conform to _____ standard	❑ Yes	❑ No
	If no, explain		
	Joints needing anchorage clamped, strapped, or blocked in accordance with _____ standard If no, explain	❑ Yes	❑ No
Test description	Flushing: Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags at outlets such as hydrants and blow-offs. Flush at one of the flow rates as specified in 10.10.2.1.3. Hydrostatic: All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200 psi (13.8 bar) or 50 psi (3.5 bar) in excess of the system working pressure, whichever is greater, and shall maintain that pressure ±5 psi (0.35 bar) for 2 hours. Hydrostatic Testing Allowance: Where additional water is added to the system to maintain the test pressures required by 10.10.2.2.1, the amount of water shall be measured and shall not exceed the limits of the following equation (for metric equation, see 10.10.2.2.6): $L = \frac{SD\sqrt{P}}{148{,}000}$ L = testing allowance (makeup water), in gallons per hour; S = length of pipe tested, in feet; D = nominal diameter of the pipe, in inches; P = average test pressure during the hydrostatic test, in pounds per square inch (gauge)		
Flushing tests	New underground piping flushed according to NFPA-24 standard by (company) If no, explain	❑ Yes	❑ No
	How flushing flow was obtained ❑ Public water ❑ Tank or reservoir ❑ Fire pump	Through what type opening ❑ Hydrant butt ❑ Open pipe	
	Lead-ins flushed according to _____ standard by (company) If no, explain	❑ Yes	❑ No
	How flushing flow was obtained ❑ Public water ❑ Tank or reservoir ❑ Fire pump	Through what type opening ❑ Y connection to flange and spigot ❑ Open pipe	

© 2012 National Fire Protection Association

FIGURE 10.10.1 Sample of Contractor's Material and Test Certificate for Underground Piping.

Hydrostatic test	All new underground piping hydrostatically tested at _____ psi for _____ hours	Joints covered ❑ Yes ❑ No
Leakage test	Total amount of leakage measured _____ gallons _____ hours	
	Allowable leakage _____ gallons _____ hours	
Forward flow test of backflow preventer	Foward flow test performed in accordance with 10.10.2.5.2: ❑ Yes ❑ No	
Hydrants	Number installed	Type and make All operate satisfactorily ❑ Yes ❑ No
Control valves	Water control valves left wide open If no, state reason ❑ Yes ❑ No	
	Hose threads of fire department connections and hydrants interchangeable with those of fire department answering alarm ❑ Yes ❑ No	
Remarks	Date left in service	
Signatures	Name of installing contractor	
	Tests witnessed by	
	For property owner (signed)	Title / Date
	For installing contractor (signed)	Title / Date

Additional explanation and notes

© 2012 National Fire Protection Association

FIGURE 10.10.1 *Continued*

ATTACHMENT C

Certificate of Inspection

CERTIFICATE OF INSPECTION
FOR
FIRE SERVICE LINE INSTALLATION

Date:_____ Time:_____

City of Bozeman Water Department Inspector:_____

This is the 1st 2nd 3rd inspection of this installation.

Fire Service Line Installed For:

Owner of Building:_____
Owner's Address:_____
Owner's Phone:_____ Building Phone:_____
Building Address:_____
Building Name:_____ a a _____

Fire Service Line Installed By:

Name of Contractor:_____
Contractor's Address:_____
Contractor's Phone:_____
Person to Contact:_____

The following were present during this inspection:

_____
_____
_____
_____

The fire service line is installed in accordance with City of Bozeman requirements for the project: **YES** **NO**

Bacteriological Tests have been completed and passed: **YES** **NO**

The "Contractor's Material & Test Certificate for Underground Piping" has been completed and submitted to the City Engineer (i.e. pressure tests have been conducted and passed): **YES** **NO**

If the answer to <u>all</u> the above items is "YES" then the City of Bozeman initially accepts the fire service line and the two year warranty period begins on the date of this inspection.

The fire service line was activated (placed into service) during this inspection: **YES** **NO**

(If "NO" indicate below the reason and the date it is to be activated.)

The first interior valve (OS&Y) was left in the OPEN CLOSED position at the completion of this inspection.

OWNER NOTE: When the first control valve (OS&Y) inside of the building is shut off for <u>any</u> reason, the City of Bozeman Fire Department must be notified immediately and informed of the shut down date, time, and duration.

==========

Comments:_____

_____

_____

_____

_____

_____

_____

_____

cc: Owner
Contractor
City Engineer's Office

CERTIFICATE OF
COMPLETION AND ACCEPTANCE

OWNER:_____ PROJECT TITLE:_____

DATE OF ACCEPTANCE:_____ PROJECT NO.: _____

PROJECT DESCRIPTION: _____

PROJECT LOCATION: _____

CONTRACTOR:_____

ENGINEER: _____

Substantial Completion Date:_____ Two-year warranty expiration date: _____

The Work performed under the Contract for the above Project has been inspected by a representative of the Owner, Contractor, City of Bozeman, and Engineer and has been found to substantially comply with the approved Contract Documents and is hereby declared complete. Acceptance by the Owner and City of Bozeman and recommendation thereto by the Engineer does not affect the "Contractor's Continuing Obligation" as described in Article 14.15 of the Standard General Conditions of the Construction Contract, or the Owner's contractual obligations.

Maintenance Bond with City of Bozeman named as dual obligee is attached.

ENGINEER'S RECOMMENDATION

On the basis of observation of the Work during construction, final inspection and review of project testing, final application for payment and accompanying documents, the Engineer is satisfied and hereby certifies that the Work has been completed in accordance with the approved Contract Documents. This acceptance shall not relieve the Contractor of his obligations under the Contract Documents.

_____ By:_____
Engineer Printed Name:_____
P.E. #_____ Date _____

CONTRACTOR'S CONCURRENCE WITH ENGINEER'S RECOMMENDATION

_____ By:_____
Contractor Printed Name:_____
Title:_____
Date:_____

OWNER'S ACCEPTANCE AND GRANT OF POSSESSION

On the basis of independent observations and inspections and the recommendations of the Engineer, the Owner accepts the Project as complete. This acceptance does not relieve the Contractor of continuing obligations as described above. The Contractor is reminded this Project is under warranty beginning _____ and that bonds shall remain in effect for two years after the Date of Acceptance specified above. The Owner hereby grants possession of all public infrastructure improvements completed by this Project to the City of Bozeman and warrants against defects in these improvements for a period of two years from the Date of Acceptance specified above.

_____ By:a_____

Owner Printed Name:_____

Title:_____

Date: _____

CITY OF BOZEMAN'S ACCEPTANCE

The City of Bozeman hereby accepts possession of all public infrastructure improvements, subject to the above indicated warranty. This acceptance does not relieve the Owner or Contractor of his continuing obligations for this work as described above or otherwise required through Improvement Agreements, conditions of plat approval, or his other contractual commitments.

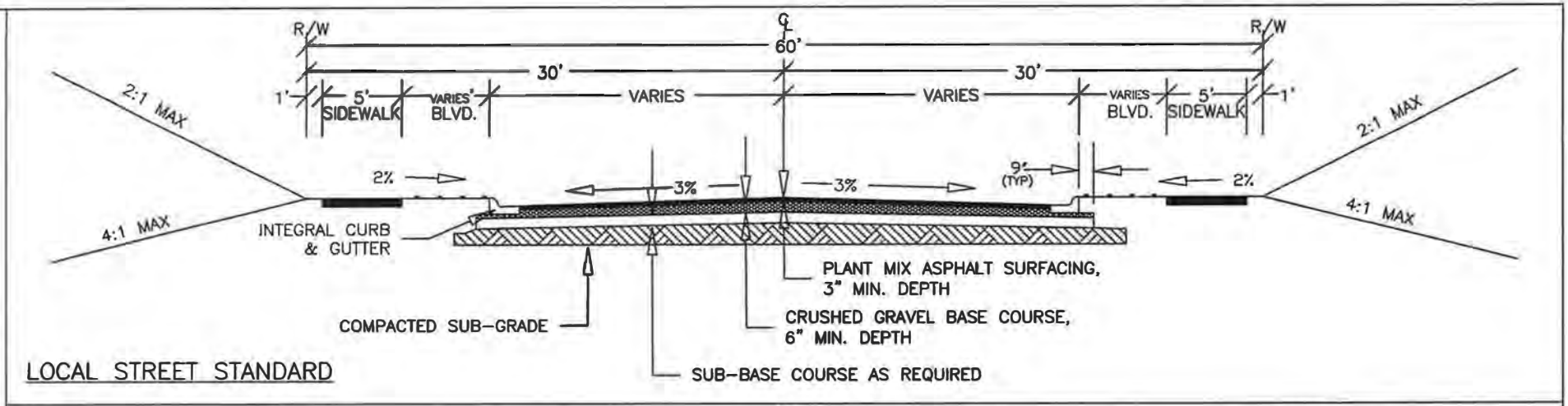
City of Bozeman_____ By:_____

Title:_____

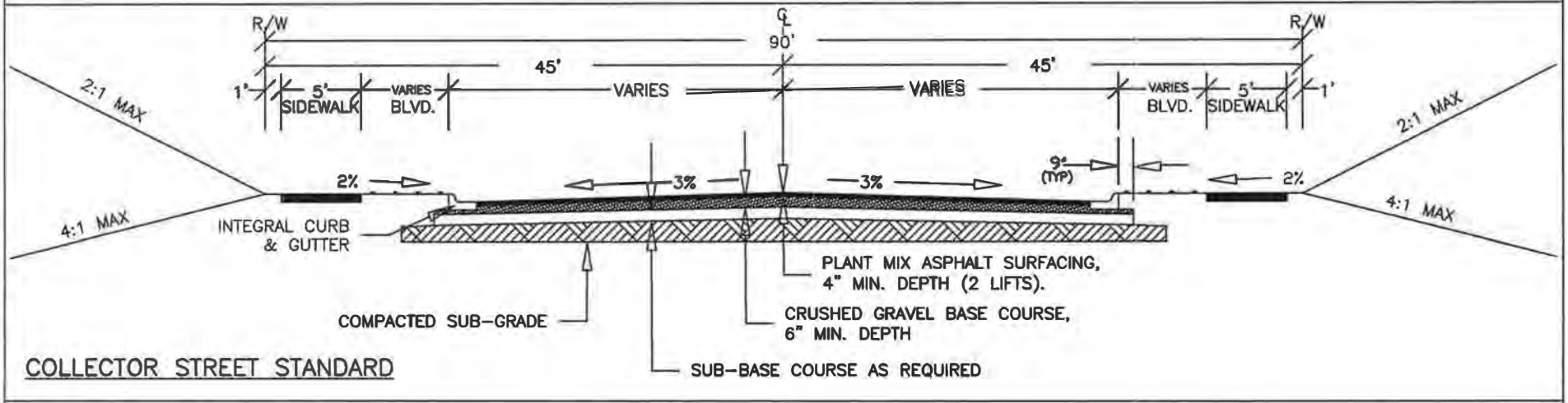
Date:_____

CITY OF BOZEMAN DESIGN STANDARDS & SPECIFICATIONS POLICY

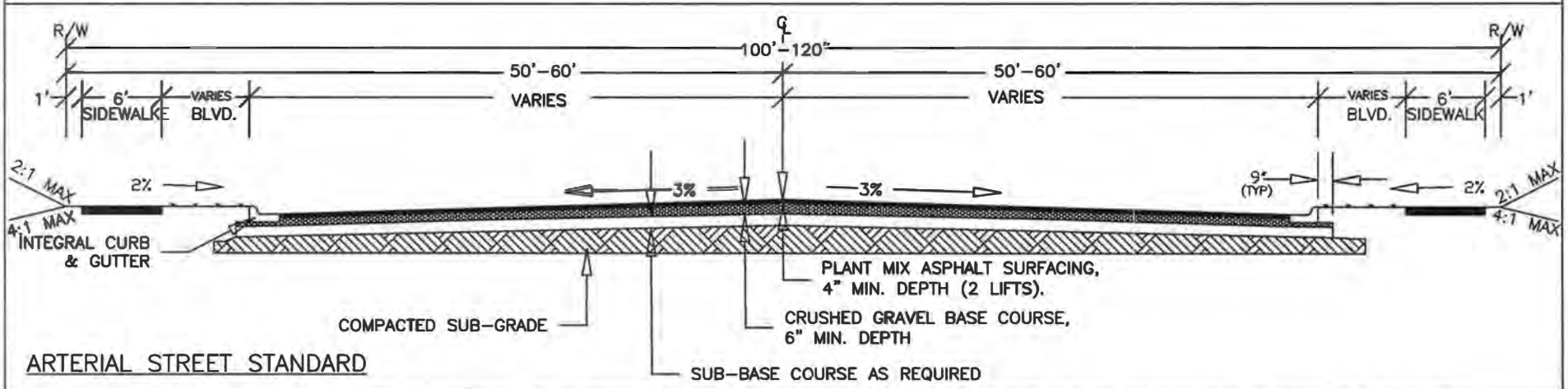
FIGURE A-1: TYPICAL ROADWAY SECTIONS



LOCAL STREET STANDARD



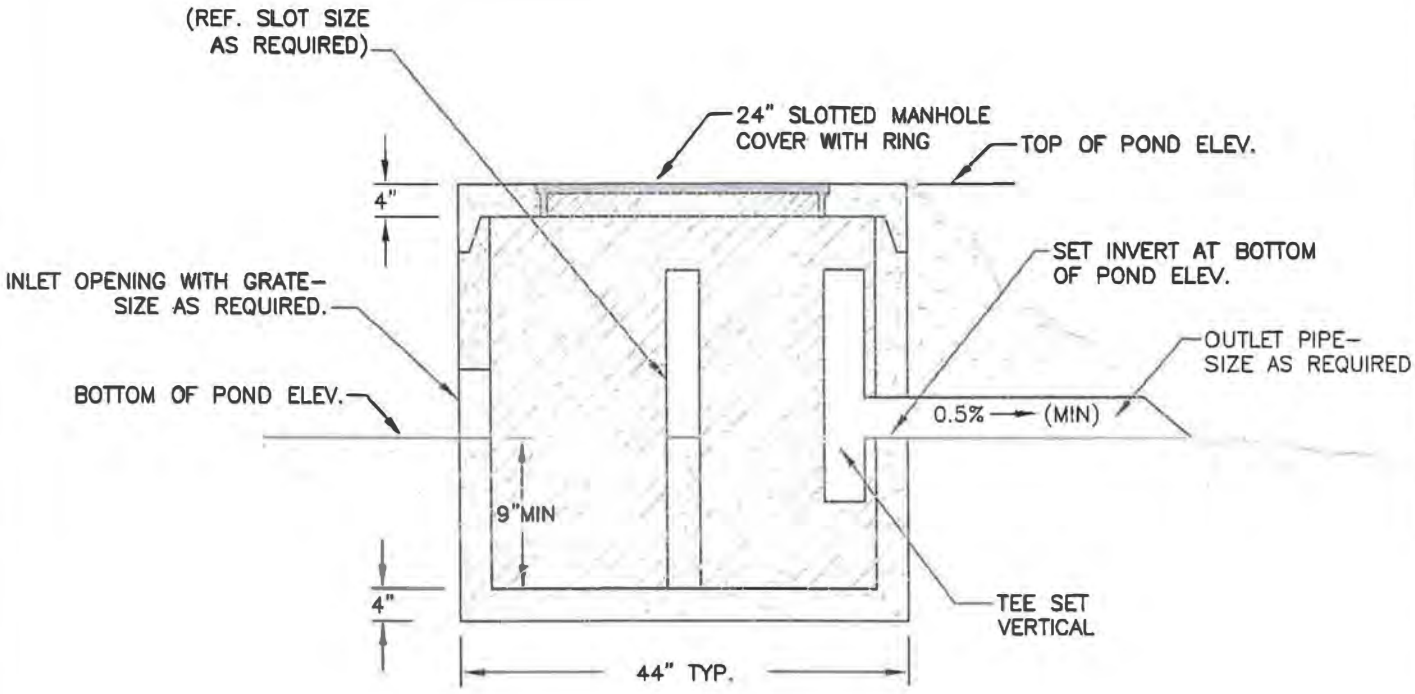
COLLECTOR STREET STANDARD



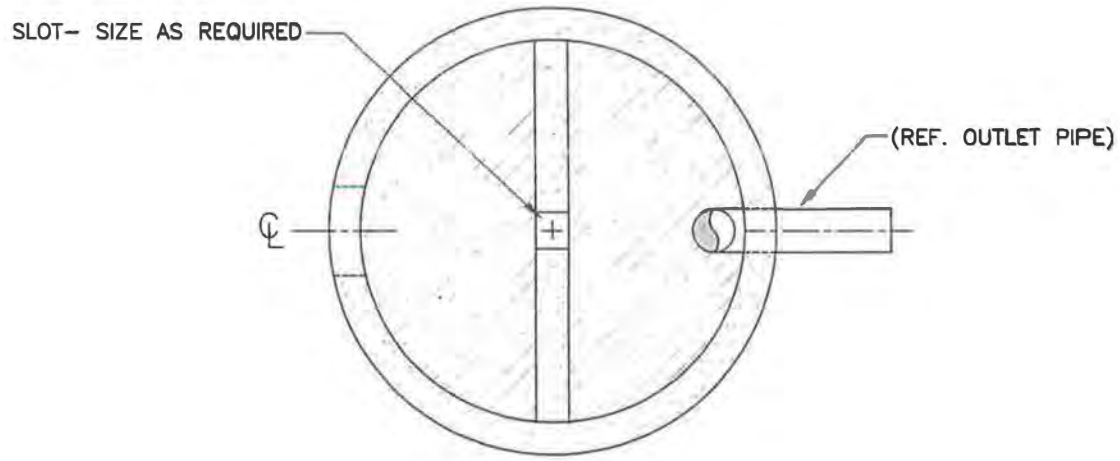
ARTERIAL STREET STANDARD

NOTE: PAVEMENT AND BASE COURSE THICKNESS SHALL BE DETERMINED BY THE DESIGN ENGINEER BASED ON SITE SOIL CONDITIONS AND AT LEAST THE 20 YEAR PERFORMANCE PERIOD TRAFFIC VOLUME.

NOTE: THE SPECIFIC RIGHT-OF-WAY AND BACK OF CURB STREET WIDTH WILL BE DETERMINED ON A CASE BY CASE BASIS THROUGH THE SUBDIVISION REVIEW PROCESS.



SIDE VIEW



TOP VIEW

CITY OF BOZEMAN DESIGN STANDARDS	SCALE: NONE	TYPICAL CONCRETE OUTLET STRUCTURE FOR STORMWATER DETENTION PONDS	FIG. A-2 MAY 2001

SIZING DETENTION BASINS – SAMPLE PROBLEM
(Rational Method)

Given: Existing Land Use:	Agricultural
Proposed Land Use:	Industrial
Drainage Area:	5 Acres
Slope:	1%
Overland Travel Distance to Channel:	120 feet
Channel Time:	4 minutes
Max. Basin Water Depth Allowable:	1 foot

Problem:

Size a detention basin to control runoff to pre-development levels and to remove sediment (40 micron particle).

Solution:

Existing Situation

Land Use:	Agricultural
Area:	5 Acres
C =	0.20 (Table I-1)
Time of Concentration:	16 minutes (Figure I-1) + 4 minutes = 20 minutes
Design Storm Frequency:	10 year (Table I-3) (Based on Future use Design Frequency)
Intensity at Tc:	1.3071 in/hr (Figure I-3)
Peak Runoff Rate:	(0.20) (1.3071) (5) = 1.31 cfs

Future Situation

Land Use:	Industrial
Area:	5 Acres
C =	0.80 (Table I-1)
Time of Concentration:	6 minutes (Figure I-1) + 4 minutes = 10 minutes
Design Storm Frequency:	10 year (Table I-3)

Detention Basin Sizing

Design Release Rate:	1.31 cfs

MINIMUM VOLUME

Storm Duration (Minutes)	Intensity (in/hr)	Future Runoff Rate (Q = CiA) (cfs)	Runoff Volume (cf)	Release Volume (cf)	Required Storage (cf)
25	1.1306	4.52	6780	1965	4815
27	1.0755	4.30	6966	2122	4844
29	1.0266	4.11	7175	2279	4872
31	0.9831	3.93	7310	2437	4873
33	0.9439	3.78	7484	2594	4890*
35	0.9085	3.63	7623	2751	4872

* Minimum Volume Required – 4890 cf

Note: 1. If controlling volume falls at a storm duration less than the future time of concentration, use the volume at the time of concentration.
2. Based on Minimum Volume and using 1 foot depth, Surface Areai= 4890 sf.

MINIMUM AREA

Assumptions:

1. Non-flocculant particles.
2. Settling velocity of 40 micron particles = 0.0069 ft/sec.

Design Release Rate: 1.31 cfs

Minimum Area Required: 1.31 cfs ÷ 0.0069 ft/seci= 190 sf

(Since 4890 > 190 sf, use 4890 sf)

BASIN SIZING

Water Depth:	1 foot
Surface Area:	4890 sf
Volume:	4890 cf
Length:	123 ft.
Width:	40 ft.

PRECONSTRUCTION MEETING CRITERIA CHECKLIST

PROJECT NAME: _____

PROJECT TYPE: _____

(water, sanitary sewer, storm sewer, streets)

OWNER/DEVELOPER: _____

ENGINEER: _____

CONTRACTOR: _____

PRECONSTRUCTION CONFERENCE SUBMITTALS CHECKLIST

REQUIRED SUBMITTAL	REQUIRED	DATE REC.	COMMENTS
Approved Plans & Specifications: DEQ Approval COB Approval			
Executed Easements			
Abandoned Easements			
Shop/Fabrication Drawings** (submit two days before precon. mtg.)			
Traffic Control Plan (submit one week before precon. mtg.)			
Electronic Plans on CD (.dwg or .PDF) (submit two days before precon.mtg.)			
Copy of Contractor's Bonds			Bonds shall be in effect until 2 yrs after the date of final completion and acceptance by the City.
Copy of Contractor's Insurance			
PERMITS: Dewatering Discharge Permit (MDHES) *			
310 Permit (SCS/FWP) *			
404 Permit (Corps) *			
Stormwater Control Permit (MDHES) *			
Street Cut Permit (COB/County) *			
Utility Occupancy Permit (MDOT/County) *			
Flood Plain (COB) *			

PRECONSTRUCTION MEETING DATE:

(Will not be scheduled until <u>all</u> above applicable submittals are received.)

** Note: Shop/Fabrication Drawings shall bear Engineer's approval when submitted.

* Note: To be determined by design engineer.

CITY OF BOZEMAN
PLAN AND SPECIFICATION CERTIFIED CHECKLIST

Project Name:

Engineer:

Reports Received:
☐ Utilities Design Report
☐ Traffic Impact Analysis
☐ Stormwater Facilities Design

CHECKLIST SUBMITTAL INSTRUCTIONS

This checklist may be used in lieu of a complete department review when the conditions listed below are met. The department reviews all certified checklists for completeness and accuracy and must approve all deviation requests. Deviation requests will result in slower turn-around by the department. Construction may not begin until approval of the certified checklist is granted by the department, and a preconstruction meeting is held. Department approval will be issued in a letter to the design engineer submitting the plans and specifications.

All sections of the certified checklist must be completed. *The answer yes may be checked when all the requirements of the section being addressed are satisfied.* Where a yes answer cannot be given, a deviation must be requested or the applicant must explain why that section of the standard is not applicable. All deviation requests must be justified by the design engineer and supported with appropriate documentation.

All infrastructure certified checklists must be signed and stamped by the professional engineer responsible for the design of the project. In addition, four sets of plans and specifications signed and stamped by a professional engineer must be included.

The plans and specifications for the above referenced project are in compliance with the following sections of the City of Bozeman Design Standards.

	PRELIMINARY REQUIREMENTS			
	1.	**Project approval obtained from City Commission**		
			☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	2.	**All conditions of project approval have been addressed**		
			☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:

I.	**CONSTRUCTION PLANS AND SPECIFICATIONS REQUIREMENTS**			
	A.	**General Requirements**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		6.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		7.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		8.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		9.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	B.	**Specification Requirements**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	C.	**Drawing Scales**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	D.	**Plan Requirements**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	E.	**Utility Plan Requirements**		
		1.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		1.b.	☐ Yes	☐ Deviation Requested:

			☐ NA	Explain:
		1.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		1.d.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	F.	**Roadway Plan Requirements**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
II.	**DRAINAGE POLICY**			
	A.	**General Design Criteria**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.d	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.e.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.f.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	B.	**Storm Drainage Plan**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:

		4.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		6.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	C.	**Storage/Treatment Facilities**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.d.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.e.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	D.	**Discharge Structures**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:

	E.	**Estimation of Runoff**		
		1.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		1.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		1.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		6	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
III.	**FLOODPLAIN REGULATIONS**			
	A.	**General**		
			☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
IV.	**ROADWAY DESIGN AND TECHNICAL CRITERIA**			
	A.	**General**		
			☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	B.	**Sidewalks, curbs and gutters and driveways**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		6.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		7.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:

		8.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	C.	**Drainage**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	D.	**Horizontal Alignment**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		6.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		7.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		8.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		9.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	E.	**Vertical Alignment**		

		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.d.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		6.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		7.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		8.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	F.	**Median Treatment**		
			☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	G.	**Roadway Specifications**		
			☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	H.	**Signs and Markings**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.a	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.b	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.c	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.d	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:

		3.e	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	I.	**Monumentation**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	J.	**Lighting**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	K.	**Bike Lanes/Paths**		
			☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
V.	**UTILITY DESIGN CRITERIA**			
	A.	**Water Distribution Lines**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		6.a	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		6.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		6.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		6.d.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		6.e.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		6.f.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		6.g.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:

		6.h.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		7.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		7.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		7.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		7.d.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		8.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		9.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		10.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		11.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	B.	**Sanitary Sewer System Design Criteria**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		6.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		7.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		8.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		9.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		10.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		11.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:

		12.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		13.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	C.	**Storm Sewers**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.d.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		6.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		6.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		6.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		7.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		7.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		8.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		8.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		8.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		8.d.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		8.e.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:

		8.f.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		8.g.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		9.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
	D.	**Alignment, Depth, and Easements**		
		1.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		2.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		3.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		4.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.a.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.b.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.c.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:
		5.d.	☐ Yes	☐ Deviation Requested:
			☐ NA	Explain:

Certified By: _____ Date: _____
(Signature of Professional Engineer)

Montana P.E. Number: _____

CERTIFIED CHECKLIST FOR TESTING & DOCUMENTATION REQUIREMENTS FOR INFRASTRUCTURE IMPROVEMENTS

All sections of the certified checklist must be completed. *The answer yes may be checked when all the requirements of the section being addressed are satisfied.* Where a yes answer cannot be given, a deviation must be requested or the applicant must explain why that section of the standard is not applicable. All deviation requests must be justified by the design engineer and supported with appropriate documentation. All infrastructure certified checklists must be signed and stamped by a professional engineer licensed in the state of Montana.

A.	☐ Yes	☐ Deviation Requested:
	☐ NA	Explain:
B.	☐ Yes	☐ Deviation Requested:
	☐ NA	Explain:
C.	☐ Yes	☐ Deviation Requested:
	☐ NA	Explain:
D.	☐ Yes	☐ Deviation Requested:
	☐ NA	Explain:
E.	☐ Yes	☐ Deviation Requested:
	☐ NA	Explain:
F.	☐ Yes	☐ Deviation Requested:
	☐ NA	Explain:
G.	☐ Yes	☐ Deviation Requested:
	☐ NA	Explain:
H.	☐ Yes	☐ Deviation Requested:
	☐ NA	Explain:
I.	☐ Yes	☐ Deviation Requested:
	☐ NA	Explain:
J.	☐ Yes	☐ Deviation Requested:
	☐ NA	Explain:
K.	☐ Yes	☐ Deviation Requested:
	☐ NA	Explain:

Certified By: _____ Date: _____

(Signature of Professional Engineer)

Montana P.E. Number: _____

SAMPLING MATERIALS BY RANDOM NUMBER SAMPLING

1. SCOPE - This method provides a procedure, in the form of several examples, for selecting samples on an approximately random basis using a system of random numbers. To accomplish this selection, choose the random sample so that each unit of material (i.e., cubic yard, square yard, ton, etc.) has the same probability of being selected. Divide each material sampled into lots, and establish a frequency of sampling.

2. PROCEDURE -

2.1. Random numbers can be generated by some calculators by planting a seed number such as date, time of day, etc., expressed as a decimal between 0 and 1. Included in this method are two tables of random numbers for use. Enter the table in a random method, such as a blind placement of a pencil. After choosing the first random number in this manner, choose consecutive numbers, following a column (or row), until the entire table has been used. At that time, repeat the initial process of random entry into the table of numbers. This method will reduce the possibility of using a value from the table more than once.

2.2. Following are examples related to particular phases of highway construction:

2.2.1. EXAMPLE NO. 1

In this example, select station numbers for density coring of a 0.75-in. nominal-maximum mixture. Specifications require four density cores for each 1 000 tons of mixture placed. The sublot size is 1000 tons with a frequency of four cores per sublot. The sublot of mixture in question will be placed on a 12-ft.-wide lane that is 4545 ft. long. The lift thickness of the 0.75-in. nominal-maximum mixture is 3.0 in. The job starts at Station No. 0+00.

Since four density cores are required for the entire 4545-ft. length, obtain one core for each 1136.25 ft. of pavement. Use the following steps to determine the station number and offset for each density core:

2.2.1.1. Refer to the random number table (see p. 5 for example).

2.2.1.2. Enter the table at any point. Select four consecutive numbers from the random number table. Use these numbers for finding the station number of the core site in each 1136.25-ft. section.

Multiply each random number by 1136.25 to determine the station number at which to obtain the density core. After determining the

location of the first core, for each of the remaining cores, add increments of 1136.25 ft., increasing with each core, to provide locations throughout the entire sublot length.

SAMPLE NO.	RANDOM NUMBER CALCULATION	STATION NUMBER
1	0.420 x 1136.25 = 477.23 + 0.00 = 477	4 + 77
2	0.859 x 1136.25 = 976.04 + 1136.25* = 2112	21 + 12
3	0.011 x 1136.25 = 12.50 + 2272.50 = 2285	22 + 85
4	0.762 x 1136.25 = 865.82 + 3408.75 = 4275	42 + 75

*1136.25-ft. increments, as determined by the sublot length, provide resultant numbers throughout the entire sublot length.

According to Subsection 402.03.02 of the *Standard Specifications*, obtain cores no closer than three inches from the pavement edge or joint. To select the transverse distance from the pavement edge (left or right), select four additional consecutive numbers from the random number table (see p. 5 for example), and multiply each random number by 11.5 (12-ft. lane width minus the 0.25-ft. offset from each side). For this example, calculate the distance from 0.25 ft. inside of the right edge of the pavement.

SAMPLE NO.	RANDOM NO. CALCULATION	OFFSET FROM RIGHT EDGE
1	0.062 x 11.5 + 0.25 =	1.0 ft.
2	0.100 x 11.5 + 0.25 =	1.4 ft.
3	0.409 x 11.5 + 0.25 =	5.0 ft.
4	0.784 x 11.5 + 0.25 =	9.3 ft.

Therefore, from the calculations above, conform to the coring schedule given below for this sublot:

SAMPLE NO.	STATION NUMBER	OFFSET FROM RIGHT EDGE
1	4 + 77	1.0 ft.
2	21 + 12	1.4 ft.
3	22 + 85	5.0 ft.
4	42t+ 75	9.3 ft.

With respect to this example, in other cases, the paving length and width will vary, but use the same procedure for obtaining random locations.

2.2.2. EXAMPLE NO. 2

In this example, select trucks to sample for running air content, slump, and concrete cylinders on Class AA Concrete for a bridge deck pour.

The pour will consist of 250 cubic yards of concrete. The trucks will be hauling 10 cubic yards each. The testing frequency is one test for each 50 cubic yards; therefore, perform five tests. There will be at least five tests required. Use the following steps to select the trucks to sample:

2.2.2.1. Refer to the random number table (see p. 5 for example).

2.2.2.2. Select five consecutive numbers from the random number table. Use these numbers to determine which trucks to sample. Multiply each number by 50 (a lot size of 50 cubic yards), and divide the answer by 10 (cubic yards per truck) to determine which trucks to sample.

SAMPLE NUMBER	RANDOM NUMBER	CALCULATED VOLUME (cubic yards)	TRUCK SAMPLED
1	0.007	x 50 = 0.35 + 0 = 0.35 ??10 = 0.04*	1st
2	0.922	x 50 = 46.1 + 50** = 96.1 ? 10 = 9.6	10th
3	0.729	x 50 = 36.5 + 100 = 136.5 ? 10 = 13.7	14th
4	0.949	x 50 = 47.5 + 150 = 197.5 ? 10 = 19.8	20th
5	0.606	x 50 = 30.3 + 200 = 230.3 ? 10 = 23.03	24th

*When this answer contains a decimal, always round upward to the next highest whole number to determine the truck number.

**Add increments of 50 cubic yards (lot size), increasing with each sample, in order to provide sampling throughout the full 250 cubic yards.

2.2.3. EXAMPLE NO. 3

In this example, select the accumulated tonnage of Crushed Stone Base for gradation testing. The frequency for gradation testing of aggregate bases is one test per 2000 tons of material. Plan quantities show 10,000 tons of Crushed Stone Base exist on this project. This quantity will require five gradation tests.

Again, select five consecutive random numbers from the random number table (see p. 5 for example). Use these numbers to determine the accumulated tonnage at which to select the sample.

Multiply each number by 2000 to determine the accumulated tonnage for sampling. Add increments of 2000 tons (lot size), increasing with each sample, in order to provide sampling throughout the full 10,000 tons.

SAMPLE NUMBER	RANDOM NUMBER CALCULATION	ACCUMULATED TONNAGE
1	0.658 x 2000 = 1316 + 0 =	1316
2	0.747 x 2000 = 1494 + 2000 =	3494
3	0.270 x 2000 = 540 + 4000 =	4540
4	0.715 x 2000 = 1430 + 6000 =	7430
5	0.418 x 2000 = 836 + 8000 =	8836

Obtain samples as near the above-listed accumulated tonnages as possible.

2.3. The system of selecting random samples can be related to periods of time, number of pieces, tons, etc. The key to randomness, using this method, relies heavily on the manner of entering the table. Do not use the same set of numbers repeatedly.

km113.doc

TABLE 1
RANDOM NUMBERS

.600	.504	.248	.230	.996	.462	.422	.054	.224	.121
.116	.227	.802	.349	.241	.956	.079	.632	.126	.677
.098	.726	.507	.607	.963	.410	.572	.777	.237	.851
.147	.867	.802	.416	.370	.377	.775	.256	.348	.148
.644	.067	.001	.158	.702	.148	.667	.217	.421	.149
.310	.531	.520	.560	.888	E.287	.567	.251	.593	.571
.493	.235	.886	.178	.490	X.007	.640	.343	.894	.079
.788	.272	.484	.487	.277	A.922	.435	.716	.924	.304
.652	.523	.317	.601	.705	M.729	.669	.435	.984	.239
.816	.045	.423	.943	.227	#.949	.395	.931	.887	.242
.086	.585	.177	.851	.513	2.606	.911	.253	.669	.328
.689	.755	.027	.183	.024	E.658	.041	.512	.518	.910
.117	.029	.309	.017	.926	X.747	.584	.570	.212	.504
.700	.989	.980	.532	E.640	A.270	.610	.257	.996	.978
.321	.431	.370	.814	X.420	M.715	.548	.148	.953	.450
.515	.775	.759	.438	A.859	#.418	.689	.924	.350	.724
.543	.575	.633	.097	M.011	3.170	.357	.429	.899	.087
.629	.502	.503	.036	#.762	.280	.605	.518	.275	.017
.221	.882	.206	.415	1.776	.548	.520	.417	.253	.808
.751	.446	.189	.776	.465	.936	.970	.467	.371	.077
.553	.160	.464	.309	.298	.304	.613	.512	.816	.270
.384	.778	.284	.435	.246	.319	.078	.695	.152	.637
.969	.740	.102	.093	.055	.155	.225	.782	.226	.250
.085	.125	.750	.900	.991	.887	.993	.183	.096	.542
.667	.355	.784	.803	E.072	.206	.508	.385	.691	.127
.076	.968	.527	.749	X.062	.075	.526	.292	.176	.310
.788	.943	.091	.141	A.100	.040	.750	.870	.249	.345
.165	.422	.601	.095	M.409	.897	.963	.271	.770	.100
.472	.201	.558	.725	#.784	.025	.943	.040	.984	.011
.668	.708	.776	.490	1.270	.868	.658	.954	.916	.955

TABLE 1
RANDOM NUMBERS

.600	.504	.248	.230	.996	.462	.422	.054	.224	.121
.116	.227	.802	.349	.241	.956	.079	.632	.126	.677
.098	.726	.507	.607	.963	.410	.572	.777	.237	.851
.147	.867	.802	.416	.370	.377	.775	.256	.348	.148
.644	.067	.001	.158	.702	.148	.667	.217	.421	.149
.310	.531	.520	.560	.888	.287	.567	.251	.593	.571
.493	.235	.886	.178	.490	.007	.640	.343	.894	.079
.788	.272	.484	.487	.277	.922	.435	.716	.924	.304
.652	.523	.317	.601	.705	.729	.669	.435	.984	.239
.816	.045	.423	.943	.227	.949	.395	.931	.887	.242
.086	.585	.177	.851	.513	.606	.911	.253	.669	.328
.689	.755	.027	.183	.024	.658	.041	.512	.518	.910
.117	.029	.309	.017	.926	.747	.584	.570	.212	.504
.700	.989	.980	.532	.640	.270	.610	.257	.996	.978
.321	.431	.370	.814	.420	.715	.548	.148	.953	.450
.515	.775	.759	.438	.859	.418	.689	.924	.350	.724
.543	.575	.633	.097	.011	.170	.357	.429	.899	.087
.629	.502	.503	.036	.762	.280	.605	.518	.275	.017
.221	.882	.206	.415	.776	.548	.520	.417	.253	.808
.751	.446	.189	.776	.465	.936	.970	.467	.371	.077
.553	.160	.464	.309	.298	.304	.613	.512	.816	.270
.384	.778	.284	.435	.246	.319	.078	.695	.152	.637
.969	.740	.102	.093	.055	.155	.225	.782	.226	.250
.085	.125	.750	.900	.991	.887	.993	.183	.096	.542
.667	.355	.784	.803	.072	.206	.508	.385	.691	.127
.076	.968	.527	.749	.062	.075	.526	.292	.176	.310
.788	.943	.091	.141	.100	.040	.750	.870	.249	.345
.165	.422	.601	.095	.409	.897	.963	.271	.770	.100
.472	.201	.558	.725	.784	.025	.943	.040	.984	.011
.668	.708	.776	.490	.270	.868	.658	.954	.916	.955

TABLE 2
RANDOM NUMBERS

.605	.973	.319	.294	.236	.572	.216	.973	.931	.870
.720	.497	.679	.634	.299	.578	.743	.835	.062	.200
.918	.295	.295	.777	.854	.281	.867	.864	.374	.748
.294	.396	.441	.321	.655	.191	.205	.899	.807	.186
.089	.927	.802	.530	.937	.257	.530	.005	.539	.999
.591	.409	.668	.967	.993	.920	.812	.018	.578	.618
.494	.808	.410	.097	.633	.149	.547	.895	.829	.953
.021	.699	.597	.286	.982	.953	.913	.422	.291	.979
.926	.085	.758	.624	.491	.694	.496	.490	.949	.457
.351	.709	.461	.093	.498	.377	.639	.801	.388	.334
.329	.857	.949	.550	.095	.906	.596	.462	.891	.758
.126	.525	.834	.677	.045	.699	.568	.147	.902	.664
.572	.101	.066	.147	.069	.006	.979	.259	.765	.460
.728	.374	.402	.679	.601	.492	.002	.512	.529	.089
.524	.346	.698	.133	.013	.907	.992	.453	.883	.684
.176	.870	.306	.179	.071	.854	.086	.414	.973	.785
.031	.437	.512	.107	.842	.507	.458	.018	.881	.506
.826	.110	.065	.878	.182	.460	.442	.504	.075	.027
.945	.640	.283	.330	.163	.496	.767	.543	.921	.923
.948	.890	.677	.328	.075	.752	.207	.692	.268	.204
.232	.639	.425	.434	.795	.329	.941	.026	.867	.035
.896	.502	.074	.092	.203	.625	.541	.505	.835	.021
.643	.838	.357	.294	.592	.440	.676	.186	.304	.212
.552	.892	.843	.851	.685	.847	.963	.189	.604	.634
.623	.955	.024	.718	.534	.978	.962	.208	.645	.811
.988	.648	.182	.983	.128	.784	.606	.138	.208	.337
.326	.500	.874	.958	.826	.523	.462	.823	.955	.773
.130	.545	.756	.164	.418	.817	.707	.882	.984	.903
.907	.419	.705	.597	.655	.566	.546	.738	.614	.373
.859	.365	.476	.351	.154	.458	.645	.303	.631	.832

City of Bozeman Street Naming and Addressing Policy

A. All new street names, for both public and private streets, shall be approved by the City Engineering Department and the Gallatin County GIS Department.

B. Street names will not be reserved. Street names shall be approved prior to preliminary plat and final plat approval. Street names become effective upon filing of the final plat.

C. Street Name Selection

1. A new street shall assume the name of the street on which it aligns unless the street does not and cannot in the future connect to an existing street segment along the alignment.

2. Duplication of street names will not be permitted. Proposed street names that have the same primary name of an existing street but a different suffix (e.g. Smith Drive and Smith Lane) are considered duplicates and will not be permitted.

3. Similar (text or phonetic) or confusing spelling of street names will not be permitted (e.g. Briar Lane/ Brier Lane; Allen Lane/ Alan Lane; Beech Street/ Peach Street).

4. Only the common spelling of street names will be accepted (e.g. Jane not Jayne, Green not Greene)

5. Names that tend to be slurred or difficult to pronounce shall not be used.

6. Do not use special characters in street names such as hyphens, apostrophes, or dashes.

7. No new street names shall consist of more than two (2) words or contain more than fifteen (15) characters, excluding the suffix (street, avenue, etc.) and directional prefix, if any.

8. Wherever possible, new north-south streets that are west of the east-west zero line (Tracy Ave.) shall be designated as the appropriate numbered avenue.

9. No street name shall begin with an article.

D. Directional Prefixes

1. All streets that cross the east-west zero baseline shall be designated with the appropriate east or west directional prefix. The east-west zero baseline

is Tracy Avenue as extended and shown on the City of Bozeman's address grid map.

2. All streets that cross the north-south zero baseline shall be designated with the appropriate north or south directional prefix. The north-south zero baseline is Main Street as extended and shown on the City of Bozeman's address grid map.

E. Street Type Designations

1. Street type designations should reflect the size and function of a street. Street types are contained in the suffix of the street name.

2. Approved street type descriptions and abbreviations are as follows:

a) Avenue (AVE): a continuous street with a definite north-south directional course.

b) Boulevard (BLVD): a wide arterial or collector type roadway, typically with a median.

c) Circle (CIR): a street that intersects another street only once and terminates in a closed loop.

d) Court (CT): a relatively short, uninterrupted dead-end street.

e) Drive (DR): a curvilinear or winding street which continues through to other rights-of-way.

f) Lane (LN): a minor roadway within a subdivision.

g) Loop (LOOP): a relatively short, uninterrupted street that begins and ends on the same parent street at two different points, or a street that connects to two intersecting perpendicular streets.

h) Parkway (PKWY): same as boulevard.

i) Place (PL): a relatively short, uninterrupted dead-end street.

j) Road (RD): an arterial or collector type roadway that may run in any direction. This street type designation should not be used for new streets in the City of Bozeman, unless the new street is an extension of an existing street designated as a road.

k) Street (ST): a continuous street with a definite east-west directional course.

l) Way (WAY): a minor roadway within a subdivision.

3. Private roads should use the designations Place or Way.

F. Cul-de-sacs and bubbles

1. When a cul-de-sac is located at the end of an existing street right-of-way or alignment, it shall be given the name of that street, including the suffix, whether the cul-de-sac is straight, curves, or meanders.

2. When two cul-de-sacs approach each other from opposite directions and are in the same alignment but do not join in any manner, they shall be assigned different street names.

3. Cul-de-sac or bubble streets less than 100 feet in length that provide frontage for three or fewer lots shall not be named, but shall take the name and numbering of the street adjoining.

G. Addressing

1. Subdivision developers shall make arrangements with the Engineering Department to assign addresses for all individual lots in the subdivision prior to filing of the final plat. A copy of the proposed final plat showing approved street names shall be submitted for use in assigning addresses. Unless the proposed project has been designated for concurrent construction, the lot addresses will not be entered into the City address database until the final plat has been filed.

2. One street address number will be assigned for each separate building by the Engineering Department. For projects with multiple buildings on a single lot, a site plan showing the proposed buildings shall be submitted to the Engineering Department for address assignment prior to site plan approval. Developers of multi-unit buildings shall assign the unit or suite numbers. A floor plan showing the proposed unit or suite designations shall be submitted for approval to the City Engineer's office prior to site plan or building permit approval. Unit/suite numbers shall be assigned based on the following guidelines:

a) Multi-unit residential buildings (including condominiums) on separate lots: assign consecutive unit numbers (Unit 1, Unit 2, etc.) or unit letters (Unit A, Unit B, etc.) for each unit.

b) Multi-unit residential buildings (including condominiums) on one lot: assign consecutive unit numbers for all the units in the

development, beginning at the building closest to the main roadway entrance and continuing in a logical manner through all of the buildings (i.e.: first building: 2301 Smith Street, Units 1, 2, 3, 4; second building: 2305 Smith Street, Units 5, 6, 7, 8). Use a counter-clockwise circular sweep starting from the right side of the primary entryway as you enter. Systematically increment numbers throughout all buildings on the site so as to end at the left side of the same entryway. Avoid oscillating back and forth across the site as much as possible. If the buildings have dwelling units on separate floors, use 3-digit numbers for all of the units, with the first number being the floor level. All building accesses shall clearly identify which units are served by the access.

c) Multi-unit commercial buildings: use 3-digit numbers for the units or suites, with the first number being the floor level of the unit.

d) Accessory dwelling units shall be assigned a separate street number, however if there are no remaining street numbers available, the main dwelling unit on the property shall be designated unit A and the accessory dwelling unit shall be designated Unit B.

BOZEMAN LIGHTING AND ELECTRICAL SPECIFICATIONS

CONTENTS:

Standard Specifications for Lighting Materials and Installations

Street & Pedestrian Lighting Luminaire Submittal Form

Standard Drawings

Street Lighting – Method of Measurement

Street Lighting – Luminance Method of Measurement

Street Lighting – Step-by-Step Luminance Method of Measurement

Street Lighting Measurement Form (Excel Document, fillable form)

City of Bozeman

Standard Specifications for Lighting Materials and Installation

Table of Contents

Section I. General 3
Section II. Definitions 3
Section III. Scope of Work. 4
A. General 4
Section IV. Control of Work 4
A. General 4
B. Deviation Request 5
Section V. Utility Clearances 5
A. Overhead Powerline Clearances 5
B. Below-grade Utility Clearances 5
Section VI. Conduit 5
A. Plastic Conduit - PVC 5
B. Plastic Conduit – HDPE 6
C. Steel Conduit 6
D. Conduit Installation 6
Section VII. Pull Boxes / Splice Boxes 7
A. General 7
B. Pull Box / Splice Box Installation 7
Section VIII. Concrete Foundations 8
A. Light Standard Foundations 8
B. Concrete Foundation Pads 8
C. Concrete Fill for Pedestal Type Cabinets 8
Section IX. Wiring 9
A. General 9
Section X. Bonding and Grounding 9
A. General 9
Section XI. Lighting Control Centers and Metered Pedestals 10
A. General 10
B. Installation 10
Section XII. Lighting Design Criteria 11
A. General ..... **Error! Bookmark not defined.**
B. Correlated Color Temperature (CCT) ..... **Error! Bookmark not defined.**
All luminaires shall have a Correlated Color Temperature (CCT) of 2700K - 3000K (+/- 275K).
..... **Error! Bookmark not defined.**
C. Non-Signalized Intersection 11
D. Signalized Intersections ..... **Error! Bookmark not defined.**
E. Intersections of Pathways and Streets 12
F. Continuous Lighting on Streets 14
G. Design Considerations. 16
H. Pedestrian Lighting. 18

I. Pathway Lighting. 18
Section XIII. Streetlight Luminaires 19
A. General 19
B. Installation 20
C. Approved Manufacturers – Cobrahead Style [Refer to Figure 10 – Typical Streetlight Standard Detail] 20
D. Approved Manufacturers – Bell Style [Refer to Figure 10 – Typical Streetlight Standard Detail] 20
Section XIV. Pedestrian Luminaires 20
A. General 20
B. Installation 21
C. Approved Products – Traditional Post-top Style [Refer to Figure 11 – Typical Post-Top Pedestrian Light Standard Detail] 21
D. Approved Products – Bell Style [Refer to Figure 12 – Typical Arm-Mount Pedestrian Light Standard Detail] 21
Section XV. Pathway Luminaires 21
A. General 21
B. Installation 22
C. Approved Products 22
Section XVI. Poles. 22
A. General 22
B. Installation 23
Section XVII. Pole bases 23
A. General 23
B. Breakaway Bolt Couplings. 23
C. Frangible Transformer Base. 23
D. Non-Breakaway Anchor Base. 23
Section XVIII. Submittal Requirements 24
A. General 24

Section I. General

These specifications for the provision of lighting installations are intended to provide a set of minimum standards that shall be followed for street lighting, pedestrian lighting and pathway lighting installations within the City of Bozeman public right-of-way or property. These standards, plans, and any special provisions shall apply to all materials supplied, methods, and procedures of work to be followed, and other general minimum requirements that shall be complied with before work is accepted by the City of Bozeman.

The City of Bozeman has adopted the following as part of these standard specifications:

A Standard Specifications for Road and Bridge Construction (latest edition), Montana Department of Transportation, and all amendments and revisions pertaining thereto.
B Manual on Uniform Traffic Control Devices (latest edition), Federal Highway Administration.
C NFPA 70 - National Electrical Code (latest edition)
D NESC - National Electrical Safety Code

The standard specifications outlined in this document are revisions and amendments to the Montana Department of Transportation Standard Specifications for Road and Bridge Construction. In situations where there is a conflict or question of interpretation, these specifications and any special provisions shall prevail.

These specifications, the plans, any special provisions, and all supplemental documents are essential parts of a contract and a requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for the complete work. In case of a discrepancy, figured dimensions shall govern over scaled dimensions; plans shall govern over standard specifications; and special provisions shall govern over plans and standard specifications.

Section II. Definitions

Development Review Committee (DRC) evaluates all proposals subject to the provisions of Chapter 38, the Unified Development Code within the Bozeman Municipal Code. The DRC is charged with reviewing items related to public health and safety.

Low Pedestrian Conflict occurs when adjacent to residential, rural or industrial land uses with very low volumes of nighttime pedestrian usage. These can occur in any of the cited street classifications but are typically suburban streets with single family dwellings, multi-family residential developments, and rural or semi-rural areas.

Medium Pedestrian Conflict occurs when adjacent to commercial and institutional land uses where a moderate numbers of pedestrians utilize the streets at night. Typical are downtown office areas, blocks with libraries, schools, churches, shopping centers, restaurants, parks, and streets with transit lines.

Pathway lighting is provided to light trails and pathways that are not adjacent to streets. Pathway lighting assemblies are typically 36 inches to 48 inches. The distribution of the light is

directed towards the trail or pathway.

Pedestrian lighting is provided to light the sidewalk (attached or detached) along arterial, collector, local streets, public plazas, trails or other pedestrian areas. Pedestrian lighting assemblies are typically between 12 feet to 15 feet. The distribution of the light is directed towards the sidewalk.

Special Improvement Lighting District (SILD) an improvement district embracing street or streets or public highway therein or portions thereof and property adjacent thereto or property which may be declared by said council to be benefitted by the improvement to be made for the purpose of lighting such street or streets or public highway. All or any portion of the cost of installing and maintaining such lighting system is required to be paid by the owners of the property embraced within the boundaries of such districts.

Street lighting is provided for arterial, collector, and local streets where pedestrians and cyclists are generally present. The primary purpose of street lighting is to help the motorist identify obstacles, provide adequate visibility of pedestrians and cyclists, and assist in visual search tasks, both on and adjacent to the street. Street lighting assemblies are typically between 25 feet and 40 feet. The distribution of the light is directed towards the street.

Section III. Scope of Work.

A. General

The design engineer shall consider the need for street lighting, pedestrian lighting and pathway lighting, as specified in Section XII Lighting Criteria, in the development plans for any new or reconstructed roadways. The guidelines and specifications outlined here shall be applicable to lighting located within the City's Right of Way.

All street, pedestrian and pathway lighting shall be operated and maintained through the creation of a new SILD, through the annexation to an existing SILD or through some other equivalent means approved by the City of Bozeman. The application to create or annex to an existing SILD shall be submitted to the City within two months of preliminary approval of the development. The approval to create or annex to an SILD shall be granted prior to final plat for a subdivision or Occupancy if a final plat is not required.

Street lighting shall be installed per 38.570, BMC (in regards to completion time for improvements).

Individual yard lights on private property shall not be used for street lighting.

Section IV. Control of Work

A. General

Record drawings shall be provided to the City for all new and re-constructed lighting systems that are to be maintained by the City. Cut sheets of all equipment shall be provided with the record drawings.

For lighting projects in new subdivisions, record drawings shall be provided and a final inspection done before final plat approval.

For site plans that include lighting projects, record drawings shall be provided and a final

inspection done before occupancy approval.

Contractor is required to submit record drawings and equipment cut sheets for any electrical work that alters an existing lighting system, prior to receiving full payment for project work.

B. Deviation Request

Deviations may be granted by the City Engineer. Appeals to denials of deviation requests shall be to the Director of Public Works. Refer to Section 38.570 for additional information.

Section V. Utility Clearances

A. Overhead Powerline Clearances

Light standard assembly locations must comply with National Electrical Safety Code (NESC) Rules regarding clearance requirements between phase conductor and streetlight and between primary conductor and streetlight.

Light standard assembly locations must comply with the Occupational Safety and Health Administration (OSHA) 1926.1408 minimum clearance distances to overhead power lines.

The City will not accept work that does not meet these clearance requirements or requires a qualified worker to maintain the lighting system.

B. Below-grade Utility Clearances

Light standard foundations shall be located to maintain a minimum horizontal clearance of 10 feet from the edge of foundation to the edge of any water line, sewer line, storm drain line or gas line. When paralleling water, sewer, storm and gas lines with lighting conduit, a 10-foot horizontal separation is preferred. Where 10 foot separation is impractical, a minimum of 5-foot horizontal separation will be allowed.

Section VI. Conduit

A. Plastic Conduit - PVC

All PVC conduits located under roadways, driveways, and other vehicular access areas shall be schedule 80 type EPC-80-PVC.

Conduits under non-vehicular locations may be schedule 40 type EPC-40-PVC.

PVC conduit shall be manufactured of high-impact PVC, and shall conform to industry standards and commercial standard CS-207-60 and NEMA TC 2.

All 90-degree conduit bends shall be factory 90-degree elbows that are schedule 80 PVC or PVC coated GRC.

Field conduit bends may be used for bends that are 60-degrees or less. When bending PVC conduit in the field, use a heater that is approved by the conduit manufacturer.

Bends in PVC conduit shall be made and conform to all appropriate sections of the National Electric Code or local codes governing bending radius, and the number of bends allowed as

applicable for rigid conduit.

Conduit bends, except factory bends, shall have a radius of not less than six times the inside diameter of the conduit.

B. Plastic Conduit – HDPE

All HDPE conduit shall be factory lubricated, low friction, high-density conduit constructed of virgin high density conduit constructed of virgin high-density polyethylene resin. Conduit shall be capable of being coiled on reels in continuous lengths, transported, stored outdoors, and subsequently uncoiled for installation, without affecting its properties or performance.

Bored electrical conduit shall be HDPE and installed using trenchless technology of either jacked conduit or directional boring.

C. Steel Conduit

Steel conduit for exterior, surface mounted, above grade installations shall be Galvanized Rigid Conduit (GRC). Polyvinyl Chloride coated Galvanized Rigid Conduit (PVC coated GRC) may be used for below grade installations, encased in concrete and above grade where exposure to water is imminent.

GRC conduit shall comply with ANSI C80.1 and UL 6.

PVC coated GRC shall comply with NEMA RN 1. Coating thickness shall be a minimum of 0.040 inch (1mm), both inside and out.

D. Conduit Installation

All conduit direct buried in contact with earth shall be PVC, HDPE or PVC coated GRC. PVC conduit Installation through foundations (other than light standard foundations) shall have transition to GRC or PVC coated GRC prior to exposure above foundation.

Underground conduit shall have the following minimum diameter (ID) trade size conduit, unless otherwise approved by the Engineer.

1. Conduit Sleeves Under Roadways: 3 inch minimum
2. Conduit in Typical Trench: 2 inch minimum
3. Conduit from Pull Box / Splice Box to Foundation: 1 inch minimum
4. Conduit to Pathway Luminaires: 3/4 inch minimum

Conduits shall be placed two feet from back of curb.

All existing conduits shall be cleaned with a mandrel or cylindrical wire brush and all conduits (existing or new) shall be blown out with compressed air, before conductors or signal facilities are installed.

All empty spare conduits shall be installed with the following:

1. A nylon or polyester pull tape of at least 1250 lbs strength with footage marking tape.
2. For bored conduit installations that require complete intersection rewiring or new construction, a 12 AWG tracer wire shall be installed across every empty conduit leg, and conduit plugs shall be installed in all conduits.
3. Pull rope with footage tape, tracer wire, and conduit plugs shall be included in the price of

electrical conduit.

When conduit is specified to be installed under existing pavement by directional line boring, the boring pits shall be kept a minimum of 2 feet clear of the edge of pavement whenever possible.

Conduit installed under pavement, sidewalk, dirt, sod or any condition other than under an existing roadway shall be installed with not less than 24 inches of cover to the top of the conduit. Under existing roadway, conduit shall be installed with not less than 30 inches of cover to the top of the conduit. Conduit installed under railroad tracks shall be installed not be less than 42 inches below the bottom of the tie to the top of the conduit. [Refer to Figure 1 – Typical Conduit Burial Standard Detail].

Section VII. Pull Boxes / Splice Boxes

A. General

All pull / splice boxes and covers must be made of polymer concrete with fiberglass reinforcement with a traffic rating of TIER 22.

Pull / splice boxes shall be labeled "ELECTRIC" on pull / splice boxes containing electrical power or “LIGHTING” on all pull / splice boxes containing street lighting conductors. The labeling must be cast into the cover and not a separate independent tag. [Refer to Figure 2 – Typical In-Grade Pull Box / Splice Box Dimensions Standard Detail]

B. Pull Box / Splice Box Installation

When pull / splice boxes are located behind sidewalk or in non-pavement areas, they shall be surrounded by a 12 inch wide collar of class B concrete 6 inches deep. [Refer to Figure 3 – Typical In-Grade Composite Pull Box / Splice Box Detail]

Maximum distance between pull / splice boxes is 200 feet for street and pedestrian lights, and 100 feet for pathway lights.

Street crossings for conduit runs need to have a pull / splice box at each side of the street crossing.

Pull / splice boxes are to be installed at each street corner where conduit takes a 90 degree bend around the corner of the block.

Provide a Type 1 or Type 2 pull / splice box by each streetlight or pedestrian light with smaller 1 inch diameter conduit allowed going into light base from pull / splice box.

For pathway lights, conduit may be routed in and out of the foundation, with a minimum conduit size of 1 inch. Pull / splice boxes for pathway lights shall be placed at 90-degree bends around a corner, and at the minimum spacing listed above.

Box size shall be determined by the diameter of the Largest Trade Size Conduit (LTSC) installed in the box. For conductors 6 AWG or smaller, the box shall be sized (6) six times LTSC in width or length dimension. For conductors 4 AWG and larger, the box shall be sized (8) eight ties LTSC in width or length dimension.

For future expansion, empty conduit, with nylon or polyester tape pull tape of at least 1250 lbs strength with footage marking tape, shall terminate in a pull / splice box. Stub spare conduit(s) out of the box and cap below grade at 2 feet from the box, in the direction of future expansion. Label conduit stub out(s) in pull / splice box "for future expansion to the *direction of expansion*".

Wire connections in pull / splice boxes should use water-proof, insulated multi-tap connectors, by Burndy, or Ilsco, or equivalent.

Section VIII. Concrete Foundations

A. Light Standard Foundations

In locations where the roadway is not curbed, and/or in dirt, the top of the foundation shall be six inches above the grade of the edge of the pavement or as directed by the Engineer. The top of the foundation shall be finished smooth and have a 3/4 inch chamfered edge. [Refer to Figures 4, 5 and 6 – Typical Light Standard Foundation Electrical Details]

Where caisson foundations are located in the sidewalk, the caisson foundation shall be installed to 6 inch under finished curb or sidewalk grade or as directed by the Engineer. [Refer to Figure 4 – Typical Light Standard Foundation Electrical Details]

Where foundations are to be installed in dirt, landscaped areas, or any other situation where the top of the caisson is not being installed with an existing sidewalk or concrete improvement, the contractor shall use sono-tube on the top section of the caisson for finished appearance.

A structural engineer licensed in the state of Montana shall determine the foundation size (depth and diameter) and concrete reinforcement for the specific light standard configuration.

B. Concrete Foundation Pads

All lighting control center cabinets that are to be installed in concrete, shall have either, an approved anchor bolt template with bolts installed before concrete pour, or upon approval of the Engineer, be installed using approved concrete drop in style anchors. All lighting control center cabinets installed in areas other than concrete, shall be installed to their marked grade on a concrete foundation pad with 24" depth, sized to fit cabinet dimensions with 3 inch minimum to 6 inch maximum offset of concrete on all sides of the enclosure. Provide 3 foot x 3 foot step pad with a maximum slope of 1:24. [Refer to Figures 7a, 7b, 8 and 9 – Typical Lighting Control Center Standard Details]

C. Concrete Fill for Pedestal Type Cabinets

All pedestal type cabinets mounted on galvanized strut-channel supports shall have concrete filled post holes with a minimum depth of 36-inches and minimum diameter of 9-inches. [Refer to Figure 8 – Typical Lighting Control Center Pedestal Standard Detail]

Section IX. Wiring

A. General

All wiring shall be copper conductors installed in conduit to meet the National Electric Code.

Minimum size current carrying conductor for exterior installations shall be #10 AWG copper.

Furnish conductors of solid or stranded copper of the gauge shown in the contract.

Insulation for conductors must be Type THW, XHHW, XHHW-2, USE, RHH, RHW, THWN, and THWN-2. All insulation must be designed for 600 volts and meet NEC requirements.

All wiring shall be pulled into conduit using a nylon or polyester pull tape of at least 1250 lbs strength with footage marking tape.

Metal Clad cable (MC) or Armored Cable (AC) shall not be allowed in exterior applications.

Exterior lighting shall be powered at 120/240V-1PH-3W unless otherwise noted on the plans. Wiring color code shall be as follows:

Line 1 = Black

Line 2 = Red

Neutral = White (only required when 120V power is present)

Ground = Green

Section X. Bonding and Grounding

A. General

All PVC or PVC coated GRC conduits from a metered power source shall have a raceway ground conductor installed with the current carrying conductors, sized to the NEC. Ground conductor shall have the size increased to match current carrying conductor size increase for voltage drop purposes.

All light standard foundations for streetlights and pedestrian lights shall have a 5/8 inch diameter x 8 foot long, copper clad driven ground rod installed in the pull / splice box next to the light standard. Top of rod shall be a minimum of 4 inches below grade. Exothermic weld or underground rated lug connect a #6 AWG soft drawn bare copper conductor from rod through 1/2 inch trade size conduit in the foundation to the lug on the pole in the back of the hand hole.

In instances where no dedicated ground rod is present in the pullbox to clamp to the #6 bare copper conductor, the contractor shall clamp to the light pole foundation rebar cage. In this situation, the light pole foundation must be in direct contact with the ground (sonotube removed).

Pathway lights shall have the system grounding conductor bonded to the grounding lug inside each bollard.

All grounding electrodes shall be bonded together per the NEC.

Section XI. Lighting Control Centers and Metered Pedestals

A. General

All street lighting systems shall be metered separately from other uses, with the exception of streetlights installed in conjunction with traffic signal poles.

Lighting control centers and metered pedestals shall be located outside of the sight triangle and within the public right of way or easement at least 50 feet from intersection corners. The location shall be behind the sidewalk where possible and in the boulevard near the sidewalk when right of way does not allow for placement behind the sidewalk.

B. Installation

Electric services shall use NEMA Type 3R cabinets with hinged, lockable covers and 3/8” holes for a padlock.

Services shall be equipped with 3-way switches for hand-off-auto (HOA) operation. Wire photocell on/off control in the auto position.

Lighting control centers shall house electrically held lighting contactors that are 12-pole with 30 amp contacts rated at 600V, and 120V coils.

Street lighting circuits shall be automatically controlled with turn lock mounting delayed response photo cells. Lighting control centers shall have a 120V twist-lock receptacle type photoelectric cell with matching receptacle base attached to the assembly with heavy duty galvanized c-channel structure using 1 inch galvanized rigid conduit, mounted 8 feet above grade. Orient window of photocell to face north. Photocell to operate the lighting contactors for on/off control when HOA is in the auto position.

Meters shall be installed a minimum of 4 feet and maximum of 5 feet above grade to the center of the meter.

Section XII. Lighting Design Criteria

This section describes the luminaire selection and lighting layout for each street classification. Designers are required to submit the following to the City of Bozeman for all street lighting projects:

- Calculation summary (more information can be found in Section XII.D)
- Luminaire Submittal Form (found in Appendix A)

A. Lighting Controls

All street and pedestrian lights installed shall have on board dimmers to allow for dimming in the field after luminaires have been installed. Onboard dimmers will allow for city officials to be able to dim lights when residents are offended following new installations.

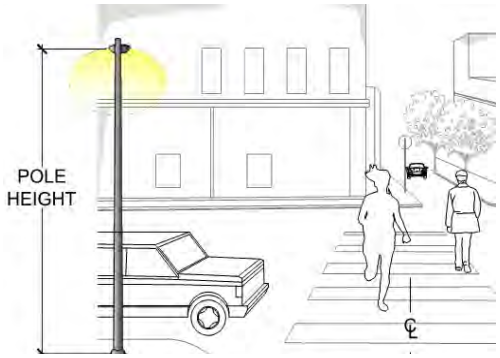
All streetlights shall have and ANSI 7-Pin receptacle to be compatible with future wireless control systems.

B. Intersections and Crosswalks

The same luminaires are to be used throughout the intersection. When an intersection is between two different street classifications, the higher street classification target criteria is used throughout the entire intersection. The recommended streetlight layout for an intersection is also dependent on whether the street classification calls for continuous or non-continuous lighting.

All traffic signal mounted streetlights shall meet the lighting requirements listed below. The intersection design shall ensure that the crosswalks are sufficiently lighted to light the vertical surface (body) of pedestrians in the crosswalk. This may require that additional streetlights be located before the intersection as shown in the Figures below.

Mid-block crossings and denoted crosswalks shall be lighted. Crosswalks can be denoted by striping, signage, flashing beacons, etc. Crosswalks are important parts of the streetscape and an appropriate lighting design will improve the visibility of pedestrians in the crosswalk. The lighting should be installed between the vehicle and the crosswalk (ie: half to one pole height before the crosswalk) to ensure that the body of the pedestrian is adequately lighted. If streetlights are installed above or immediately adjacent to the crosswalk, only the top of the pedestrian's head will be lighted making it difficult for motorists to see the pedestrian. Crosswalks and mid-block crossings shall be lighted to the Vertical Illuminance requirements in the table below. See Section D for instructions on how to set up a calculation for crosswalks and mid-block crossings.



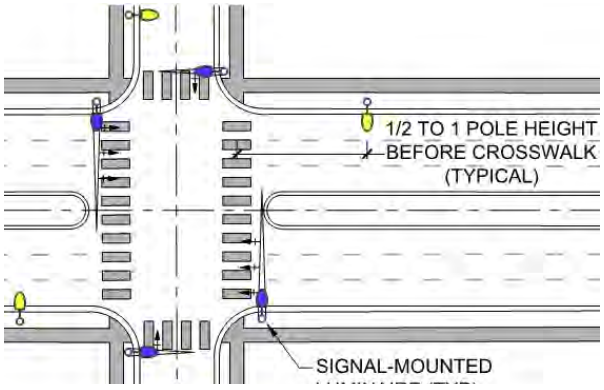


Table A: Intersection Target Horizontal & Vertical Criteria

Functional Classification	Adjacent Land Use	Average Horizontal Illuminance (Fc)	Uniformity Ratio (Fc_{avg}/Fc_{min})	Average Vertical Illuminance (Fc)	Luminaire Mounting Height (feet)	Recommended Mast Arm Length (ft)	Distribution	Max BUG Rating
Arterial / Arterial[1]	Commercial / Institutional	2.4	6	1.0	35-40	10	Type 2 or 3	3-0-3
	Residential / Industrial / Rural	1.7	6	0.8	30-35	10	Type 2 or 3	2-0-2
Arterial / Collector[1]	Commercial / Institutional	2.0	6	1.0	35-40	10	Type 2 or 3	2-0-2
	Residential / Industrial / Rural	1.4	6	0.7	30-35	10	Type 2 or 3	2-0-2
Arterial / Local[1]	Commercial / Institutional	1.9	6	0.8	35-40	10	Type 2 or 3	2-0-2
	Residential / Industrial / Rural	1.2	6	0.6	30-35	10	Type 2 or 3	2-0-2
Collector / Collector[2]	Commercial / Institutional	1.7	8	0.8	30-35	6	Type 2 or 3	2-0-2
	Residential / Industrial / Rural	1.1	8	0.5	30-35	6	Type 2 or 3	1-0-2
Collector / Local[2]	Commercial / Institutional	1.5	8	0.7	30-35	6	Type 2 or 3	1-0-2
	Residential / Industrial / Rural	0.9	8	0.5	30-35	6	Type 2 or 3	1-0-2
Local / Local >30mph	Commercial / Institutional	1.3	10	0.6	25-30	6	Type 2 or 3	1-0-1
	Residential / Industrial / Rural	0.7	10	0.5	25-30	6	Type 2 or 3	1-0-1
Local / Local <30mph	Commercial / Institutional	NA						
	Residential / Industrial / Rural	NA						

* A U2 BUG rating is acceptable when using a house side shield?

1. Arterial mid block crossing shall follow the arterial/arterial intersection criteria.
2. Collector mid block crossing shall follow the collector/collector intersection criteria.

Signalized, large intersections

This intersection type applies to:

- Arterial/Arterial
- Arterial/Collector

For a signalized intersection, with continuous lighting, the typical streetlight arrangement is interrupted by placing a streetlight half to one pole height in front of the crosswalk. This is called out as “1/2 to 1 pole height before crosswalk”. See the Crosswalk section for more information.

Additional streetlights should be located on signal poles if additional lighting is needed to meet the intersection criteria.

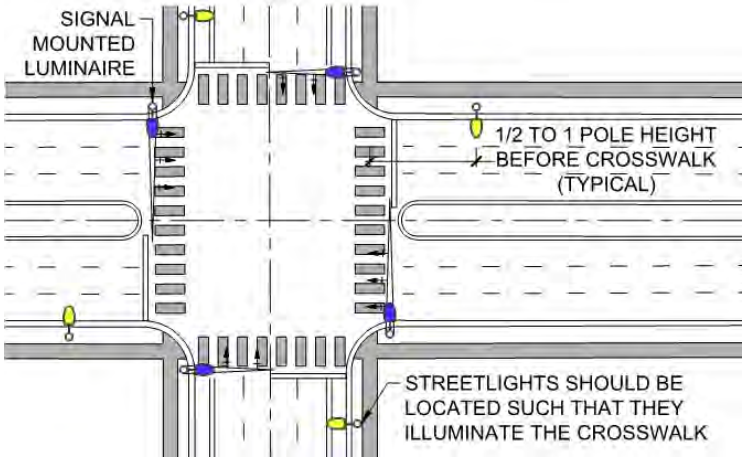


Figure 3: Signalized, Large Intersection

Non-signalized, large intersection

This intersection type applies to:

- Arterial/Collector
- Arterial/Local
- Collector/Collector

The larger street sections should be continuously lighted through the intersection. The typical streetlight arrangement is carried through the intersection. The streetlights should be located half to one pole height before the crosswalk, if it exists.

The smaller cross street should have at least one light located before the stop bar.

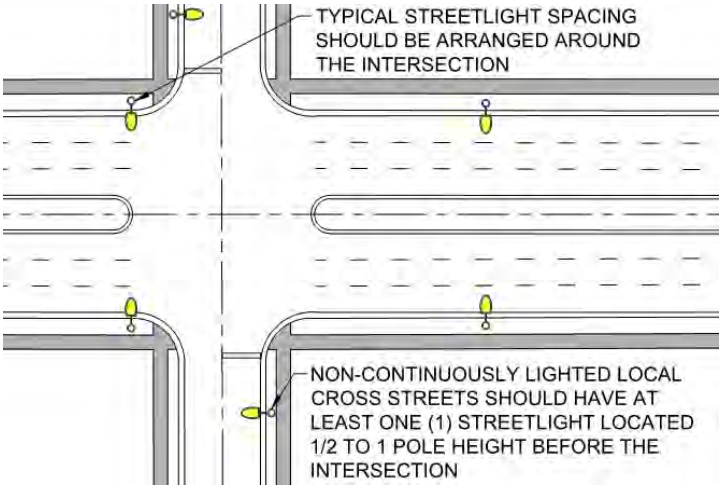


Figure 4: Non-Signalized, Large Intersection

Signalized, small intersection

This intersection type applies to:

- Arterial/Local
- Collector/Collector

Streetlights should be located half to one pole height before the crosswalk. This will light the people within the crosswalk. An additional streetlight located along the cross street should be included to better illuminate the crosswalk if necessary. Additional streetlights should be located on signal poles if additional lighting is needed to meet the intersection criteria.

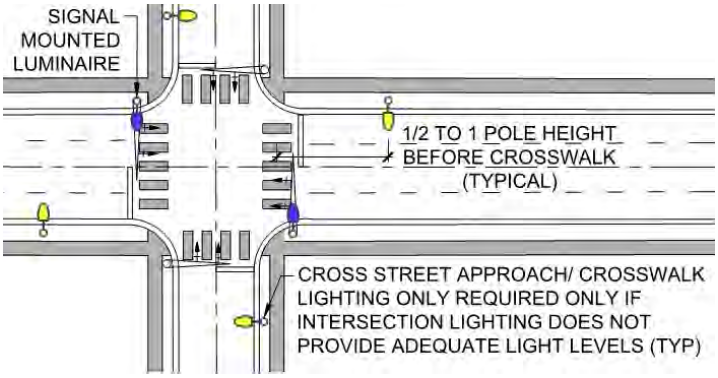


Figure 5: Signalized, Small Intersection

Non-signalized, small intersection

This intersection type applies to:

- Collector/Local
- Local/Local

At least one luminaire is to be placed at each intersection.

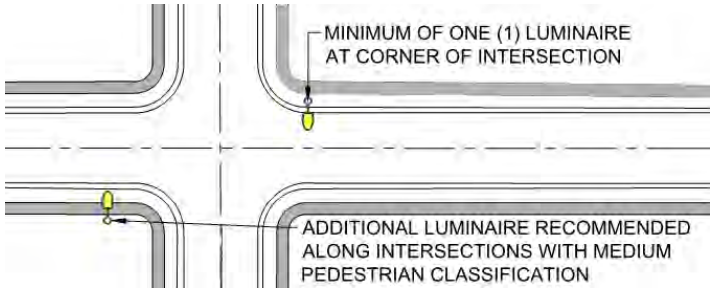


Figure 6: Non-Signalized, Small Intersection

Mid-Block Crosswalks

A streetlight shall be located one half to 1 mounting height in front of the crosswalk on both sides of the street for all mid-block crossings.

Figure 1: Streetlight Placement with Respect to Mid-Block Crossing

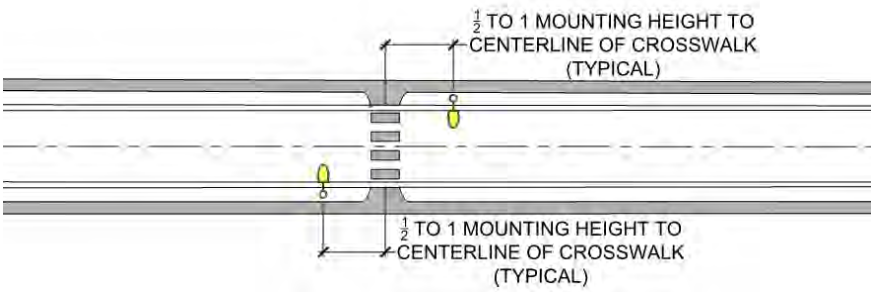


Figure 7: Mid-Block Crossing

C. Continuous Lighting on Streets

Provide continuous lighting for all arterial, collector, and local streets as specified in Table A. Lighting criteria varies for each street classification based on adjacent land use. Due to a higher pedestrian activity, streets located adjacent to commercial and institutional properties will have a higher lighting criteria. Commercial and institutional properties include churches, schools, retail areas, and restaurants. Streets located adjacent to residential, industrial, and rural properties, as well as office parks have a lower lighting criteria due to lower pedestrian activity. The lighting criteria and adjacent land use shall be evaluated on a block-by-block basis. Therefore, if a project is traveling through a residential area and passes by a school, the block that the school is on will have a higher criteria than the rest of the project. A house-side shield is highly recommended on all installations and may be needed to meet the required maximum BUG Rating. All streetlights shall have a U0 uplight rating, unless an external house side shield is being used. When an external shield is in use, light can be reflected upwards, therefore, when a shield is necessary to reduce light trespass, a U2 uplight rating is acceptable. Internal house side shields can maintain a U0 uplight rating and are preferred. All roadway calculations where a house-side shield is intended on being used shall be calculated with an .ies file that includes the shielding.

Designers should strive to meet the luminaire spacing that will provide the highest quality street lighting possible, but this is not always feasible. It is necessary to integrate lighting locations to coordinate with other improvements:

- Clearance from driveways (10 feet commercial and 5 feet residential).
- Clearance from fire hydrants (5 feet).
- Trees (centered in between trees or 10 feet from the tree trunk).

Place poles and luminaires near property lines wherever practical and avoid locations in front of doorways, windows, and lines of egress. A staggered luminaire arrangement is preferred but is not always feasible. Single sided arrangements should only be used when necessary.

Table B: New Construction Lighting Design Guidance.

Functional Classification	Adjacent Land Use	Average Luminance (cd/m^2)	Uniformity Ratio (L_{avg}/L_{min})	Luminaire Mounting Height (ft)	Arrangement	Lumen Output Range	Distribution	Max CCT	Max BUG Rating
Principal Arterial	Commercial / Institutional	0.9	5	30-35	Staggered	11,000 - 14,000	Type 2 or 3	3,000	B2-U0-G
					Single Sided	Not Recommended			
	Residential / Industrial / Rural	0.6	6	30-35	Staggered	7,000 - 10,000	Type 2	3,000	B1-U0-G
					Single Sided	7,000 - 12,000	Type 2	3,000	B1-U0-G
Minor Arterial	Commercial / Institutional	0.6	6	30-35	Staggered	7,000 - 10,000	Type 2	3,000	B2-U0-G
					Single Sided	7,000 - 12,000	Type 2	3,000	B2-U0-G
	Residential / Industrial / Rural	0.4	8	30-35	Staggered	3,500 - 5,500	Type 2	2,700	B1-U0-G
					Single Sided	5,000 - 7,500	Type 2	2,700	B1-U0-G
Collector	Commercial / Institutional	0.5	10	25-30	Staggered	3,500 - 5,000	Type 2	3,000	B1-U0-G
					Single Sided	4,000 - 6,000	Type 2	3,000	B1-U0-G
	Residential / Industrial / Rural	0.3	10	25-30	Staggered	2,500 - 4,000	Type 2	2,700	B1-U0-G
					Single Sided	3,500 - 4,500	Type 2	2,700	B1-U0-G
Local - Continous	Commercial / Institutional	0.3	10	25-30	Single Sided	3,500 - 4,500	Type 2	3,000	B1-U0-G
Local	Residential / Industrial / Rural	NA	10	25-30	Single Sided	2,500 -4,000	Type 2	2,700	B0-U0-G

* A U2 BUG rating is acceptable when using a house side shield.
* At time of publication, all Principal Arterial Streets except for Cottonwood Road are owned and maintained by MDT.

All new installations and retrofits of streetlights shall conform to the standards set forth in Table B, based on street classification, adjacent land use, and luminaire arrangement.

D. Calculations

Lighting calculations are required for all street lighting projects for the City of Bozeman. Calculations shall be done in AGi32, DIALux, Visual, or comparable software, and include the following calculation grids:

- **Roadway Luminance**
  - A calculation grid is required for every lane of traffic and shall be oriented in the direction of travel spaced 10' OC along each lane, with two points across each lane.
  - Every section of roadway where criteria changes requires a separate calculation grid.
- **Intersection Illuminance**
  - Intersection calculations shall be done using horizontal illuminance grids that include the whole intersection, as well as all crosswalks associated with the intersections. Calculation points shall be placed in a 5'x5' grid.
- **Sidewalk Illuminance**
  - Horizontal sidewalk illuminance grids shall be placed on all sidewalks, spaced every 5'-10' OC along the sidewalk with two points across the sidewalk.
- **Light Trespass Illuminance**
  - Light trespass grids shall be located 5' past the edge of ROW, into private property. Light trespass grids shall be placed 5' AFF, oriented toward the street with calculation points every 5'-10' OC.
  - Light trespass calculation grids shall be separated based on adjacent land use. If the project goes from a residential area to a commercial area, a separate light trespass calculation grid will be required for each section of the project.
  - If a structure is within 5' from the property line, light trespass grid to be placed on the structure, 5' AFF.
  - Light trespass values shall not exceed the following:
    - Residential properties: 0.1Fc Maximum.
      - If this criteria is not feasible with proper shielding and distribution, a variance may be considered to allow up to 0.2Fc Maximum light trespass in residential areas. Designer will be required to submit a narrative describing the efforts to control light trespass to the City Engineer.
    - Commercial and mixed-use residential properties: 0.3Fc Maximum
- **Crosswalk Vertical Illuminance**
  - Vertical illuminance grids shall be placed in all crosswalks at 5' AFF, and oriented according to Figure 9. Calculation points shall be located along the center line of each crosswalk, placed every 5' OC.

Designers shall submit to the City a calculation summary table for each calculation grid and

include the average illuminance or luminance, maximum illuminance or luminance, minimum illuminance or luminance, and Avg:Min ratio. Calculated values may vary from criteria by no more than 10% above or below.

Calculations shall not include a light loss factor (LFF).

Figure 8: Intersection Calculation Grid Setup

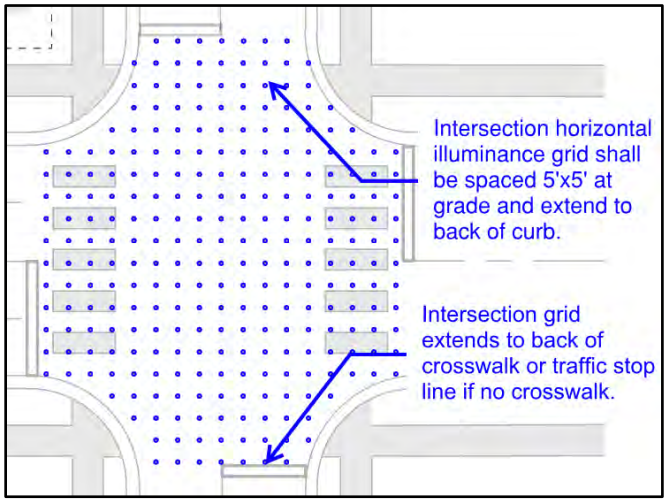


Figure 8: Horizontal Intersection Illuminance Grid

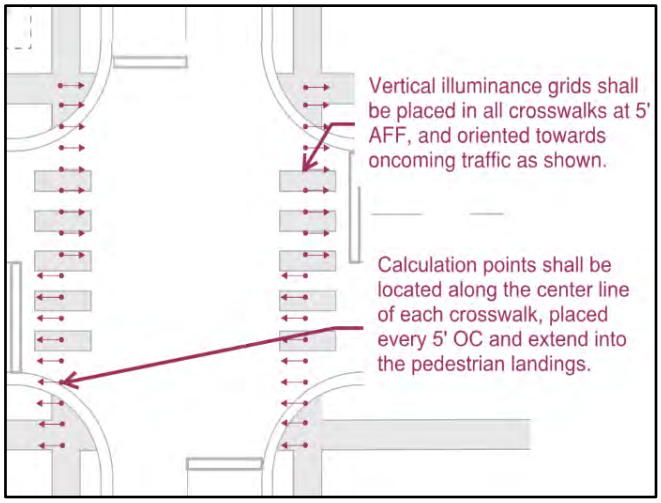


Figure 9: Vertical Intersection Illuminance Grid

Figure 10: Roadway, Sidewalk, and Light Trespass Calculation Grid Setup

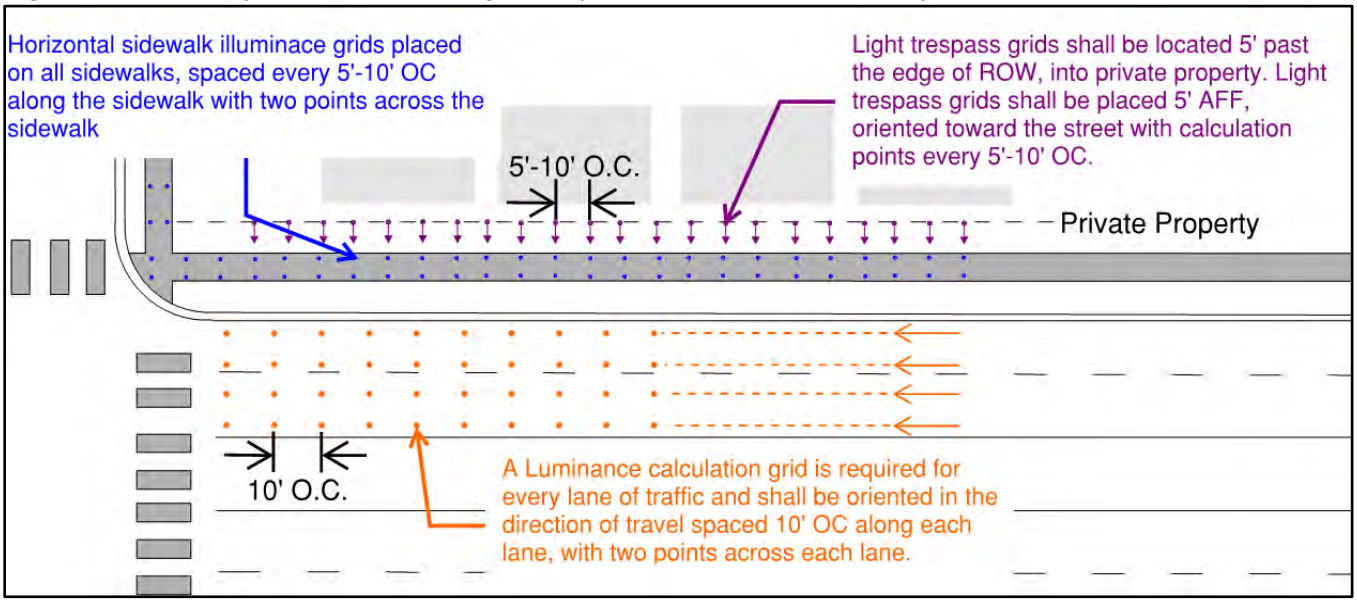


Figure 10: Calculation Grids for Roadway Luminance, Sidewalk Illuminance, and Light Trespass

E. Design Considerations.

In addition to the requirements outlined in Table B, the following layout criteria shall be used:

- When a streetlight location falls near an unlit intersection, the light shall be located at the intersection;
- Streetlights shall be located at property lines to the greatest extent possible, but not in conflict with other utility service providers;
- All proposed local streets within the proposed subdivision, having a curve of 300 feet or longer in length, shall have a streetlight in the middle of the horizontal curve or as required by the City Engineer;
- A streetlight shall be placed at the terminal ends of center median islands having trees and/or other fixed objects not having a breakaway design for speeds of 25 miles per hour or greater;
- Additional streetlights may be required by the DRC when potential traffic hazards are identified during plan review; and
- Street and pedestrian lighting arrangements with poles aligned on opposite sides of the street, rather than staggered are allowed.
- Mounting heights shall be measured from the grade of the street at the edge of the travelled way and shall comply with the requirements of Table B.

F. Pedestrian Lighting.

Pedestrian lighting is defined as luminaires mounted between 12ft and 15ft and shall be installed at 60 feet to 105 feet on center, as appropriate to coordinate with landscape and hardscape features. Two pedestrian lights shall be installed on opposite sides of the street at all intersections of pathways and local streets located within the proposed development or along existing streets or roads abutting the development, unless the pathway intersects the street at a lighted intersection. Pedestrian lights shall have a lumen output range of 2,000 – 3,500 lumens, and a maximum B.U.G. rating of B2-U1-G1. Pedestrian lights in special districts, including those along Main Street and Wilson Ave, will require special approval from a City Engineer. Spacing of pedestrian lights shall be determined by meeting the illuminance requirements outlined in Table C.

Table C. Pedestrian Lighting Guidance.

Adjacent Land Use	Average Horizontal Illuminance for Pedestrian Walkways in Maintained Footcandles	Illuminance Uniformity Ratio (avg/min)
Commercial or Institutional	0.5	4.0
Residential, Industrial or Rural	0.3	6.0

Source: Roadway Lighting (RP-8), Illuminating Engineering Society of North America.

G. Pathway Lighting.

Pathway lights shall be installed along pathways through parks and other pathways that are detached from the street. All pathway lights shall comply with City of Bozeman specifications. Pathway lights shall have a height range of 40 - 48 inches, a lumen output range of 500 - 1,000 lumens, and a maximum wattage of 25 Watts.

Section XIII. Streetlight Luminaires

A. General

- All luminaires shall be light emitting diode (LED).
- Color temperature 3000K maximum, per ANSI C78.377-2011 standard.
- All luminaires shall be equipped with a surge suppression device with a minimum immunity level of 10kV.
- All luminaires shall have a field adjustable dimming system to allow for onsite dimming once installed.
- Shielding: All luminaires shall have standard house-side shielding options. Front-side shielding may also be required to control light trespass across the street. Front-side shields may be custom, but manufacturer standard shielding is preferred.
- New light installations will be evaluated by the City of Bozeman during the required 2-year warranty period immediately following project acceptance. The City may require the developer to modify light installations through shielding or dimming to get the desired light distribution.
- The contractor may be required to provide house side light shields to the City of Bozeman for each new luminaire as a condition of project acceptance.
- All luminaires shall have a minimum ingress protection (IP) rating of IP66, and shall be UL/ETL listed for wet locations.
- All luminaires shall be equipped with a 0-10V or DALI dimming driver, capable of receiving input line voltage 120V-277V. Driver shall comply with Federal Communication Commission (FCC) 47 Code of Federal Regulations (CFR) part 15 non-consumer radio frequency interference (RFI) and/or electromagnetic interference (EMI) standards. Minimum power factor (PF) shall be no less than 0.9 at full input power. Maximum total harmonic distortion (THD) shall be no greater than 20 percent at full input power.
- A minimum 10 year warranty is required for all parts, materials, and shipping required to repair or replace luminaire.
- All luminaires are to be equipped with an ANSI C136.41 7-pin receptacle. Shorting caps are to be installed on each luminaire.
- Luminaires are to have a Type II distribution. Type III distribution allowed on Principal Arterials and Large Signalized Intersections.
- Access to all internal parts requiring replacement shall not require tools (i.e., “tool-less entry”).
- Luminaire shall be tested in accordance with IES LM79 and TM21 certifying photometric performance and rated life, respectively. LM79 (performance) and TM21 (predicted life) testing shall both be for the same luminaire’s operating drive current as specified.
- Luminaires shall have a minimum L70 live of 100,000 hours based on IES TM21 testing.
- Luminaire system efficacy shall be no less than 80 lumens per input watt.
- Luminaire shall have an external label per ANSI C136.15 and internal label per ANSI C136.22.
- Luminaires shall be equipped with internal leveling bubble.
- Breakaway connections using sheer bolts must have a skirt to protect the bolts.
- Luminaires shall be powder coat finished black or powder coat finished to match pole, unless installed on a local street, then either dark brown or hunter green.
- Luminaire distribution shall be equal or less than the Illuminating Engineering Society of North America’s (IES) TM 15-11 Backlight, Uplight, and Glare (BUG) ratings as

specified in Table B.

B. Installation

Luminaires shall be mounted in accordance with the manufacturer's specifications.

Plumb or level all elements, symmetrically arrange, and securely assemble. Conceal all conductors in the poles and assembly.

Luminaires shall have an adjustable slipfitter-type mounting system for the installation on 1.25 inch (1.66 inch o.d.) to 2 inch (2.375 inch o.d.) outside diameter pipe tenons. Slipfitter shall consist of a two-piece clamp and four 9/16 inch hex bolts. Slipfitter shall allow for a vertical tilt adjustment of +/- 5 percent in order to mount plumb for a U0 rating.

C. Approved Manufacturers – Cobrahead Style [Refer to Figure 10 – Typical Street Light Standard Detail]

- GE Evolve LED Cobrahead
- Cree XSP (only to be used with a House-Side Shield and distribution Type II Long)
- Lumec Roadfocus

D. Approved Manufacturers – Bell Style [Refer to Figure 10 – Typical Streetlight Standard Detail]

- Lumec Domus
- Architectural Area Lighting Universe
- Or Pre-Approved Equal

Section XIV. Pedestrian Luminaires

A. General

- All luminaires shall be light emitting diode (LED).
- Color temperature maximum 3000K, per ANSI C78.377-2011 standard.
- All luminaires shall be equipped with a surge suppression device with a minimum immunity level of 10kV.
- All luminaires shall be equipped with a 0-10V dimming driver, capable of receiving input line voltage 120V-277V. Driver shall comply with Federal Communication Commission (FCC) 47 Code of Federal Regulations (CFR) part 15 non-consumer radio frequency interference (RFI) and/or electromagnetic interference (EMI) standards. Minimum power factor (PF) shall be no less than 0.9 at full input power. Maximum total harmonic distortion (THD) shall be no greater than 20 percent at full input power.
- A minimum 10 year warranty is required for all parts, materials, and shipping required to repair or replace luminaire.
- All luminaires are to be equipped with an ANSI C136.41 7-pin receptacle. Shorting caps are to be installed on each luminaire.
- Luminaires are to have either a Type III or Type V distribution. Type V distributions will be considered for special use through DRC review.
- Access to all internal parts requiring replacement shall not require tools (i.e., "tool-less entry").
- Luminaire shall be tested in accordance with IES LM79 and TM21 certifying

photometric performance and rated life, respectively. LM79 (performance) and TM21 (predicted life) testing shall both be for the same luminaire's operating drive current as specified.
- Internal house-side shield must be available.
- Luminaire system efficacy shall be no less than 60 lumens per input watt.
- Luminaire shall have an external label per ANSI C136.15 and internal label per ANSI C136.22.
- Luminaires shall be powder coat finished black or powder coat finished to match pole, unless installed on a local street, then either dark brown or hunter green.
- Luminaire distribution shall be equal or less than the Illuminating Engineering Society of North America's (IES) TM 15-11 Backlight, Uplight, and Glare (BUG) rating of B2 U1 G1
    - For applications approved for Type V distribution, the Backlight rating shall not apply.

B. Installation

Luminaires shall be mounted in accordance with the manufacturer's specifications.

Plumb or level all elements, symmetrically arrange, and securely assemble. Conceal all conductors in the poles and assembly.

C. Approved Products – Traditional Post-top Style [Refer to Figure 11 – Typical Post-Top Pedestrian Light Standard Detail]

- Sternberg Euro
- Architectural Area Lighting Providence
- Or approved equal

D. Approved Products – Bell Style [Refer to Figure 12 – Typical Arm-Mount Pedestrian Light Standard Detail]

- Lumec Domus
- Architectural Area Lighting Universe
- Or approved equal

Section XV. Pathway Luminaires

A. General

- All luminaires shall be light emitting diode (LED).
- Color temperature maximum 3000K, per ANSI C78.377-2011 standard, +/- 275K.
- All luminaires shall be equipped with a surge suppression device with a minimum immunity level of 10kV.
- All luminaires shall be equipped with a 0-10V dimming or DALI driver, capable of receiving input line voltage 120V-277V. Driver shall comply with Federal Communication Commission (FCC) 47 Code of Federal Regulations (CFR) part 15 non-consumer radio frequency interference (RFI) and/or electromagnetic interference (EMI) standards. Minimum power factor (PF) shall be 0.9 at full input power. Maximum total harmonic distortion (THD) shall be 20 percent at full input power.
- A minimum 10 year warranty is required for all parts, materials, and shipping required to repair or replace luminaire.
- All luminaires are to be equipped with an ANSI C136.41 7-pin receptacle. For

luminaires that are not supplied with integral 7-pin receptacles, provide the 7-pin receptacle in pole cap on the top of the pole. Shorting caps are to be installed on each luminaire.

- Luminaires are to have either a Type III or Type V distribution. Type V distributions will be considered for special use through DRC review.
- Luminaire shall be tested in accordance with IES LM79 and TM21 certifying photometric performance and rated life, respectively. LM79 (performance) and TM21 (predicted life) testing shall both be for the same luminaire's operating drive current as specified.
- Luminaire system efficacy shall be no less than 30 lumens per input watt.
- Luminaires shall be powder coat finished black.
- Vandal proof. Not flat heads, rounded heads.
- Concrete base, no direct burial
- Luminaire distribution shall be equal or less than the Illuminating Engineering Society of North America's (IES) TM 15-11 Backlight, Uplight, and Glare (BUG) ratings as follows:
    - B2 U1 G1
    - For applications approved for Type V distribution, the Backlight rating shall not apply.

B. Installation

Luminaires shall be mounted in accordance with the manufacturer's specifications.

Plumb or level all elements, symmetrically arrange, and securely assemble. Conceal all conductors in the assembly. [Refer to Figure 13 – Typical Pathway Light Standard Detail]

C. Approved Products

- Lithonia Lighting KBR8 LED Bollard
- Lithonia Lighting D-Series LED Bollard
- Or approved equal

Section XVI. Poles.

A. General

Unless specifically approved by the City Commission, the use of "Montana Angle", "Budget Angle", or similar style streetlight poles is prohibited.

All poles, mast arms, and luminaires for streetlights and signal poles shall be round, tapered steel with galvanized and painted finish.

Poles for pedestrian lights shall be round, non-tapered steel, with optional decorative fluting, and galvanized and painted finish.

Unless a variance is granted, all future ARTERIAL AND COLLECTOR street and signal light poles shall be "Hunter Green" (RAL#6005), Moss Green, or similar in color, excepting that all future street and signal light poles in the Downtown Business District and North 7th Avenue TIF District shall be black, and further excepting that entryway streets into Montana State University (i.e. S. 8th Avenue, College Street, Kagy Boulevard, and S. 11th Avenue) may be dark Bobcat Blue.

The height of streetlight poles shall be determined based upon the lumen output and application. Refer to Lighting Design Criteria.

Streetlight luminaires shall have a mast arm of 6 feet for local and collector streets, or 10 feet for principal and minor arterials.

All streetlight poles shall be installed on a concrete foundation with the appropriate base for the application. [Refer to Figure 9 – Typical Streetlight Standard Details]

All poles, foundations, and breakaway bases shall meet the criteria set forth in the AASHTO publication Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.

B. Installation

Streetlight poles shall be placed typically at five feet from back of curb.

Streetlight standards, pedestrian light standards and pathway lights shall have an access panel and cover near base for access to wiring, fusible, in-line, water tight, breakaway connectors on wiring in pole hand hole area such as Bussman type water tight fuse holders. [Refer to Figures 14, 15 and 16 – Typical Pole Base Standard Details]

Section XVII. Pole bases

A. General

Unless otherwise protected, a breakaway base should be provided for all streetlight standards within the clear zone along rural and high-speed urban highways, except where located within 1.5 times pole height from a bus stop. Non-breakaway bases shall be used for all pedestrian lights and pathway lights.

B. Breakaway Bolt Couplings.

Breakaway bolt couplings are aluminum connectors or sleeves that are designed to shear when the pole is hit. The bottom of the coupling is threaded onto the foundation anchor bolts, and the light standard is attached to the top of the coupling. Four couplings are used with each light standard. Where breakaway supports are required, use the breakaway bolt coupling unless it will not function with the approved light standard. [Refer to Figure 14 – Typical Breakaway Bolt Coupling Standard Details]

C. Frangible Transformer Base.

The frangible transformer base consists of a cast aluminum apron between the concrete foundation and the base of the pole. It is designed to deform and breakaway when hit by a vehicle bumper. Use the frangible transfer base where a breakaway base is justified but breakaway bolt couplings cannot be used. [Refer to Figure 15 – Typical Frangible Transformer Base Detail]

D. Non-Breakaway Anchor Base.

A non-breakaway anchor base consists primarily of a metal plate that is welded to the bottom of the light standard. The plate allows the light standard to be bolted directly to the foundation without an intermediate breakaway device. It does not meet AASHTO breakaway base criteria. [Refer to Figure 16 – Typical Non-Breakaway Pole Base Detail]

Section XVIII. Submittal Requirements

A. General

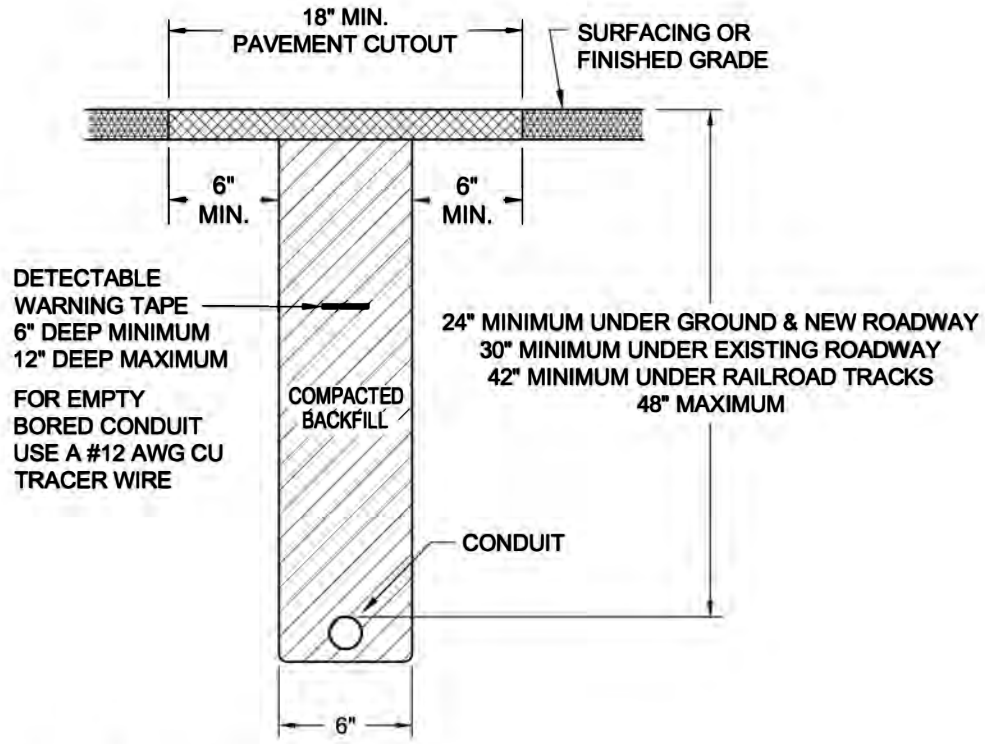
- Plan sheets showing pole locations, conduit locations, pull / splice box locations, and meter locations are required.
- For Street Lighting submittals, provide luminaire cutsheets showing compliance with *Table 1. New Construction Lighting Design Guidance* and Section XIII. Streetlight Luminaires,
- For Pedestrian Lighting submittals, provide a Photometric Plan for new installations showing compliance with *Table 3. Pedestrian Lighting Guidance*. Also provide luminaire cutsheets showing compliance with Section XIV. Pedestrian Luminaires.
- For Pathway Lighting submittals, provide luminaire cutsheets showing compliance with Section XII.J. Lighting Design Criteria – Pathway Lighting, and Section XV. Pathway Luminaires.
- Details of point of service, lighting control center, electrical one-line diagrams, pole foundations, poles, and luminaires are required.
- Prior to construction, submit shop drawings (cut sheets) for all material and equipment.
- Lighting calculations showing roadway luminance, intersection illuminance, sidewalk illuminance, and light trespass.

Roadway Luminaire Submittal Form

Luminaire Manufacturer & Catalog Number	=		
Street Classification	☐ Principal Arterial	☐ Minor Arterial	☐ Collector
	☐ Local (Commercial, Inst	☐ Local (Residentail, Industrial, Rural)	
Adjacent Land Use	☐ Commercial, Institutional	☐ Residentail, Industrial, Rural	
Luminaire Characteristics	Initial Luminaire Lumen Output =	System Wattage =	Luminaire Efficacy (lm/W) =
Correlated Color Temperature (CCT)	=		
Color Rendering Index (CRI)	=		
BUG Rating (per IES TM-15)	Backlight =	Uplight =	Glare =
IES Photometric Data in .ies Format	☐ Yes	☐ No	☐ Other
LED Retrofit Luminaire	☐ Yes	☐ No	
0-10V Dimmable Driver	☐ Yes	☐ No	
Field Dimmable	☐ Yes	☐ No	
Exterior Label (per ANSI C136.15) & Interior Label (per ANSI C136.22)	☐ Yes	☐ No	
Tool-Less Entry	☐ Yes	☐ No	
Luminaire Housing Finish	=		
Rated Life (IES TM-21)	=		
Ambient Temperature Range	Minimum Temperature=	Maximum Temperature=	
Vibration Rating (ANSI C136.31)	=		
UL Listing	☐ Wet Location	☐ Damp Location	IP Rating =
Passive Cooling System	☐ Yes	☐ No	
LED Compatible 7-pin Receptacle (ANSI C136.41)	☐ Yes	☐ No	☐ Control Module
Internal Wiring and Quick Disconnects	=		
Operating Voltage	Voltage =	Frequency (Hz) =	
Power Factor	=		
Total Harmonic Distortion	=		
Surge Protection (IEEE C62.41.2)	=		
Warranty Period	=		
Warranty Start Date	=		
Other Submittals	=		

Pedestrian Luminaire Submittal Form

Luminaire Manufacturer & Catalog Number	=		
Adjacent Land Use	☐ Commercial, Institutional	☐ Residentail, Industrial,	Rural
Path or Sidewalk Lighting	☐ Path	☐ Sidewalk	
Luminaire Characteristics	Initial Luminaire Lumen Output =	System Wattage =	Luminaire Efficacy (lm/W) =
Correlated Color Temperature (CCT)	=		
Color Rendering Index (CRI)	=		
BUG Rating (per IES TM-15)	Backlight =	Uplight =	Glare =
IES Photometric Data in .ies Format	☐ Yes	☐ No	☐ Other
0-10V Dimmable Driver	☐ Yes	☐ No	
Field Dimmable	☐ Yes	☐ No	
LED Retrofit Luminaire	☐ Yes	☐ No	
Exterior Label (per ANSI C136.15) & Interior Label (per ANSI C136.22)	☐ Yes	☐ No	
Luminaire Housing Finish	=		
Rated Life (IES TM-21)	=		
Ambient Temperature Range	Minimum Temperature=	Maximum Temperature=	
Vibration Rating (ANSI C136.31)	=		
UL Listing	☐ Wet Location	☐ Damp Location	IP Rating =
LED Compatible 7-pin Receptacle (ANSI C136.41)	☐ Yes	☐ No	☐ Control Module
Internal Wiring and Quick Disconnects	=		
Operating Voltage	Voltage =	Frequency (Hz) =	
Power Factor	=		
Total Harmonic Distortion	=		
Warranty Period	=		
Warranty Start Date	=		
Other Submittals	=		

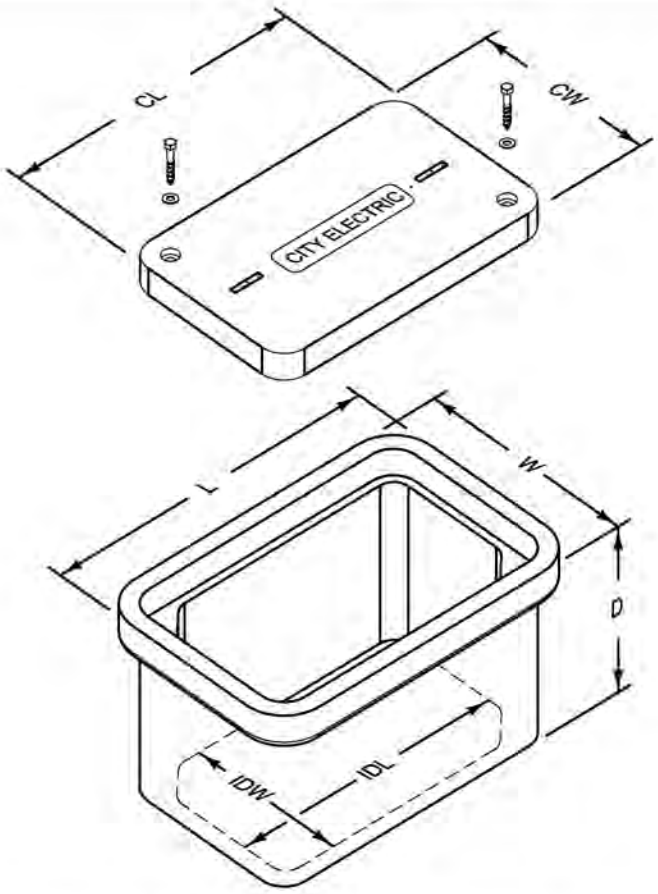


DETAIL NOTES

1. CONTRACTOR SHALL COORDINATE TRENCHING WITH OTHER UNDERGROUND UTILITIES. CONTRACTOR SHALL USE COMMON TRENCHES AT ALL ROAD CROSSINGS WHEREVER POSSIBLE.

2. 1-#12 AWG LOCATE WIRE AND A NYLON OR POLYESTER PULL TAPE WITH 1,250 LBS TEST STRENGTH AND FOOTAGE MARKINGS IN ALL EMPTY CONDUITS.

FIGURE 1	TYPICAL CONDUIT BURIAL STANDARD DETAIL	THE CITY OF BOZEMAN ENGINEERING DEPARTMENT 20 E. OLIVE -- P.O. BOX 1230 BOZEMAN, MONTANA 59771-1230 PHONE: (406) 582-2280 -- FAX: (406) 582-2283



PULL BOX / SPLICE BOX - COMPOSITE MINIMUM DIMENSIONS								
TYPE 1			TYPE 2			TYPE 3		
L	=	20"	L	=	25"	L	=	32"
W	=	13"	W	=	15"	W	=	19"
D	=	12"	D	=	12"	D	=	20"
IDL	=	17"	IDL	=	21"	IDL	=	28"
IDW	=	10"	IDW	=	11"	IDW	=	15"
CL	=	18"	CL	=	23"	CL	=	30"
CW	=	11"	CW	=	13"	CW	=	17"

DETAIL NOTES

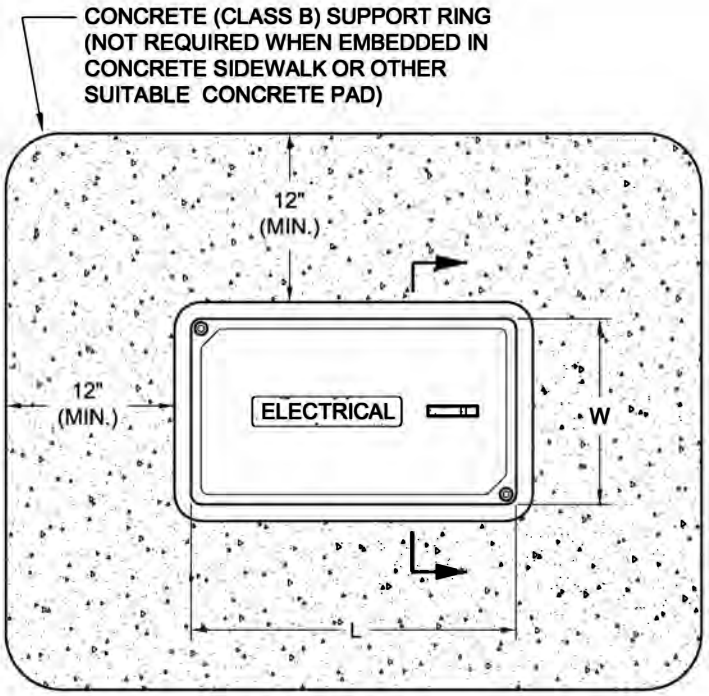
1. BOX COVERS MUST BE POLYMER CONCRETE WITH FIBERGLASS REINFORCEMENT, TRAFFIC RATED TO TIER 22 AND BOLTED.

2. BOX COVERS SHALL BE LABELED AS FOLLOWS:
   - "CITY ELECTRIC" ON ALL PULL BOXES CONTAINING CITY ELECTRICAL POWER.
   - "UTILITY ELECTRIC" ON ALL PULL BOXES CONTAINING UTILITY ELECTRICAL POWER.
   - "CITY LIGHTING" ON ALL PULL BOXES CONTAINING CITY OWNED STREET LIGHTING CONDUCTORS.
   - "UTILITY LIGHTING" ON ALL PULL BOXES CONTAINING UTILITY OWNED STREET LIGHTING CONDUCTORS.

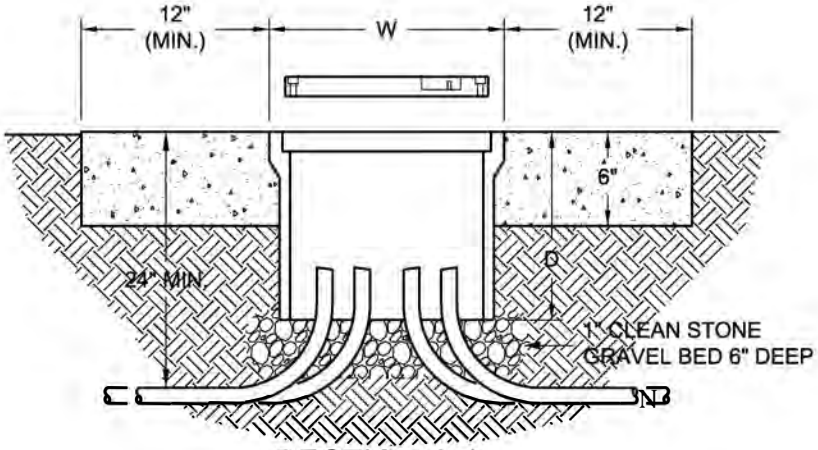
   LABELING MUST BE CAST INTO THE COVER AND NOT A SEPARATE INDEPENDENT TAG.

3. REFER TO N.E.C. ARTICLE 314 "PULL AND JUNCTION BOXES AND CONDUIT BODIES MINIMUM SIZE" FOR BOX SIZE REQUIREMENTS BASED ON CONDUIT AND WIRE SIZES

FIGURE 2	TYPICAL PULL BOX / SPLICE BOX MINIMUM DIMENSIONS STANDARD DETAILS	THE CITY OF BOZEMAN ENGINEERING DEPARTMENT 20 E. OLIVE -- P.O. BOX 1230 BOZEMAN, MONTANA 59771-1230 PHONE: (406) 582-2260 -- FAX: (406) 582-2263



PLAN VIEW



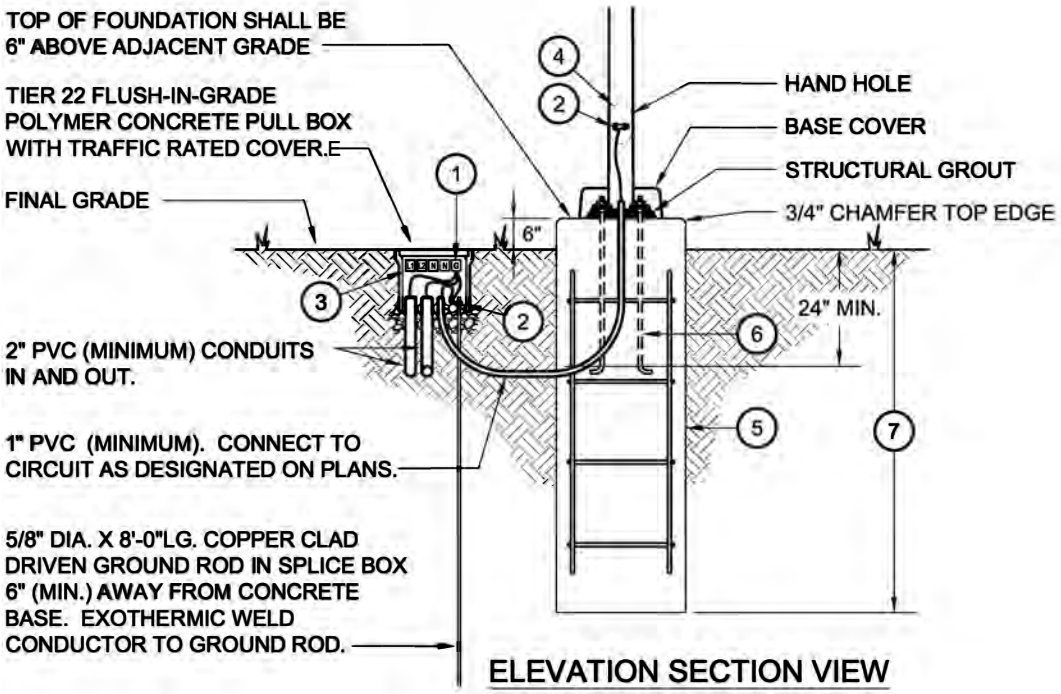
SECTION A-A

TYPICAL PULL BOX / SPLICE BOX

DETAIL NOTES

1. ALL PULL OR SPLICE BOXES SHALL BE TRAFFIC RATED TO TIER 22 MINIMUM.
2. REFER TO FIGURE 2 FOR PULL BOX SIZE REQUIREMENTS.

FIGURE 3	TYPICAL IN-GRADE COMPOSITE PULL BOX / SPLICE BOX DETAIL	THE CITY OF BOZEMAN ENGINEERING DEPARTMENT 20 E. OLIVE -- P.O. BOX 1230 BOZEMAN, MONTANA 59771-1230 PHONE: (406) 582-2280 -- FAX: (406) 582-2283



ELEVATION SECTION VIEW

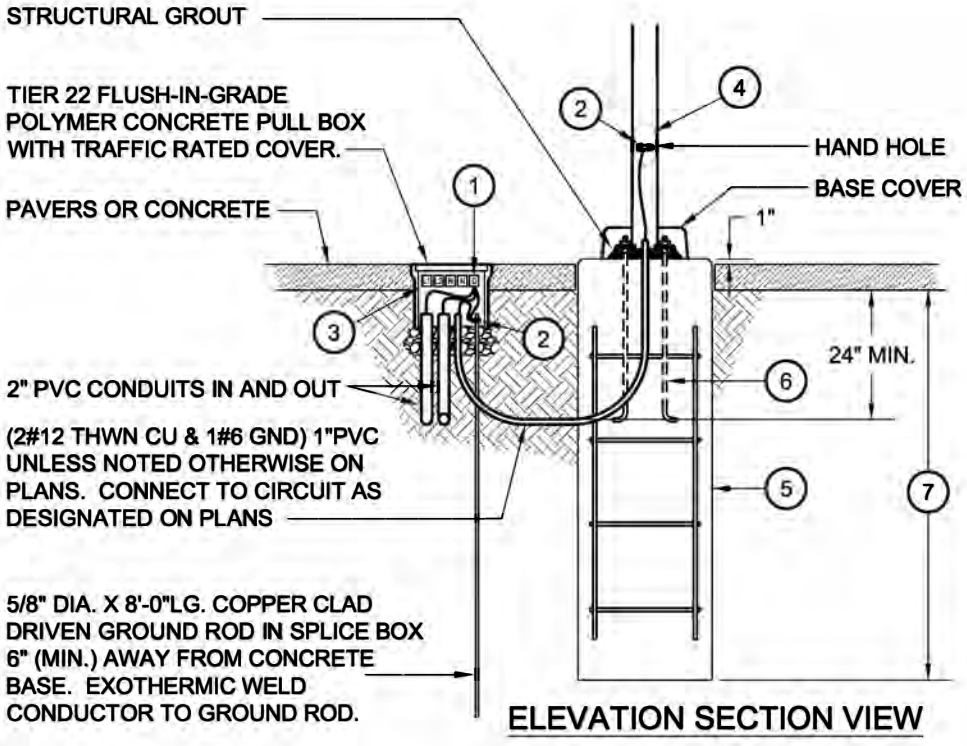
FOUNDATION DETAIL NOTES

1. BOND RACEWAY GROUND TO GROUND ROD IN PULL BOX# SPLICE BOX.
2. BOND (1-#6 SOFT DRAWN BARE CU) TO GROUND ROD IN PULL BOX / SPLICE BOX AND GROUNDING LUG IN POLE BASE HAND HOLE.
3. PROVIDE 3-TERMINAL UNDERGROUND RATED LUG CONNECTORS TO FIT #14AWG - #4AWG COPPER WIRE, BY BURNDY OR ILSCO NIMBUS OR APPROVED EQUAL. MAXIMUM OF (5) REQUIRED OR (1) FOR EACH CONDUCTOR IN HOME RUN.
4. AT EACH POLE BASE HAND HOLE, PROVIDE A BREAKAWAY, WATERPROOF, IN-LINE FUSE HOLDER BY EATON OR APPROVED EQUAL WITH FNQ-R 15A FUSE FOR EACH HOT AND A BREAKAWAY, WATERPROOF CONNECTOR ON NEUTRAL (IF REQUIRED).
5. LIGHT STANDARD FOUNDATION EMBEDMENT DEPTH, DIMENSIONS AND REINFORCEMENT SHALL BE DESIGNED BY A STRUCTURAL ENGINEER LICENSED IN THE STATE OF MONTANA. WELDING OF REBAR CAGES NOT PERMITTED.
6. DIMENSION FOR ANCHOR BOLT SPACING BY POLE MANUFACTURER.
7. DEPTH OF FOUNDATION PER STRUCTURAL ENGINEER.

GENERAL NOTE

FOUNDATION DETAILS ARE INCLUDED ONLY TO SHOW ELECTRICAL COMPONENTS.

FIGURE 4	TYPICAL STREET LIGHT STANDARD FOUNDATION ELECTRICAL DETAIL IN SOFTSCAPE	THE CITY OF BOZEMAN ENGINEERING DEPARTMENT 20 E. OLIVE -- P.O. BOX 1230 BOZEMAN, MONTANA 59771-1230 PHONE: (406) 582-2280 -- FAX: (406) 582-2283



ELEVATION SECTION VIEW

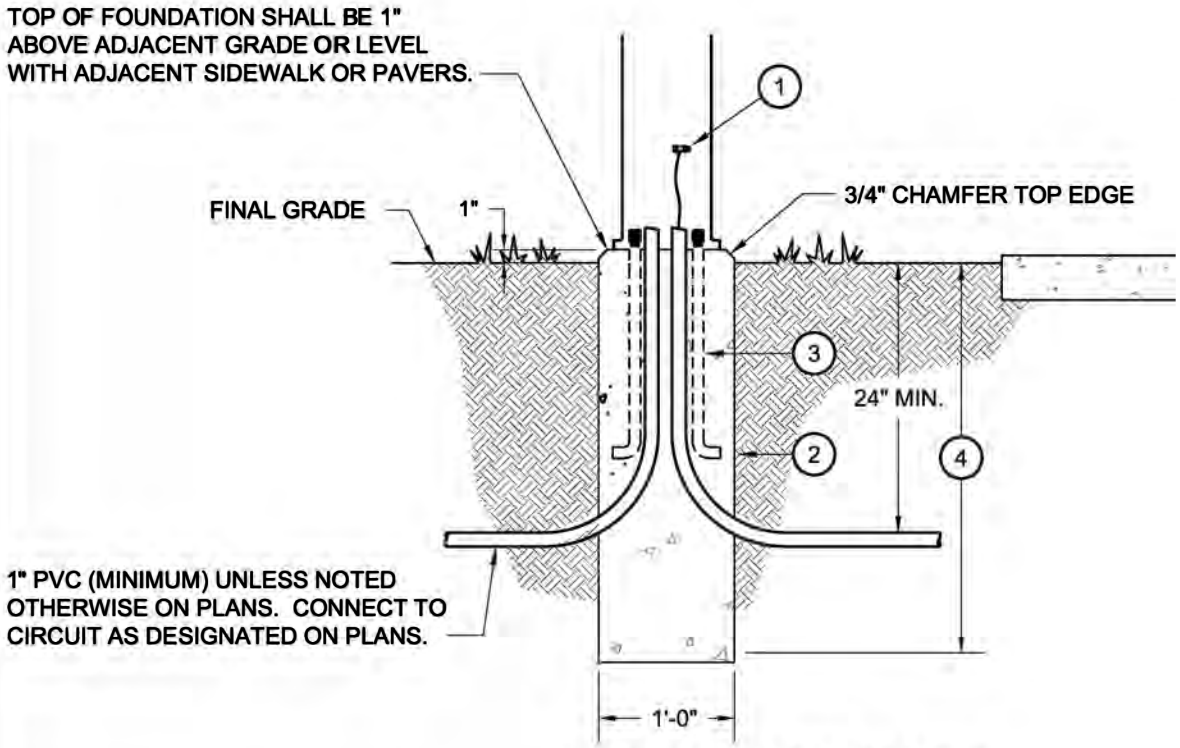
FOUNDATION DETAIL NOTES

1. BOND RACEWAY GROUND TO GROUND ROD IN PULL BOX / SPLICE BOX.
2. BOND (1-#6 SOFT DRAWN BARE CU) TO GROUND ROD IN PULL BOX / SPLICE BOX AND GROUNDING LUG IN POLE BASE HAND HOLE.
3. PROVIDE 3-TERMINAL UNDERGROUND RATED LUG CONNECTORS TO FIT #14AWG - #4AWG COPPER WIRE, BY BURNDY OR ILSCO NIMBUS OR APPROVED EQUAL. MAXIMUM OF (5) REQUIRED OR (1) FOR EACH CONDUCTOR IN HOME RUN.
4. AT EACH POLE BASE HAND HOLE, PROVIDE A BREAKAWAY, WATERPROOF, IN-LINE FUSE HOLDER BY EATON OR APPROVED EQUAL WITH FNQ-R 15A FUSE FOR EACH HOT AND A BREAKAWAY, WATERPROOF CONNECTOR ON NEUTRAL (IF REQUIRED).
5. LIGHT STANDARD FOUNDATION EMBEDMENT DEPTH, DIMENSIONS AND REINFORCEMENT SHALL BE DESIGNED BY A STRUCTURAL ENGINEER LICENSED IN THE STATE OF MONTANA. WELDING OF REBAR CAGES NOT PERMITTED.
6. DIMENSION FOR ANCHOR BOLT SPACING BY POLE MANUFACTURER.
7. DEPTH OF FOUNDATION PER STRUCTURAL ENGINEER.

GENERAL NOTE

FOUNDATION DETAILS ARE INCLUDED ONLY TO SHOW ELECTRICAL COMPONENTS.

FIGURE 5	TYPICAL STREET LIGHT STANDARD FOUNDATION ELECTRICAL DETAIL IN HARDSCAPE	THE CITY OF BOZEMAN ENGINEERING DEPARTMENT 20 E. OLIVE -- P.O. BOX 1230 BOZEMAN, MONTANA 59771-1230 PHONE: (406) 582-2280 -- FAX: (406) 582-2283



ELEVATION SECTION VIEW

FOUNDATION DETAIL NOTES

1. BOND (1-#6 SOFT DRAWN BARE CU) TO GROUNDING LUG IN POLE BASE.
2. LIGHT STANDARD FOUNDATION EMBEDMENT DEPTH, DIMENSIONS AND REINFORCEMENT SHALL BE DESIGNED BY A STRUCTURAL ENGINEER LICENSED IN THE STATE OF MONTANA.
3. DIMENSION FOR ANCHOR BOLT SPACING BY POLE MANUFACTURER.
4. DEPTH OF FOUNDATION PER STRUCTURAL ENGINEER.

GENERAL NOTE

FOUNDATION DETAILS ARE INCLUDED ONLY TO SHOW ELECTRICAL COMPONENTS.

FIGURE 6	TYPICAL PATHWAY LIGHT STANDARD FOUNDATION ELECTRICAL DETAIL	THE CITY OF BOZEMAN ENGINEERING DEPARTMENT 20 E. OLIVE -- P.O. BOX 1230 BOZEMAN, MONTANA 59771-1230 PHONE: (406) 582-2280 -- FAX: (406) 582-2283

NOTE:
REFER TO FIGURE 7b FOR NOTES.

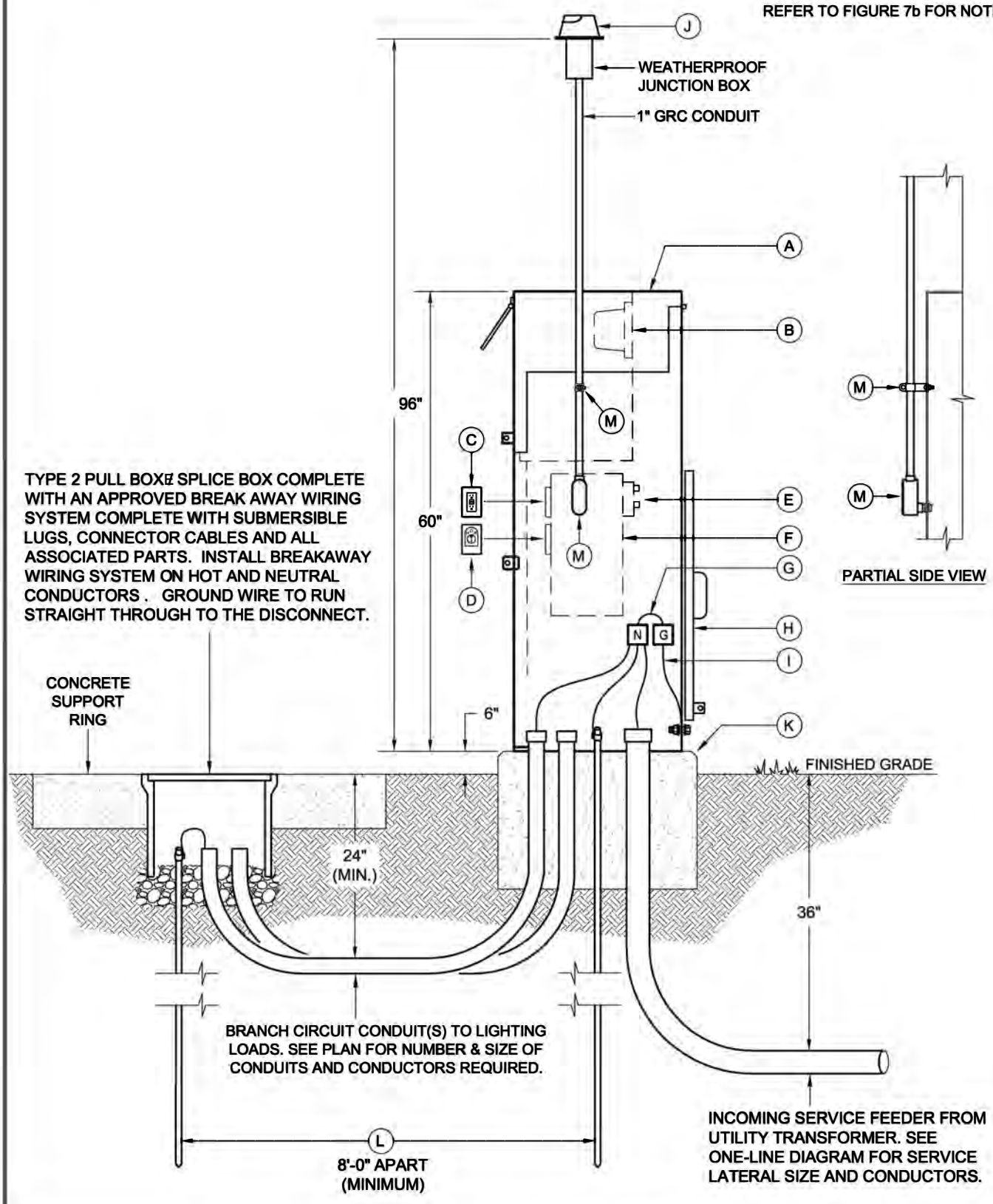


FIGURE 7A	TYPICAL LIGHTING CONTROL CENTER CABINET STANDARD DETAIL	THE CITY OF BOZEMAN ENGINEERING DEPARTMENT 20 E. OLIVE -- P.O. BOX 1230 BOZEMAN, MONTANA 59771-1230 PHONE: (406) 582-2280 -- FAX: (406) 582-2263

CABINET COMPONENT LIST

(A) FULLY HINGED METER/TEST SECTION LOCKABLE COVER WITH HOLD OPEN ARM TO KEEP COVER FROM BLOWING SHUT. COMBINATION ALL-IN-ONE COMMERCIAL METER POWER PEDESTAL IN A NEMA 3R STAINLESS STEEL ENCLOSURE.

(B) UTILITY METER INSIDE NEMA 3R ENCLOSURE. METER SHALL HAVE LEVER BYPASS AND INTERNAL LOCKING TAB ON METER COVER.

(C) GFCI MAINTENANCE RECEPTACLE FLUSH MOUNTED IN PANEL DEAD FRONT INSIDE OF THE NEMA 3R ENCLOSURE.

(D) HAND-OFF-AUTO SWITCH - 15A-2P, HOA SWITCH WITH LEGEND FLUSH MOUNTED IN PANEL DEAD FRONT INSIDE OF THE NEMA 3R ENCLOSURE.

(E) UTILITY TERMINATION LANDING LUGS.

(F) LOAD CENTERS WITH SERVICE MAIN AND BRANCH BREAKERS. ENGINEER SHALL PROVIDE PANEL SCHEDULE FOR BREAKERS REQUIRED.

(G) PROVIDE NEUTRAL TO GROUND BONDING JUMPER.

(H) LIFT OFF SERVICE COVER WITH PAD LOCK HASP.

(I) CABINET GROUND BOND #6 BARE COPPER CONDUCTOR.

(J) NEMA 3R 120V PHOTOELECTRIC CONTROL WITH 3-PRONG TWIST-LOCK RECEPTACLE BASE WIRED THROUGH THE H.O.A. SWITCH. THE PHOTOELECTRIC CONTROL SHALL BE MOUNTED TO A WEATHERPROOF JUNCTION BOX ON TOP OF A 1" GRC CONDUIT AT 96" ABOVE FINISHED GRADE. ORIENT PHOTOCELL WINDOW NORTHWARD TO MINIMIZE THE SUN'S INTERFERENCE.

(K) REINFORCED CONCRETE (CLASS B) FOUNDATION PER STRUCTURAL ENGINEER LICENSED IN THE STATE OF MONTANA. MINIMUM 6" ABOVE GRADE, 3/4" CHAMFER ALL EXPOSED EDGES, 4" OVERLAP ON ALL SIDES.

(L) 3/4" X 8'-0" Lg. COPPER CLAD DRIVEN GROUND ROD. EXOTHERMIC WELD OR UNDERGROUND RATED LUG CONNECT CONDUCTOR TO GROUND ROD. (2) REQUIRED - 8'-0" APART (MIN.)

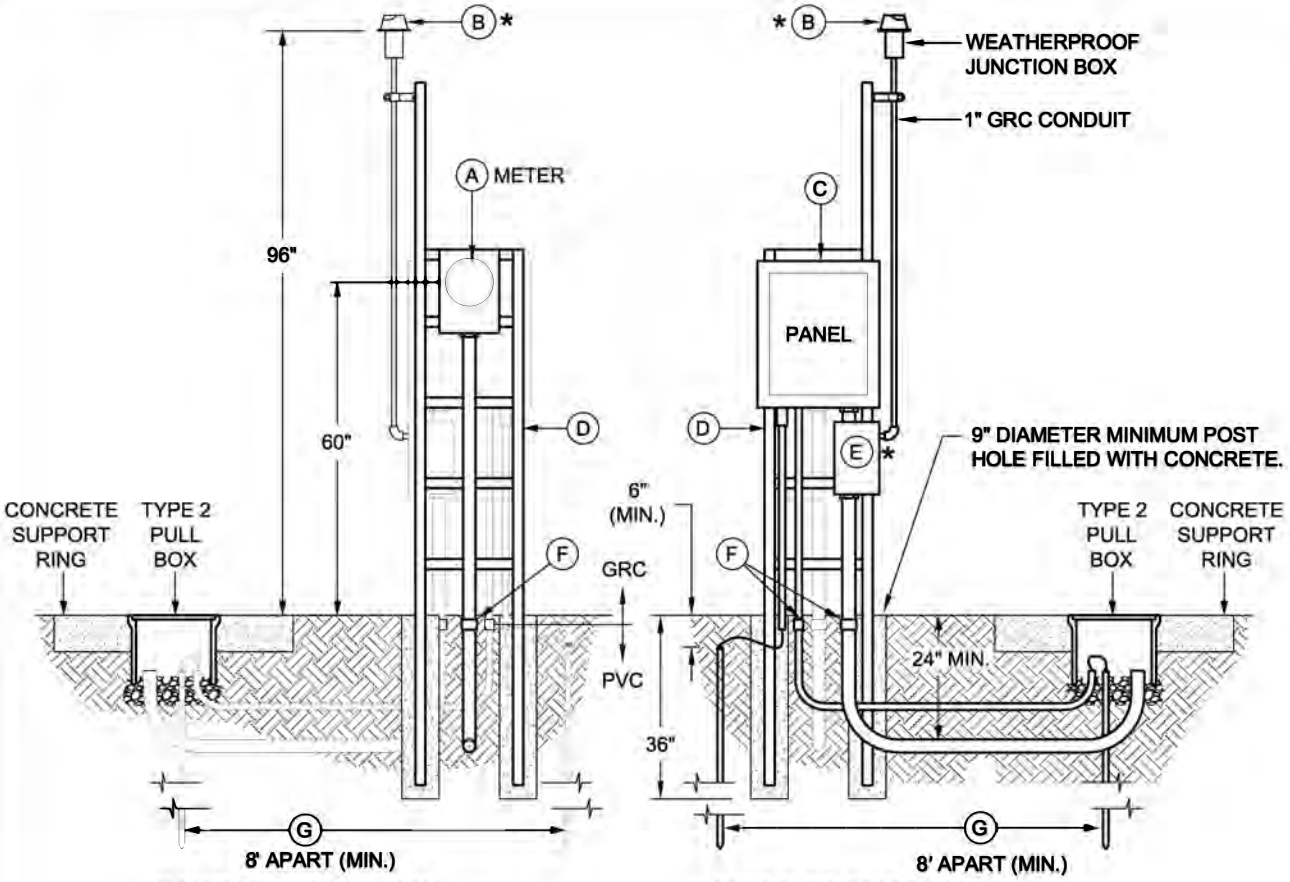
(M) PROVIDE 1" GRC LB AND THREADED CONNECTION FOR CABINET ENTRY. INSTALL CONDUIT HANGER WITH BOLT, BOLTED TO CABINET TO PREVENT CONDUIT MOVEMENT. ENSURE CONDUIT DOES NOT INTERFERE WITH OPERATION OF HINGED COVER.

TYPICAL CABINET REQUIREMENTS:

200AMP MCB,120/240V-1Ø-3W STAINLESS STEEL, NEMA 3R, METER/ POWER PEDESTAL WITH SEPARATE SEALABLE AND LOCKABLE CUSTOMER SECTION WITH:

1. LOAD CENTER (ENGINEER SHALL PROVIDE SCHEDULE FOR # OF CIRCUITS) FOR ALWAYS ON LOADS THAT INCLUDE:
   (APPLIES TO STREET LIGHTS AND PEDESTRIAN LIGHTS)
   - SERVICE ENTRANCE M.C.B. - ENGINEER TO PROVIDE SIZE ON THE PANEL SCHEDULE.
   - CONTROL POWER CIRCUIT BREAKER - ENGINEER TO PROVIDE SIZE ON THE PANEL SCHEDULE.
   - SWITCHED LOAD CENTER MAIN BREAKER - ENGINEER TO PROVIDE ON THE PANEL SCHEDULE.
   - BRANCH BREAKERS AS SHOWN - ENGINEER TO PROVIDE SIZE AND QUANTITY ON THE PANEL SCHEDULE.
   - CIRCUIT DIRECTORY TO DOCUMENT CONFIGURATION IN POCKET ON HINGED DOOR.
   - MAINTENANCE RECEPTACLE FLUSH MOUNTED IN DEAD FRONT INSIDE ENCLOSURE.
2. CONTROL CIRCUIT INCLUDING:
   (ONLY APPLIES TO PATHWAY AND PEDESTRIAN LIGHTS THAT DO NOT HAVE INDIVIDUAL ANSI 7-PIN RECEPTACLES.)
   - PHOTOCELL RECEPTACLE, MOUNTED EXTERNALLY ON NEMA-3R ENCLOSURE.
   - ONE HAND-OFF-AUTO (HOA) SWITCH FLUSH MOUNTED IN DEAD FRONT.
   - ONE LIGHTING CONTACTOR CONTROLLING ONE LOAD CENTER IN THIS SECTION.
   - ONE 12-CIRCUIT LOAD CENTER PHOTOCELL ON/OFF CONTROLLED.
   - A CIRCUIT DIRECTORY TO DOCUMENT CONFIGURATION IN POCKET ON HINGED DOOR.

FIGURE 7B	TYPICAL LIGHTING CONTROL CENTER CABINET COMPONENT LIST	THE CITY OF BOZEMAN ENGINEERING DEPARTMENT 20 E. OLIVE -- P.O. BOX 1230 BOZEMAN, MONTANA 59771-1230 PHONE: (406) 582-2280 -- FAX: (406) 582-2263



FRONT ELEVATION

REAR ELEVATION

LIGHTING CONTROL CENTER (PEDESTAL)

PEDESTAL COMPONENT LIST

(A) 200A, 120/240V, NEMA 3R METER HOUSING CONFORMING TO UTILITY PROVIDER REQUIREMENTS.

* (B) NEMA 3R 120V PHOTOELECTRIC CONTROL WITH 3-PRONG TWIST-LOCK RECEPTACLE BASE WIRED THROUGH THE H.O.A. SWITCH. THE PHOTOELECTRIC CONTROL SHALL BE MOUNTED TO A WEATHERPROOF JUNCTION BOX ON TOP OF A 1" GRC CONDUIT AT 96" ABOVE FINISHED GRADE ORIENTED NORTHWARD TO MINIMIZE THE SUN'S INTERFERENCE.

(C) 200A, 120/240V-1Ø-3W, NEMA 3R SERVICE ENTRANCE RATED LOAD CENTER WITH COPPER BUS, SERVICE MAIN AND BRANCH BREAKERS AS LISTED ON ENGINEER PROVIDED PANEL SCHEDULE. PROVIDE SPACES FOR CIRCUITS AS DESIGNED PLUS A MINIMUM OF TWO AVAILABLE SPACES FOR FUTURE USE. PROVIDE NEUTRAL TO GROUND SERVICE ENTRANCE BOND PER N.E.C.

(D) HEAVY DUTY, GALVANIZED C-CHANNEL TYPE RACKING SET IN CONCRETE. PAINT TO MATCH PANEL COLOR. PROVIDE A MINIMUM OF (5) C-CHANNEL CROSS MEMBERS.

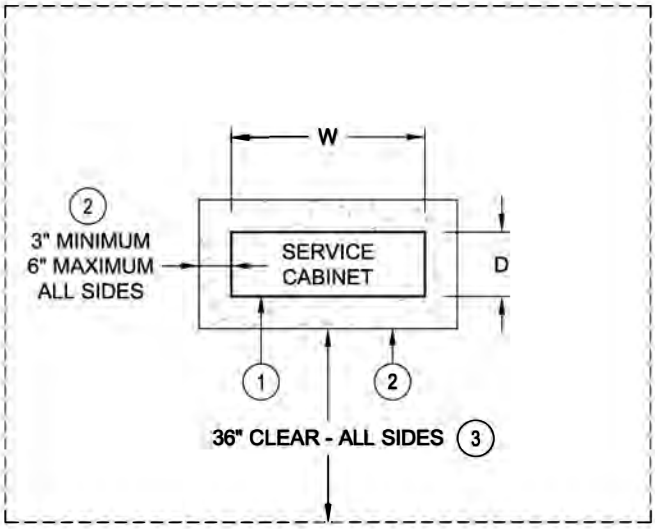
* (E) 30-AMP, 12-POLE, ELECTRICALLY HELD, LIGHTING CONTACTOR FURNISHED WITH 120-VOLT COIL, NEMA 3R ENCLOSURE WITH PAD LOCKABLE COVER AND HOA SWITCH MOUNTED INSIDE ENCLOSURE.

(F) PROVIDE TRANSITION FITTING (JUST BELOW GRADE) FROM PVC CONDUIT IN EARTH TO GRC CONDUIT ABOVE GRADE. PROVIDE 2-HOLE CONDUIT STRAPS ON ALL C-CHANNEL CROSS MEMBERS.

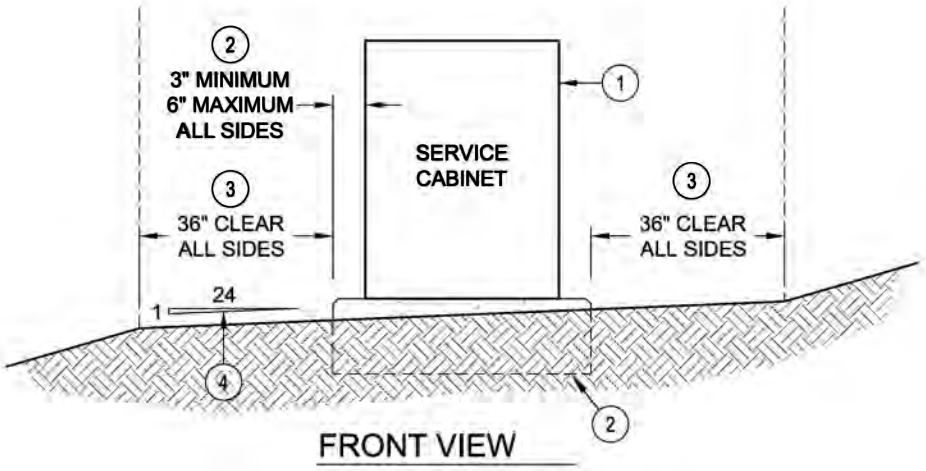
(G) (2) 3/4" x 8'-0" COPPER-CLAD DRIVEN GROUND RODS WITH APPROVED GROUND ROD CLAMP. 8'-0" (MIN.) APART AND 6" (MIN.) BELOW GRADE.

* THESE TWO DEVICES (B & E ABOVE) ARE ONLY REQUIRED FOR PROJECTS WITH PAYWAY AND PEDESTRIAN LIGHTS THAT DO NOT HAVE INDIVIDUAL ANSI 7-PIN RECEPTACLES ON THE LUMINAIRES.

FIGURE 8	TYPICAL LIGHTING CONTROL CENTER METERED PEDESTAL STANDARD DETAILS	THE CITY OF BOZEMAN ENGINEERING DEPARTMENT 20 E. OLIVE -- P.O. BOX 1230 BOZEMAN, MONTANA 59771-1230 PHONE: (406) 582-2280 -- FAX: (406) 582-2263



PLAN VIEW



FRONT VIEW

TYPICAL SERVICE CABINET DETAIL

DETAIL NOTES

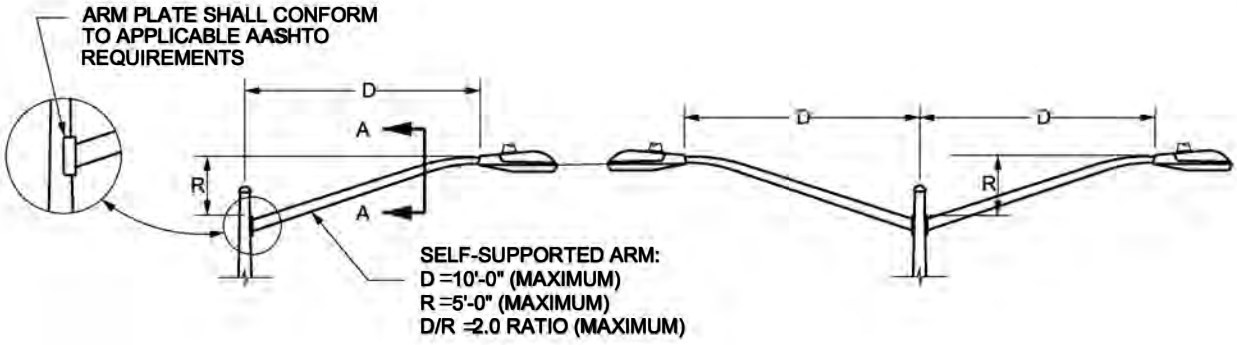
(1) PREBUILT NEMA 3R SERVICE CABINET. REFER TO SERVICE CABINET DETAILS FOR MORE INFORMATION.

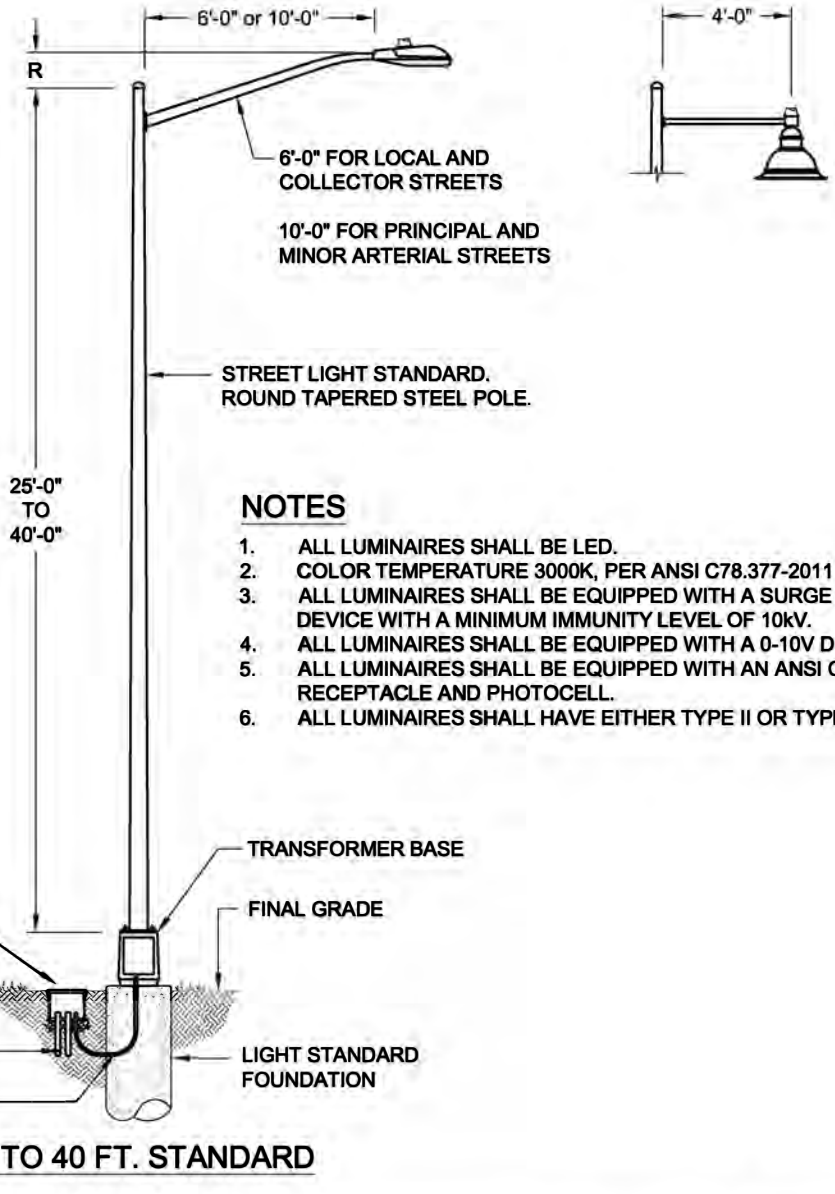
(2) REINFORCED CONCRETE (CLASS B) FOUNDATION PAD, PER STRUCTURAL ENGINEER LICENSED IN THE STATE OF MONTANA, WITH 1" CHAMFER ON ALL EXPOSED EDGES. EDGE OF CONCRETE TO EXTEND 3" (MINIMUM) OR 6" (MAXIMUM) BEYOND EDGE OF CABINET.

(3) MINIMUM OF 36" CLEAR ZONE ON ALL SIDES OF CONCRETE PAD.

(4) MAXIMUM OF 1:24 SLOPE IN CLEAR ZONE AREA.

FIGURE 9	TYPICAL LIGHTING CONTROL CENTER METERED PEDESTAL STANDARD DETAILS	THE CITY OF BOZEMAN ENGINEERING DEPARTMENT 20 E. OLIVE -- P.O. BOX 1230 BOZEMAN, MONTANA 59771-1230 PHONE: (406) 582-2280 -- FAX: (406) 582-2263



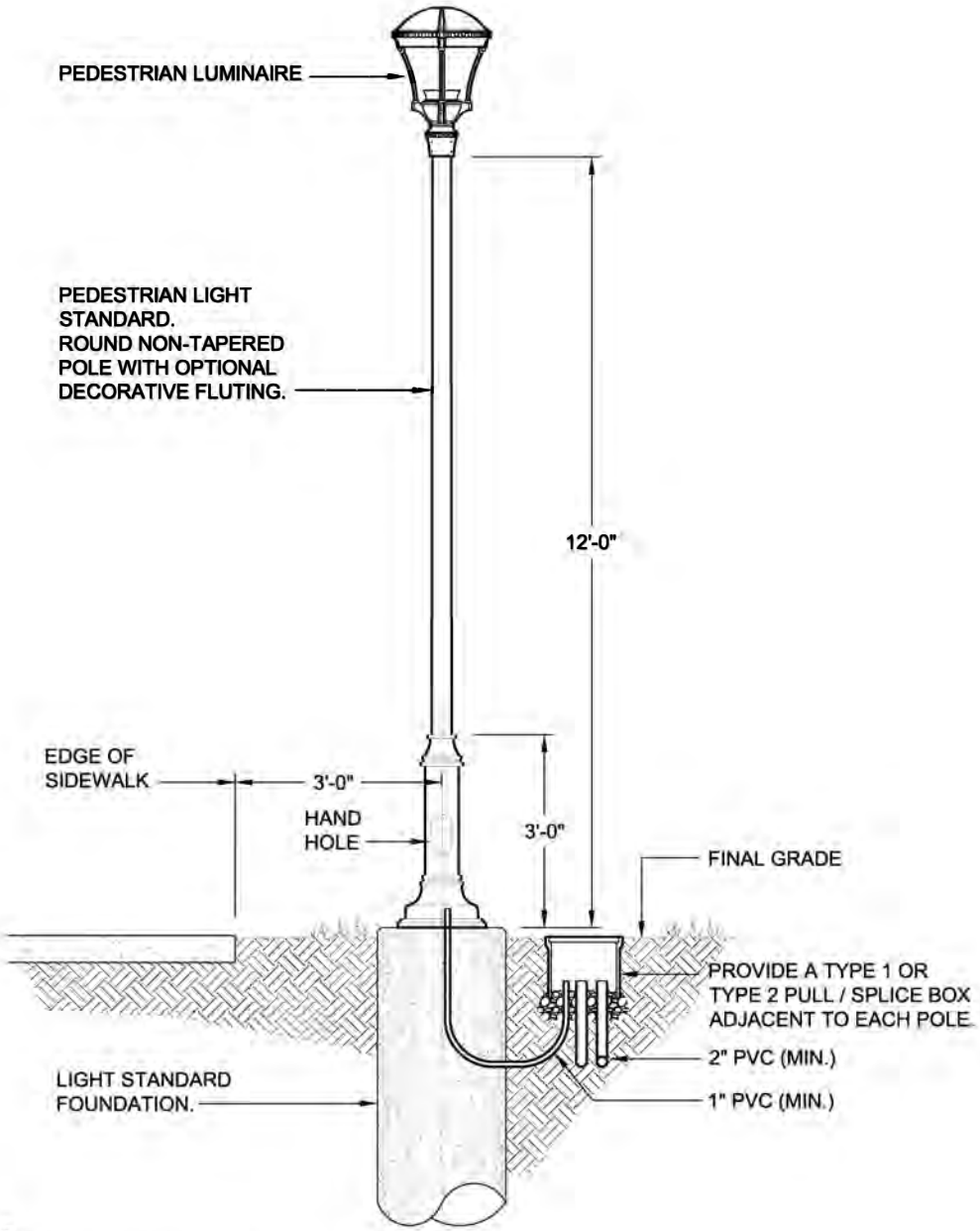


NOTES

1. ALL LUMINAIRES SHALL BE LED.
2. COLOR TEMPERATURE 3000K, PER ANSI C78.377-2011 STANDARD.
3. ALL LUMINAIRES SHALL BE EQUIPPED WITH A SURGE SUPPRESSION DEVICE WITH A MINIMUM IMMUNITY LEVEL OF 10kV.
4. ALL LUMINAIRES SHALL BE EQUIPPED WITH A 0-10V DIMMING DRIVER.
5. ALL LUMINAIRES SHALL BE EQUIPPED WITH AN ANSI C136.41 7-PIN RECEPTACLE AND PHOTOCELL.
6. ALL LUMINAIRES SHALL HAVE EITHER TYPE II OR TYPE III DISTRIBUTION.

25 FT. TO 40 FT. STANDARD

FIGURE 10	TYPICAL STREET LIGHT STANDARD DETAILS	THE CITY OF BOZEMAN ENGINEERING DEPARTMENT 20 E. OLIVE -- P.O. BOX 1230 BOZEMAN, MONTANA 59771-1230 PHONE: (406) 582-2280 -- FAX: (406) 582-2283



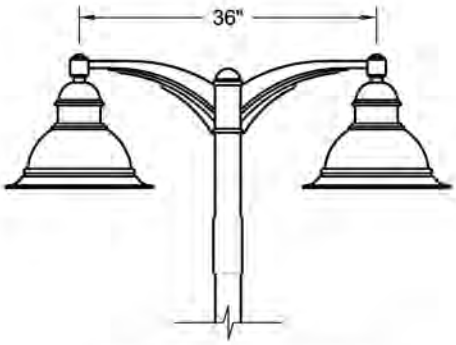
NOTES

1. ALL LUMINAIRES SHALL BE LED.
2. COLOR TEMPERATURE 3000K, PER ANSI C78.377-2011 STANDARD.
3. ALL LUMINAIRES SHALL BE EQUIPPED WITH A SURGE SUPPRESSION DEVICE WITH A MINIMUM IMMUNITY LEVEL OF 10kV.
4. ALL LUMINAIRES SHALL BE EQUIPPED WITH A 0-10V DIMMING DRIVER.
5. ALL LUMINAIRES SHALL BE EQUIPPED WITH AN ANSI C136.41 7-PIN RECEPTACLE AND PHOTOCELL.
6. ALL LUMINAIRES SHALL HAVE EITHER TYPE III OR TYPE IV DISTRIBUTION.

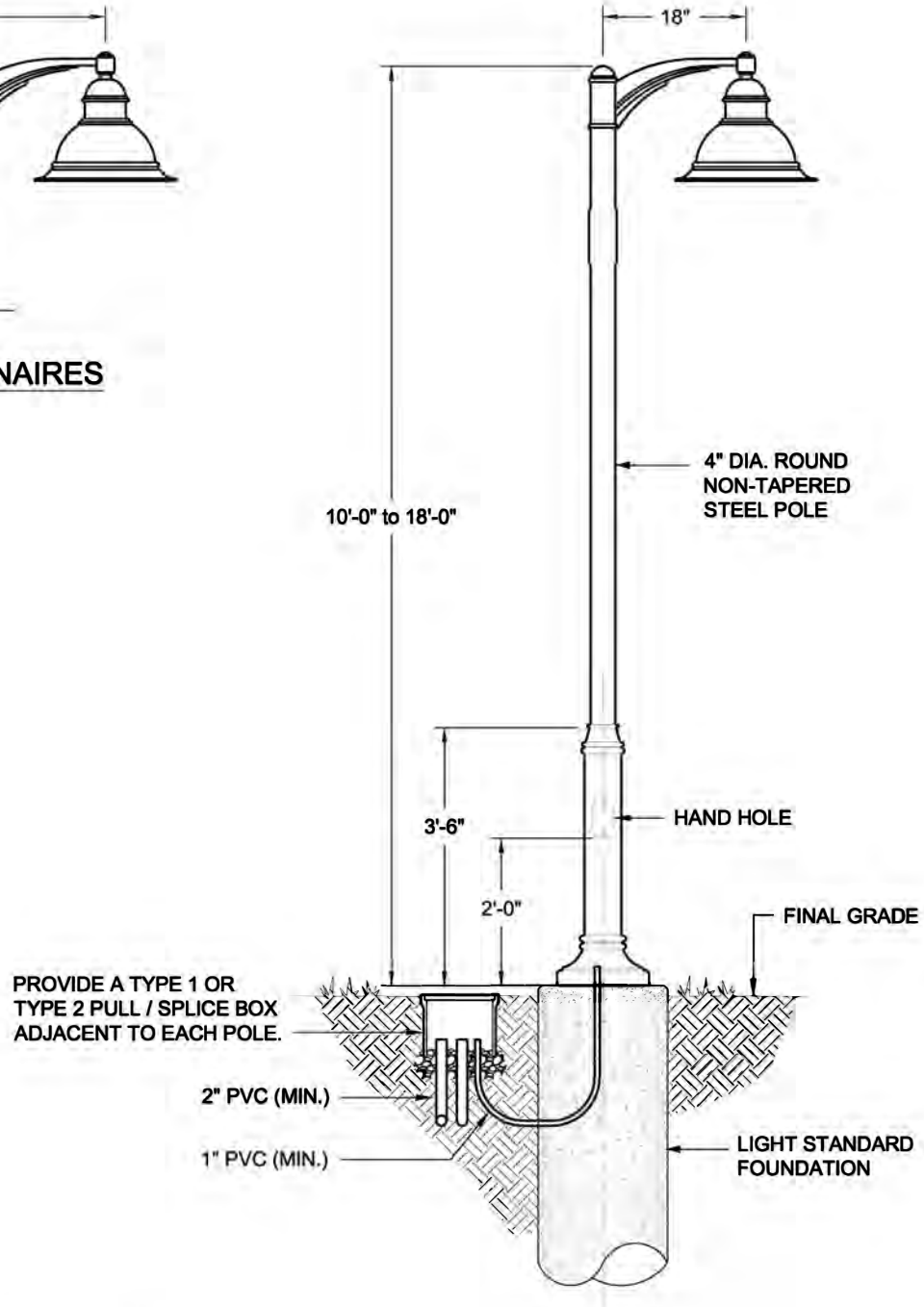
FIGURE 11

TYPICAL PEDESTRIAN LIGHT STANDARD DETAIL

THE CITY OF BOZEMAN
ENGINEERING DEPARTMENT
20 E. OLIVE -- P.O. BOX 1230
BOZEMAN, MONTANA 59771-1230
PHONE: (406) 582-2280 -- FAX: (406) 582-2263



TWIN LUMINAIRES



NOTES

1. ALL LUMINAIRES SHALL BE LED.
2. COLOR TEMPERATURE 3000K, PER ANSI C78.377-2011 STANDARD.
3. ALL LUMINAIRES SHALL BE EQUIPPED WITH A SURGE SUPPRESSION DEVICE WITH A MINIMUM IMMUNITY LEVEL OF 10kV.
4. ALL LUMINAIRES SHALL BE EQUIPPED WITH A 0-10V DIMMING DRIVER.
5. ALL LUMINAIRES SHALL BE EQUIPPED WITH AN ANSI C136.41 7-PIN RECEPTACLE AND PHOTOCELL.
6. ALL LUMINAIRES SHALL HAVE TYPE III DISTRIBUTION.

FIGURE 12	TYPICAL ARM MOUNT PEDESTRIAN LIGHT STANDARD DETAIL	THE CITY OF BOZEMAN ENGINEERING DEPARTMENT 20 E. OLIVE -- P.O. BOX 1230 BOZEMAN, MONTANA 59771-1230 PHONE: (406) 582-2280 -- FAX: (406) 582-2283

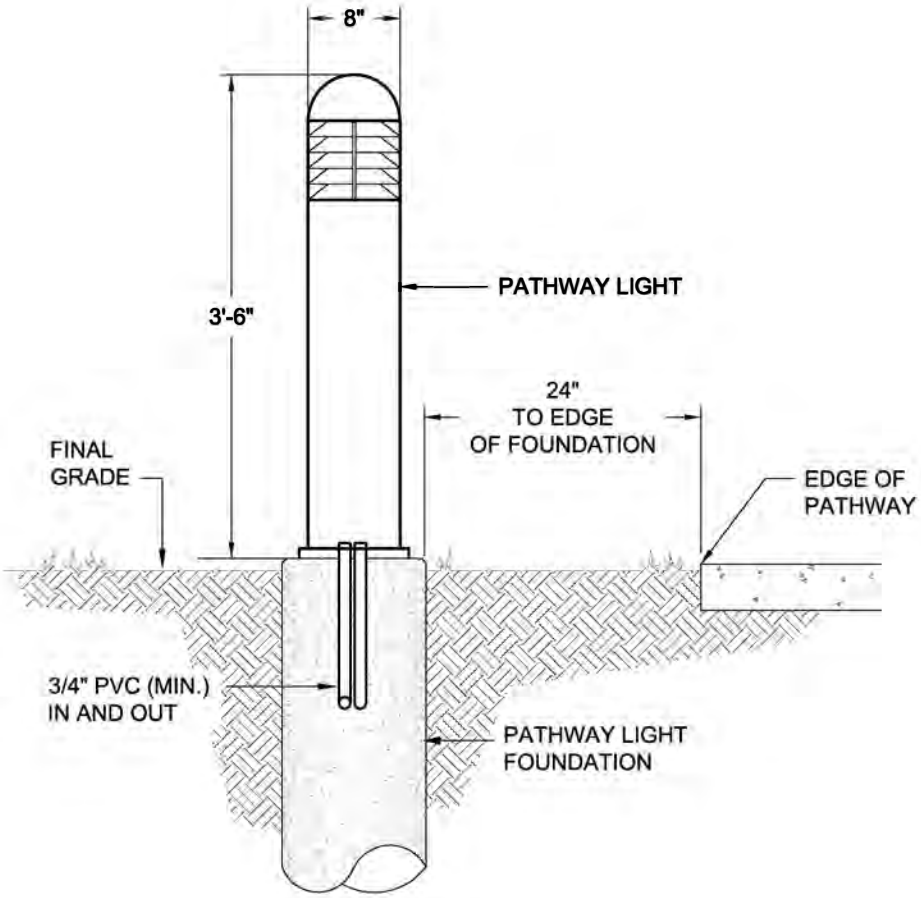
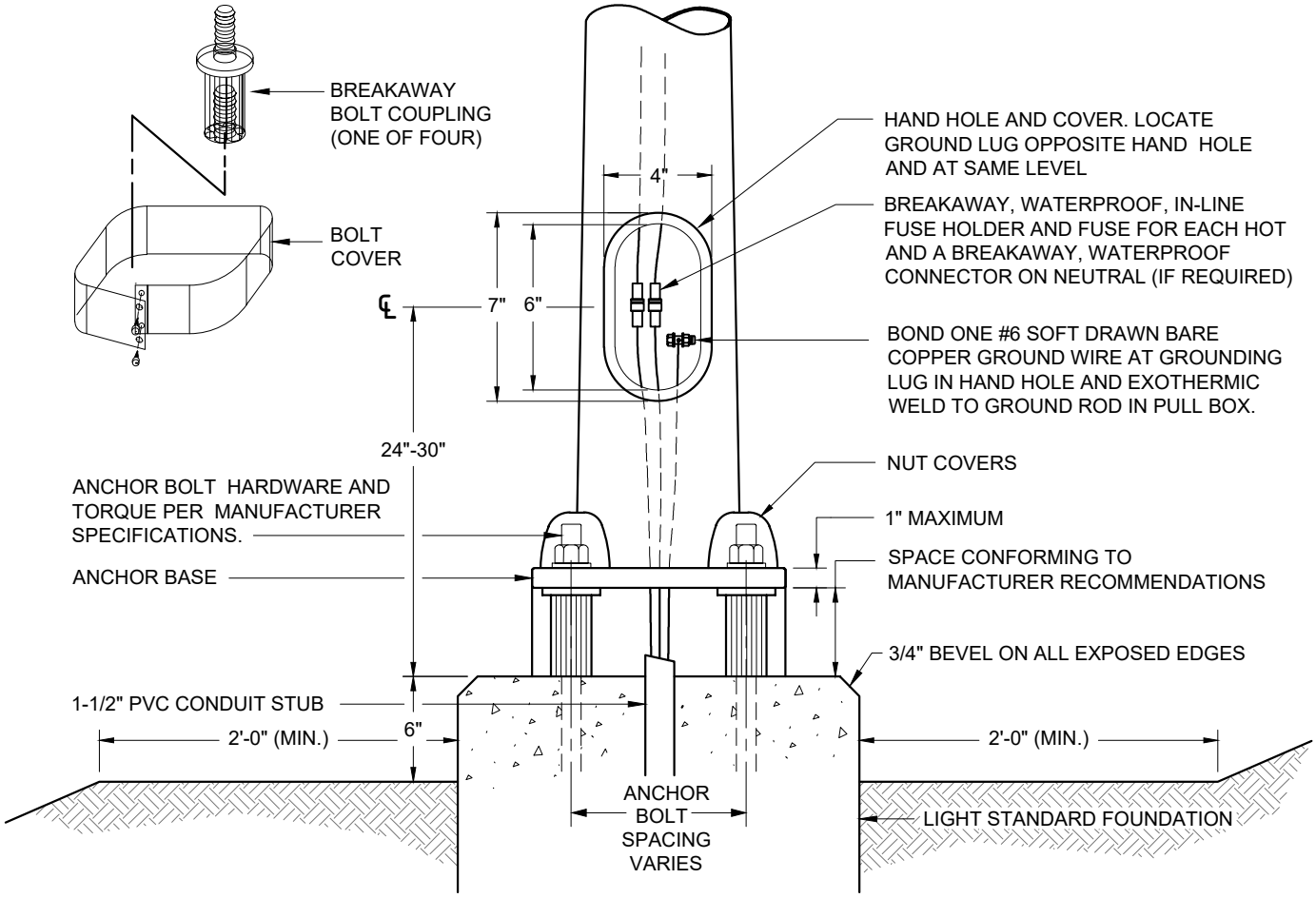


FIGURE 13

TYPICAL PATHWAY LIGHT
STANDARD DETAILS

THE CITY OF BOZEMAN
ENGINEERING DEPARTMENT
20 E. OLIVE -- P.O. BOX 1230
BOZEMAN, MONTANA 59771-1230
PHONE: (406) 582-2280 -- FAX: (406) 582-2283



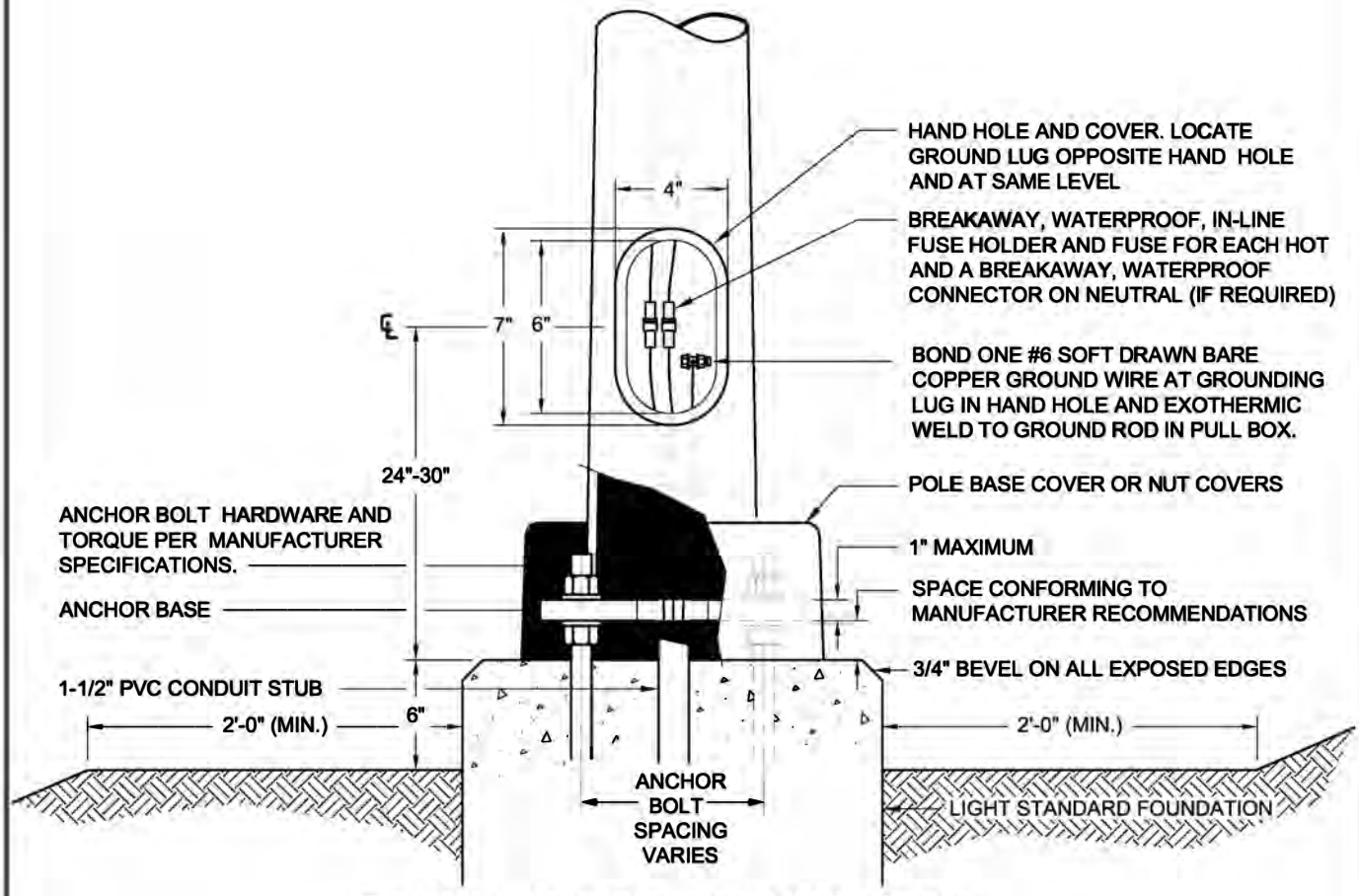
TYPICAL BREAKAWAY BASE DETAIL

FOR USE WITHING CLEAR ZONE OR UNPROTECTED INSTALLATIONS.

NOTES

1. LIGHT STANDARD FOUNDATIONS MAY BE PRECAST CONCRETE OR CAST-IN-PLACE CONCRETE.
2. ALL CONDUCTORS SHALL BE SIZED IN CONFORMANCE WITH N.E.C. REQUIREMENTS IMSA 19-1 3 CONDUCTOR #14 AWG MINIMUM

CITY OF BOZEMAN STANDARD DRAWING	Date: 2020-04-07 Scale: N.T.S.	TYPICAL POLE BASE STANDARD DETAILS	FIGURE 14



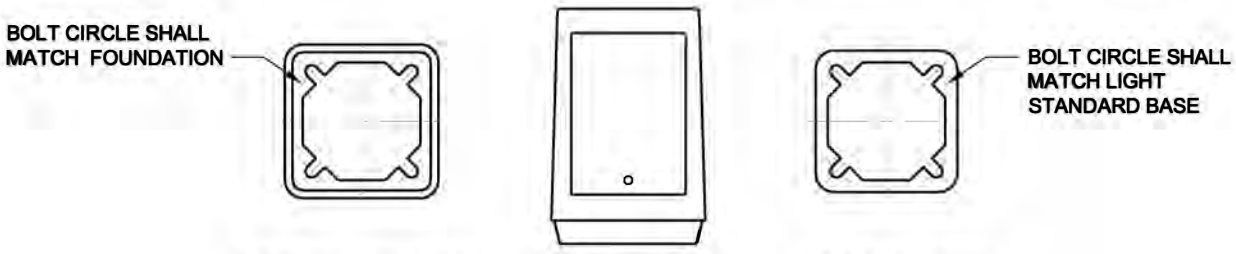
TYPICAL NON-BREAKAWAY BASE DETAIL

FOR USE ONLY OUTSIDE CLEAR ZONE OR IN PROTECTED INSTALLATIONS.

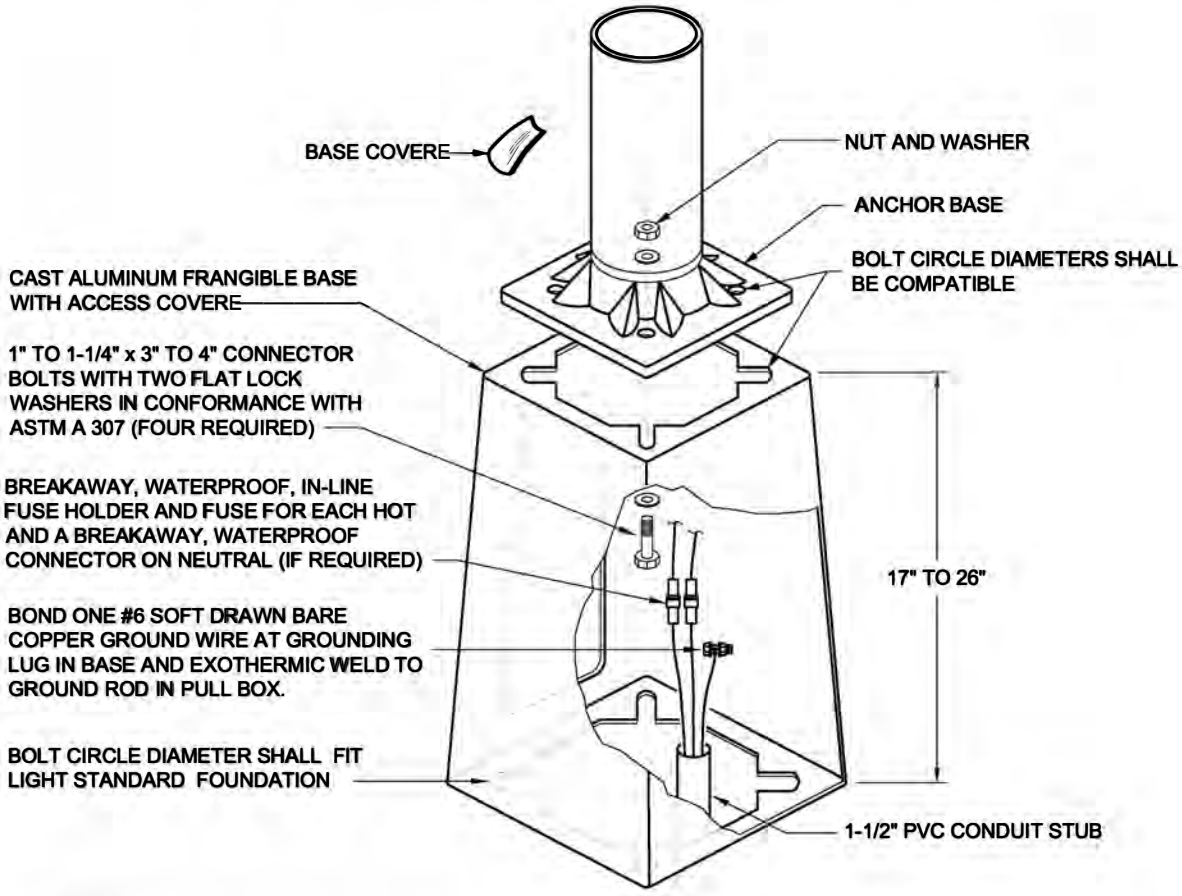
NOTES

1. LIGHT STANDARD FOUNDATIONS MAY BE PRECAST CONCRETE OR CAST-IN-PLACE CONCRETE.
2. ALL CONDUCTORS SHALL BE SIZED IN CONFORMANCE WITH N.E.C. REQUIREMENTS IMSA 19-1 3 CONDUCTOR #14 AWG MINIMUM.

FIGURE 15	TYPICAL NON-BREAKAWAY POLE BASE STANDARD DETAIL	THE CITY OF BOZEMAN ENGINEERING DEPARTMENT 20 E. OLIVE -- P.O. BOX 1230 BOZEMAN, MONTANA 59771-1230 PHONE: (406) 582-2280 -- FAX: (406) 582-2263



NOTE: MATCH EXISTING BREAKAWAY TRANSFORMER BASE AS CLOSELY AS POSSIBLE.



NOTES

1. ALL BREAK-AWAY TRANSFORMER BASES SHALL CONFORM TO AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS".
2. LIGHT STANDARD FOUNDATIONS MAY BE PRECAST CONCRETE OR CAST-IN-PLACE CONCRETE.
3. ALL CONDUCTORS SHALL BE SIZED IN CONFORMANCE WITH N.E.C. REQUIREMENTS IMSA 19-1 3 CONDUCTOR #14 AWG MINIMUM.
4. HAND HOLE IS NOT REQUIRED IN THE POLE IF A BREAKAWAY TRANSFORMER BASE IS USED.

FIGURE 16	TYPICAL FRANGIBLE TYPE TRANSFORMER BASE DETAIL	THE CITY OF BOZEMAN ENGINEERING DEPARTMENT 20 E. OLIVE -- P.O. BOX 1230 BOZEMAN, MONTANA 59771-1230 PHONE: (406) 582-2280 -- FAX: (406) 582-2283

City of Bozeman – Street Lighting Method of Measurement

Introduction

Street lighting luminance measurements are best taken on nights with clear skies, dry pavement and in areas with little to no light contribution from adjacent properties. Preliminary luminance measurements may be taken using OpticaLight, a luminance photo-mapping application on an iPad or iPhone. The recommended distance for taking luminance measurements with the OpticaLight App is 20-ft to 30-ft from the measurement point. The technician performing the luminance measurements shall complete the Street Lighting Measurement Form to record the measured street luminance values and the factors that may affect the lighting measurements. If the measurements from OpticaLight result in an average luminance that is below the acceptable tolerance from the luminance criteria, luminance measurements shall be re-taken using a calibrated luminance meter with a 1-degree or 1/3-degree measuring angle and +/- 2% accuracy.

Street Lighting Method of Measurement

1. **Intent**: There are many factors that can lead to differences between calculated street luminance and street luminance measured in the field. The intent of this report is to provide guidance for City of Bozeman field technicians to measure the luminance of street lighting installations to compare with luminance criteria. By first understanding the many factors that affect street luminance conditions and differences with calculated street luminance, technicians will be able to:

    a. Determine which factors can be avoided by following these recommended methods;
    b. Understand which factors can be accounted for and considered as reasonable variations; and
    c. Identify which factors may need further investigation to troubleshoot any issues that need to be addressed in order to bring a non-compliant street lighting installation into compliance.

2. **Measured vs. Calculated Street Luminance**: The following factors affect the measurement of street luminance to some degree. Some factors can have a significant impact on the luminance and perceived brightness of the street surface, while other factors have a minimal effect.

    a. Pavement Conditions: The street surface material, age and condition affects the reflectance, and therefore, the luminance and perceived brightness of the street surface.

        i. Type of Pavement: The Illuminating Engineering Society's Recommended Practice for Roadway Lighting (RP-8-14) defines four pavement types (R1 – R4) that have different reflectance properties. The most common pavement types used within the United States are types R1 (typical concrete) and R3 (typical asphalt).

            1. R1: Mostly diffuse reflectance properties characteristic of Portland cement or asphalt surface with a minimum of 15% of the aggregates composed of artificial brightener aggregates.

2. R2: A combination of diffuse and specular reflectance characteristics of asphalt surfaces with aggregate composed of a minimum of 60% gravel of size greater than 10 mm. Also asphalt surfaces composed of 10% - 15% artificial brightener in aggregate mix.

3. R3: Slightly specular reflectance typical of asphalt surfaces with dark aggregates, rough texture and some months of use. This surface is common in the United States.

4. R4: Mostly specular surface typical of very smooth asphalt texture.

ii. Age of Pavement: As pavement ages, the reflectance properties also change, particularly with asphalt pavement. Pavement reflectance can be measured using a standard 18% reflectance photo-gray card.

1. Concrete (type R1): The reflectance properties of concrete pavement are much more stable throughout the life of the pavement than asphalt.

2. Asphalt (type R3): Fresh, newly laid asphalt is very dark. Over a period of 6 - 12 months from laying new asphalt, the pavement lightens and eventually stabilizes to be a more consistent reflectance. When measuring luminance of an asphalt street, the pavement reflectance should be measured by comparing the luminance of a standard 18% reflectance photo-gray card with the luminance of the pavement, using the following equation:

$$R_{pavement} = \frac{L_{pavement} \times R_{gray\ card}}{L_{gray\ card}}$$

$R_{pavement} = Reflectance\ of\ Pavement$
$R_{gray\ card} = Reflectance\ of\ Gray\ Card = 0.18$
$L_{pavement} = Luminance\ of\ Pavement$
$L_{gray\ card} = Luminance\ of\ Gray\ Card$

When measuring the pavement reflectance, the measurement of the pavement luminance and gray card luminance should be taken with the meter aimed at the same point, moving the photo-gray card instead of moving the meter. Moving the meter to aim at a different point may result in a different light level at the two points, introducing error into this measurement.

iii. Wet Pavement: When pavement is wet, the street surface becomes more specular, affecting the reflectance and luminance of the street. Luminance measurements should not be taken when the pavement is wet.

iv. Snow: When there is snow on the street, luminance and brightness of the street is significantly increased. Luminance measurements should not be taken when there is snow on the streets.

b. Atmospheric Conditions:

i. Ambient Temperature: At higher ambient temperatures, electronic components operate at a lower efficiency, resulting in a reduction in lumen output from LEDs. At lower ambient temperatures, the electronic components operate at a higher efficiency, increasing the lumen output from LEDs. The effect of temperature will vary depending on the luminaire's thermal management design.

ii. Cloudy Sky: Clouds increase the reflection of light pollution back to the ground. Particularly when the ground is covered with snow and the sky is overcast, there is more light contribution from sky glow than under clear sky conditions. Under cloudy sky conditions, luminance measurement shall be taken both with lights off and lights on to determine the contribution from reflected sky glow.

iii. Humidity and Airborne Particulates: In high humidity or poor air quality conditions, more light is scattered in the air before reaching the roadway surface. If the effect of light scattering in the air is visible, luminance measurements should not be taken.

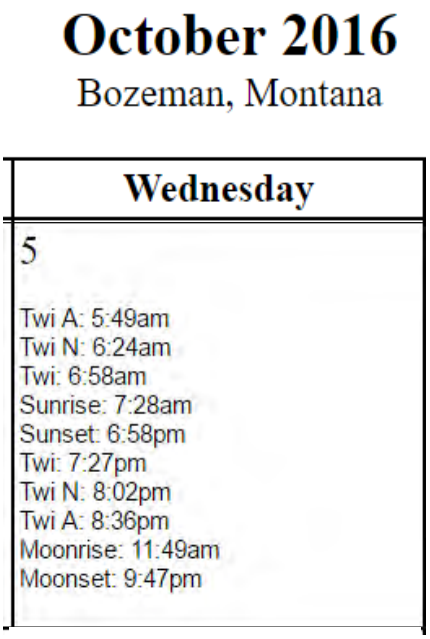
c. Ambient Lighting Conditions:

i. Twilight: After sunset and before sunrise, is the period of twilight when the skylight fades into darkness. Twilight has three stages, civil twilight, nautical twilight and astronomic twilight. Street lighting measurements shall not be taken until Nautical Twilight to eliminate light contribution from the sky. Nautical Twilight can be determined using the Sunrise Sunset Calendar website: http://www.sunrisesunset.com/USA/Montana.asp

1. Civil Twilight: During civil twilight, electric lighting is not needed to clearly distinguish terrestrial objects. During clear evening's civil twilight, horizontal illuminance decreases from approximately 45 footcandles to 0.2 footcandles.

2. Nautical Twilight: During nautical twilight, the horizon is still clearly distinguishable. During a clear evening's nautical twilight, horizontal illuminance decreases from approximately 0.2 footcandles to 0.0008 footcandles.

3. Astronomical Twilight: By the end of astronomical twilight, the sky is dark enough for all astronomical observations.


October 2016
Bozeman, Montana

Wednesday
5 Twi A: 5:49am Twi N: 6:24am Twi: 6:58am Sunrise: 7:28am Sunset: 6:58pm Twi: 7:27pm Twi N: 8:02pm Twi A: 8:36pm Moonrise: 11:49am Moonset: 9:47pm

Excerpt from the Sunrise Sunset Calendar website

ii. Moonlight: On a clear night, full moonlight produces 0.01 footcandles, and a quarter moon produces 0.001 footcandles. The contribution, even from full

moonlight, is generally not enough to effect the lighting measurement. However, technicians should note the phase of the moon and moonrise in the luminance measurement report. If measurements are taken during a full moon, the technician may also take luminance measurements with the lights turned off to establish the contribution from moonlight.

iii. Light Spill from Adjacent Properties: Light contribution from adjacent properties may be significant, and should be accounted for by technicians when measuring street luminance. At sites where light spill from adjacent properties may affect street luminance measurements, technicians should measure the street luminance both with the streetlights turned off, and again with streetlights turned on.

d. Electrical / Utility Conditions: Voltage supplied can affect the lumen output of a luminaire. Lower voltage may result in reduced lumen output and higher voltage may result in increased lumen output. Some variation in voltage is expected, but should not exceed +/- 5% from the design voltage at the luminaire. The following factors may affect the voltage supplied to a luminaire:

i. Wire Sizing: Voltage drop occurs over distance of electrical wiring, and is a function of the wire type, wire size, length of wire, ampacity of the electrical load and the supply voltage. Larger gauge wire has less voltage drop per linear foot than smaller gauge wire. For LED street lighting retrofit projects, the electrical load is most often being reduced from the original load. Since the existing wire was engineered for a higher load, it is typically over-sized for the new lower LED loads and voltage drop is not usually a concern.

ii. Wire Type: Copper wire has the best conductivity and longevity, maintaining its conductivity over time. Aluminum wire is more susceptible to corrosion and thermal expansion and contraction, which can affect the wiring connections and conductivity over time. In older street lighting installations, the age of the wiring may contribute to inadequate operating conditions.

iii. Conduit Type: For in-grade electrical wiring installations, PVC and HDPE conduit provides the best long-term protection of the wiring. While most new street lighting installations use these conduit types, some older street lighting may have been installed with galvanized rigid conduit (GRC) or even with direct bury cable (DBC) with no conduit protection. GRC and DBC installations can corrode or degrade over time, reducing the functional life of the wiring, which may contribute to inadequate operating conditions.

iv. Utility Supply Voltage: Voltage supplied by the utility to the Lighting Control Center may vary from the design voltage. If the voltage at the Lighting Control Center is more than 2% below the design voltage, the City should contact the electrical utility to help determine the cause.

e. Luminaire Manufacturing

i. Manufacturing Quality: Optics and light output may vary between the sample luminaire that was used to create the photometry used in the lighting calculations and the actual luminaires installed in the field. While normal tolerances in the manufacturing process should be expected, the quality of manufacturing process may result in unacceptable variation from the specifications.

ii. Luminaire Specifications: Luminaires have multiple options for different optical distributions and lumen outputs. If the installed luminaires do not match the specified and calculated luminaires, the measured light levels may vary significantly from designed levels.

iii. Thermal Management: Heat from LEDs is emitted back through the circuit board that the LED is mounted to. If this heat is not adequately dispersed away from the circuit board, and the LEDs overheat, the light output degrades much faster.

iv. LED Driver: The LED driver regulates the electrical voltage and current that is delivered to the LEDs. The electrical current is typically expressed in milliamps (mA). LEDs can be driven at multiple drive currents, with lower drive currents emitting less light and higher drive currents emitting more light. If the light output is too low, a higher drive current will increase the light output of the luminaire. Some drivers are designed with field selectable drive current that may be set to a higher drive current without replacing the driver.

f. Measuring Equipment

i. Calibrated Luminance Meter: Calibrated luminance meters like the Konica Minolta LS-110 or LS-160 provide high accuracy luminance measurements at low light levels that are typical in street lighting applications. Luminance values can be measured at any distance.

ii. OpticaLight iPhone/iPad Application: The OpticaLight iPhone/iPad application provides a less expensive option for measuring luminance. Luminance measurement from this application tend to be lower than the LS-110 luminance meter by 15% - 20% on average. The accuracy improves when measurements are taken at a distance of 20-ft to 30-ft from the measurement point. When there is high contrast, measurements may need to be taken at a closer range to reduce the area within the view, thereby reducing the contrast within the view.

g. Construction

i. Light Pole Locations: As-built light pole locations may vary from designed locations to avoid conflicts that were unforeseen during the design phases. Light pole locations that vary significantly from the design may adversely impact the measured light levels on the street.

ii. Light Pole Geometry: The pole height and mast arm length should match the design specifications. Variations in height or location of the luminaire may affect the measured light levels on the street.

iii. Luminaire Orientation & Positioning: Luminaires may be installed with a tilt or twist, resulting in the luminaire not being level, changing the light distribution from the intended design.

h. Light Loss Factors

Roadway lighting calculations are performed using light loss factors that reduce the lumen output of luminaires to ensure that adequate luminance is provided through the life of the lighting system as the light source ages and dirt accumulates on the luminaire. A lighting calculation using light loss factors results in the "maintained luminance" of the street. When a new lighting installation is being measured, these light loss factors should be close to 1.0, resulting in "initial luminance" of the street.

i. Lamp Lumen Depreciation (LLD): For maintained lighting calculations, the Lamp Lumen Depreciation (LLD) factor for LED luminaires shall be 0.9.

ii. Luminaire Dirt Depreciation (LDD): For maintained lighting calculations, the Luminaire Dirt Depreciation (LDD) factor for LED luminaires shall be 0.9.

iii. Total Light Loss Factor (LLF): Multiplying the LLD(0.9) x LDD(0.9) results in a total Light Loss Factor (LLF) of 0.81.

References

European Road Lighting Technologies - Luminance Design and Pavement Reflection Factors
http://international.fhwa.dot.gov/euroroadlighting/04.cfm
"Furthermore, results of studies have shown that, in the case of porous asphalts, it typically takes between 6 months and a year for the pavement to stabilize in order to obtain reliable R-values."

"In an additional conversation with Werner Riemenschneider, however, he clarified that after the pavement had aged for 6 to 12 months, the Swiss typically found that the measured average values were within 15 percent of the average design value, usually on the high side."

"In the good cases the Belgians noted discrepancies of less than 10 percent, when comparing measured luminance levels against calculated levels for pavements, where the reflection characteristics have been determined."

"In Switzerland, experts emphasized the importance of dry roadways when conducting field measurements. There are, however, only a couple of summer months during which pavements are dry enough to be measured. In addition, the team heard warnings about dew points and pavement ages. It was noted that, during observations in cold weather (typically October through December), with a clear sky, when conditions were under the dew point, a water film could suddenly appear on the roadway. This film could provide a reflectance differential of 200 percent. Given these difficulties and variations in pavement reflection characteristics, the Swiss typically verify lighting installations with incident light measurements."

PNNL – Lumen Maintenance and Light Loss Factors
http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22727.pdf

Twilight Envelope (3.2 lux) as a Visibility Criterion
http://www.visualexpert.com/Resources/twilightcriterion.html
During civil twilight, approximately the first half hour after sunset, ground illuminance in good weather declines by a factor of about 100, from roughly 330 lux to 3.2 lux.

American Meteorological Society
Civil Twilight: http://glossary.ametsoc.org/wiki/Civil_twilight
During a clear evening's civil twilight, horizontal illuminance decreases from ~585–410 lux to ~3.5–2 lux.

Nautical Twilight: http://glossary.ametsoc.org/wiki/Nautical_twilight
During a clear evening's nautical twilight, horizontal illuminance decreases from ~3.5–2 lux to ~0.008 lux.

Astronomical Twilight: http://glossary.ametsoc.org/wiki/Astronomical_twilight
During a clear evening's astronomical twilight, horizontal illuminance due to scattered sunlight decreases from ~0.008 lux to ~6 × 10-4 lux.

Sunrise/Sunset Calendar
http://www.sunrisesunset.com/USA/Montana.asp
This website provides calendars with sunrise/sunset information for specific locations, with appropriate adjustments for latitude, longitude and time zone. Information display options include

sunrise, sunset, moon phase, moonrise, moonset, civil twilight, nautical twilight and astronomical twilight.

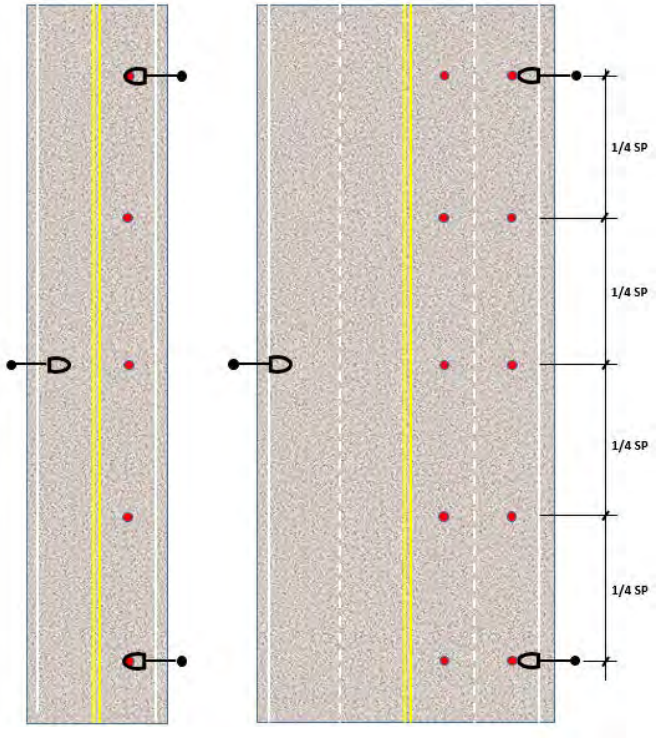
City of Bozeman – Street Lighting Method of Measurement

Step-by-Step Street Luminance Measurement Method

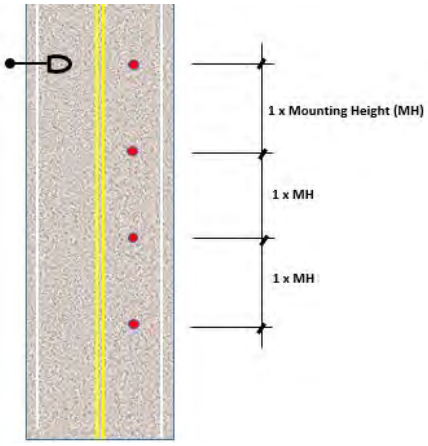
1. **Schedule and Prepare for Site Visit**:
   a. **Determine Measurement Start Time**:
   Street lighting measurements shall not be taken until Nautical Twilight to eliminate light contribution from the sky. Nautical Twilight can be determined using the Sunrise Sunset Calendar website: http://www.sunrisesunset.com/USA/Montana.asp

   b. **Arrange Traffic Control** (if necessary)

   c. **Resources & Equipment Needed**
      i. Personal Protective Equipment (PPE)
         1. High Visibility Vest
         2. High Visibility Pants or Gators
         3. Hard Hat
      ii. Measuring Wheel or 200-ft Measuring Tape
      iii. Luminance Measurement Equipment
         1. iPad/iPhone with OpticaLight App, or
         2. Calibrated Luminance Meter
      iv. Photo-gray Card to measure pavement reflectance
      v. Camera
      vi. Street Lighting Measurement Form (Excel Spreadsheet) to record conditions taken in steps 2-4 below.



2. **Record Field Conditions**:
   a. Pavement Type (Concrete, Asphalt-New, or Asphalt-Aged)
   b. Pavement Conditions (dry, wet, or snow packed): Only measure when pavement is dry
   c. Sky Conditions (clear, partly cloudy, overcast)
   d. Light spill from adjacent properties



3. **Layout & Mark Measurement Points**:
   a. Locate points in the center of each lane spaced at 1/4 of the street light pole spacing

4. **Measured and Record Street Luminance**:
   a. Select Luminance Measurement Equipment (OpticaLight or Calibrated Luminance Meter)
   b. Measure Pavement Reflectance
      i. Measure Gray Card Luminance
      ii. Measure Pavement Luminance at same location
   c. Measure Street Lighting Luminance
      i. With OpticaLight, luminance measurements should be taken 20-ft to 30-ft away for most accurate readings.
   d. Measure Ambient Luminance (only required if there is significant contribution of light from adjacent sites)

CLANTON & ASSOCIATES

LIGHTING DESIGN AND ENGINEERING

City of Bozeman – Street Lighting

Luminance Method of Measurement

The City of Bozeman Street Lighting Standards are based on roadway luminance criteria. Luminance is the intensity of light per unit area that is emitted from a surface in a given direction, expressed as candela per square meter (cd/m^2). The luminance of the roadway surface is the light reflected off of the pavement toward a driver. Accurate luminance measurements require a calibrated luminance meter with a 1/3 – degree measuring angle and +/- 2% accuracy. Konica Minolta produces very high quality luminance meters the LS-160 is the current model offered by Konica Minolta (http://sensing.konicaminolta.us/products/ls-160-luminance-meter/), and the Konica Minolta LS-110 can be rented from Advanced Test Equipment Rentals (http://www.atecorp.com/products/minolta/ls-110.aspx).

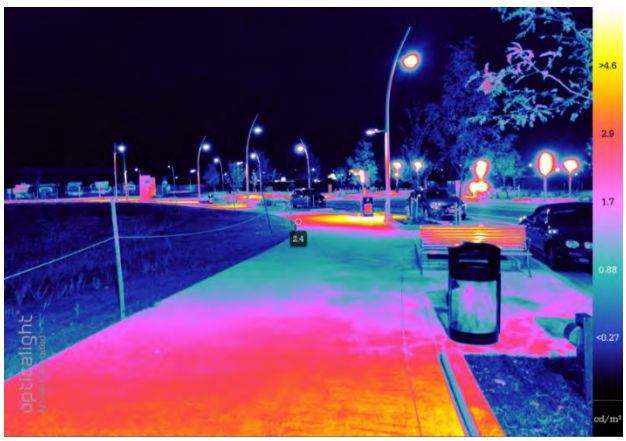


Konica Minolta LS-160
Luminance Meter

For preliminary testing, there is a photographic luminance mapping application from OpticaLight (website) for iPad and iPhone (https://itunes.apple.com/us/app/opticalight-candela/id1086540410?mt=8). The OpticaLight App was tested and compared to measurements from a calibrated Konica Minolta LS-110 luminance meter. The accuracy of the OpticaLight App was found to be more accurate for measurements that were taken at close range (20ft to 30ft), and less accurate for more distant measurements.

Distant Measurements		
Optica Light App	**Konica Minolta**	**% Difference**
0.57	1.07	47%
0.31	0.44	30%
1.7	1.9	11%
1.8	1.97	9%
2.4	2.9	17%
0.65	0.86	24%
0.48	0.7	31%
Low	0.49	
1.13	**1.29**	**24%**

Near Measurements		
Optica Light App	**Konica Minolta**	**% Difference**
1.6	1.88	15%
6.1	6.9	12%
2.1	2.4	13%
0.33	0.44	25%
0.51	0.67	24%
0.32	0.39	18%
0.66	0.69	4%
0.41	0.43	5%
0.33	0.38	13%
1.5	1.55	3%
5.7	6	5%
0.13	0.2	35%
0.04	0.05	20%
1.52	**1.69**	**15%**



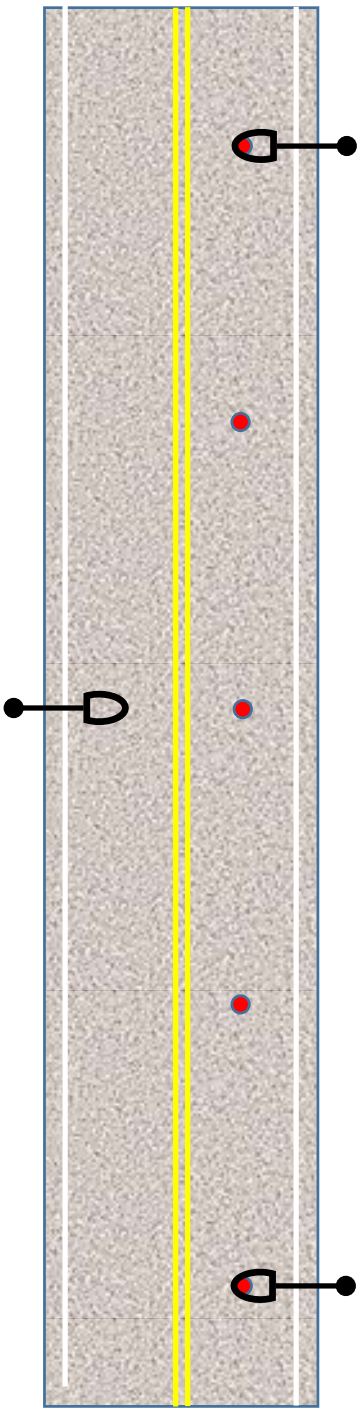
OpticaLight Photo Luminance Mapping App

OpticaLight App vs. Konica Minolta
LS-110 Luminance Meter

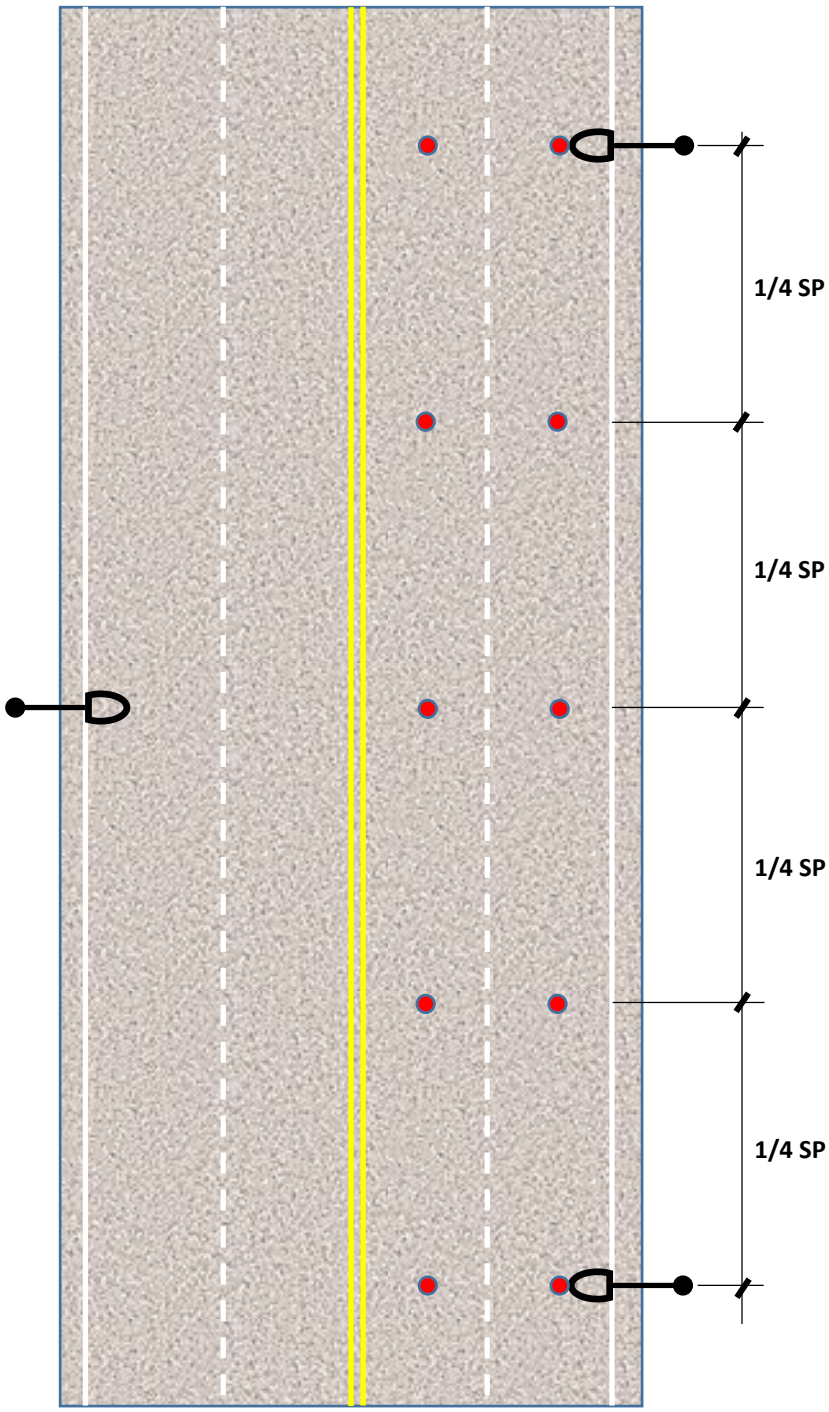
CLANTON & ASSOCIATES

LIGHTING DESIGN AND ENGINEERING

Luminance Measurement Grid



One-Lane Measurement Grid

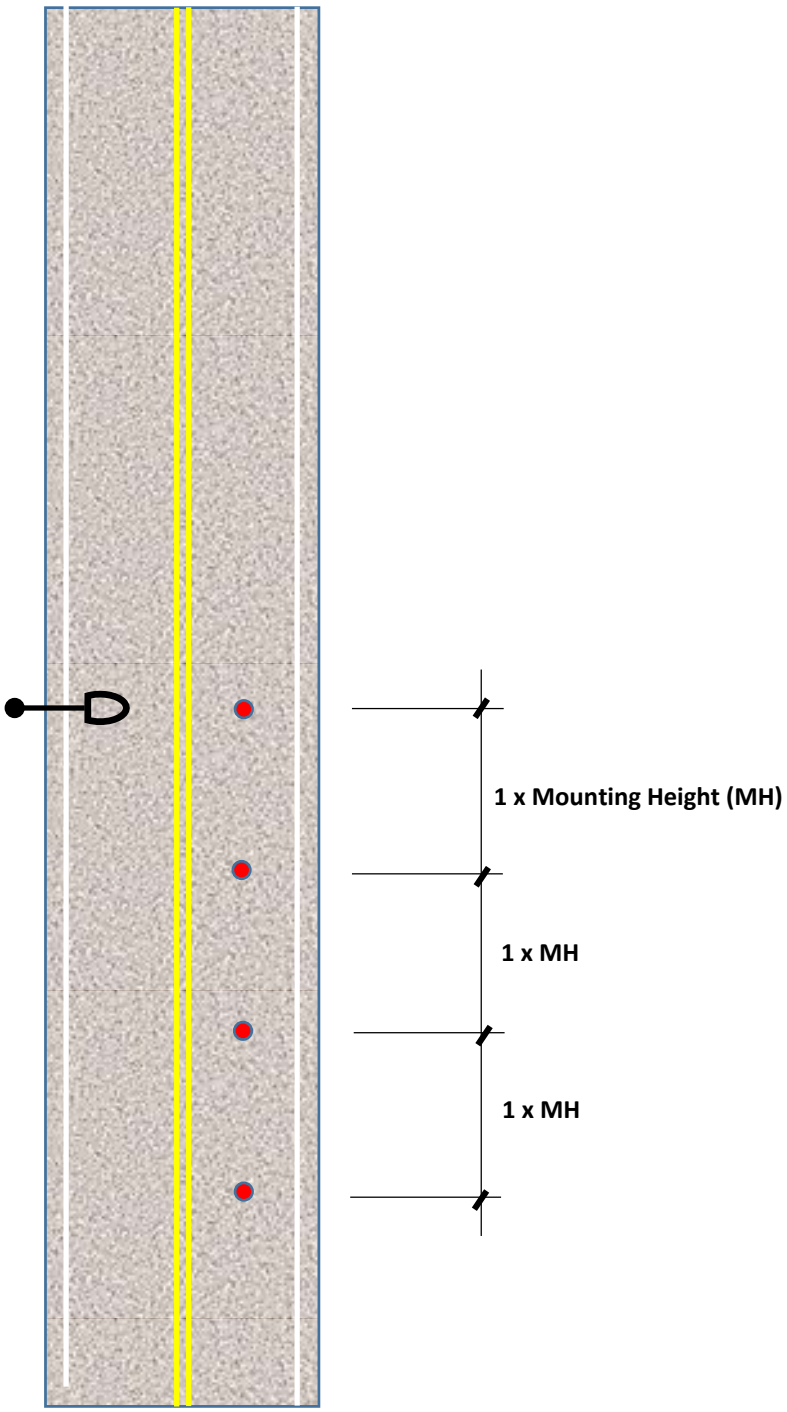


Two-Lane Measurement Grid

CLANTON & ASSOCIATES

LIGHTING DESIGN AND ENGINEERING

Luminance Measurement Grid



Single Luminaire Measurement Grid

City of Bozeman – Street Lighting

Luminance Method of Measurement

OpticaLight Application Luminance Mapped Images







City of Bozeman – Street Lighting

Luminance Method of Measurement

OpticaLight Application Luminance Mapped Images





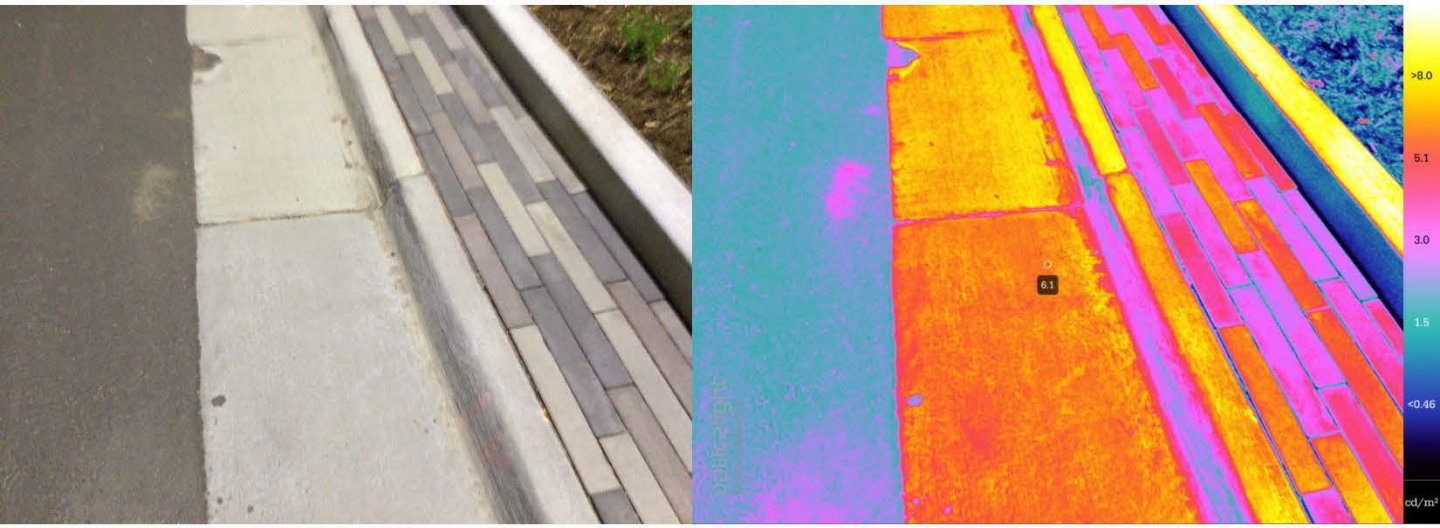


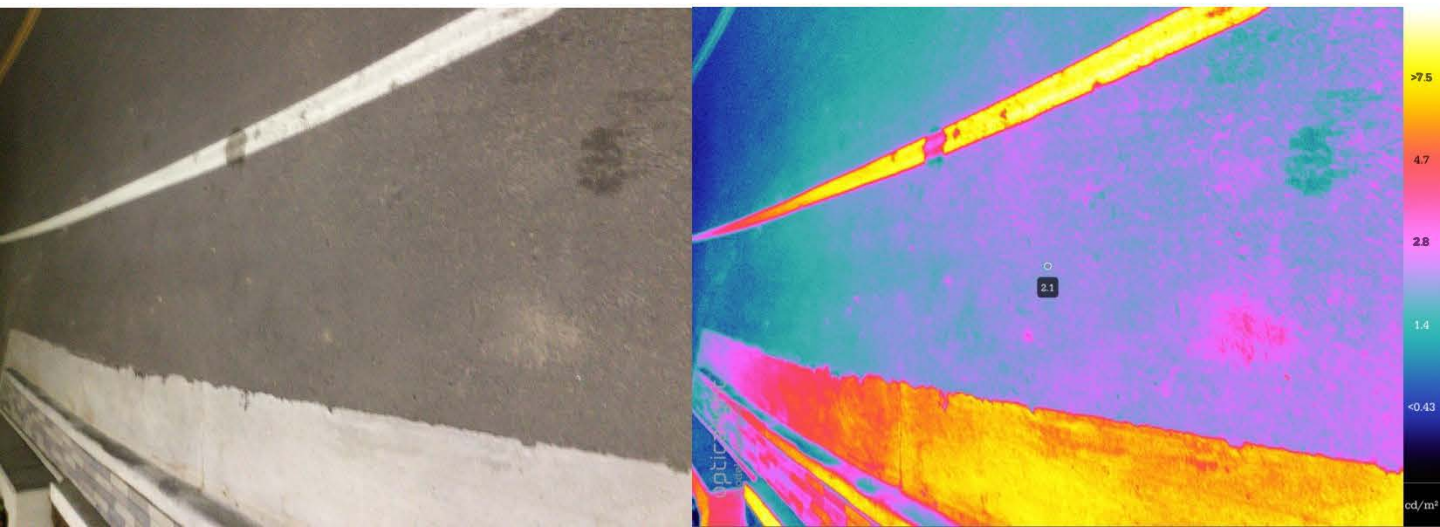
City of Bozeman – Street Lighting

Luminance Method of Measurement

OpticaLight Application Luminance Mapped Images



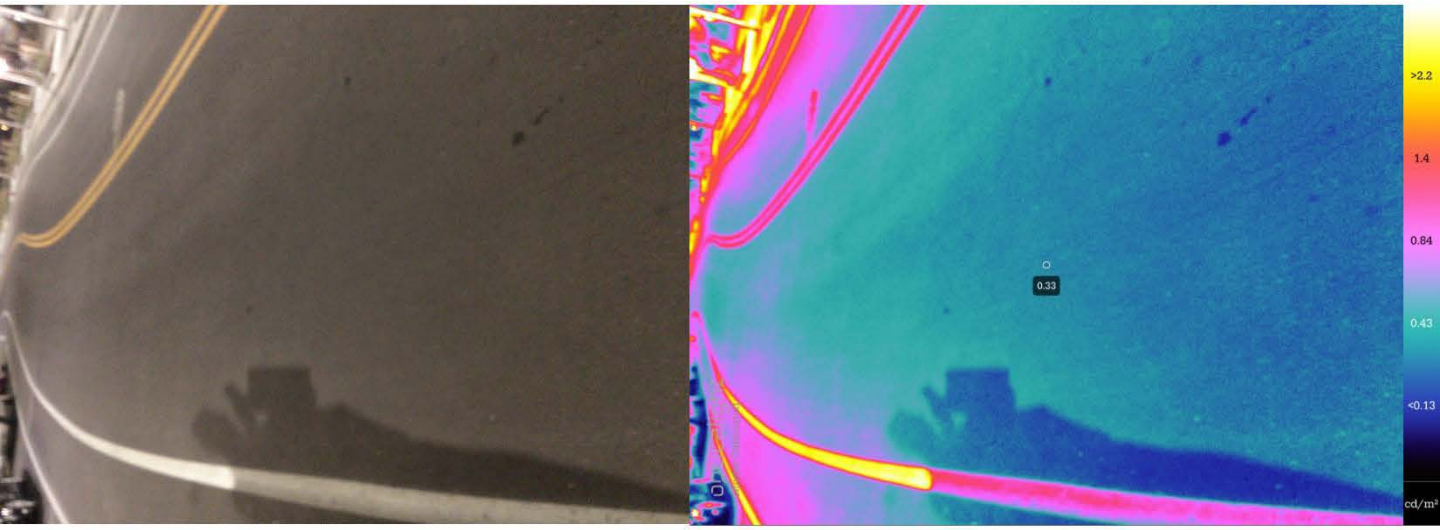




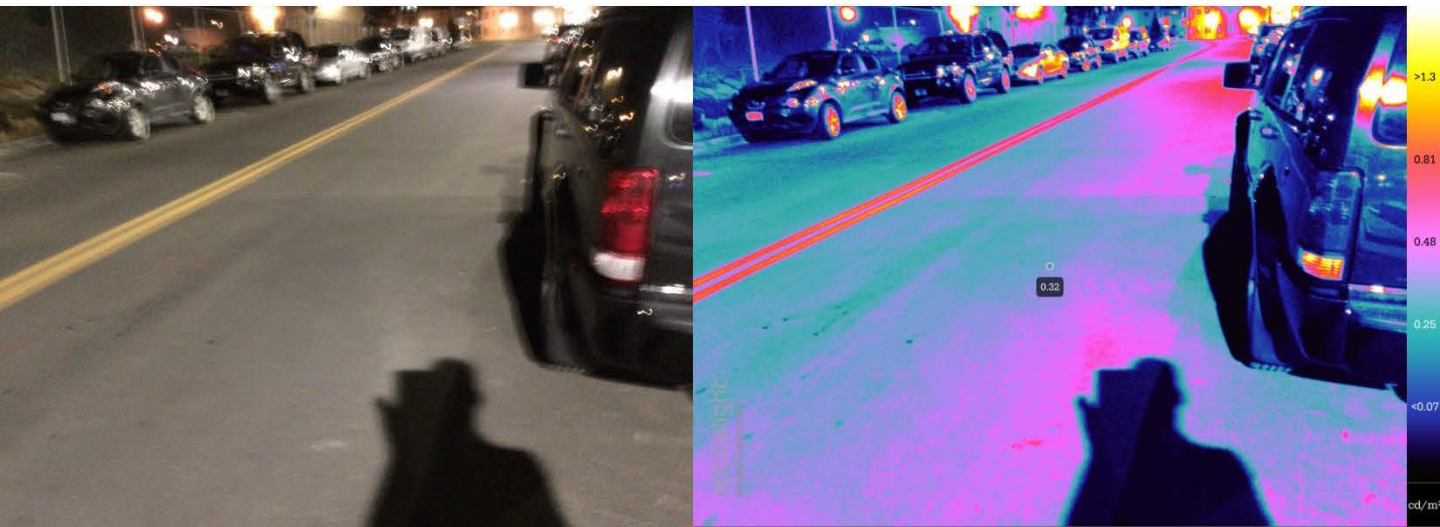
City of Bozeman – Street Lighting

Luminance Method of Measurement

OpticaLight Application Luminance Mapped Images







City of Bozeman – Street Lighting

Luminance Method of Measurement

OpticaLight Application Luminance Mapped Images





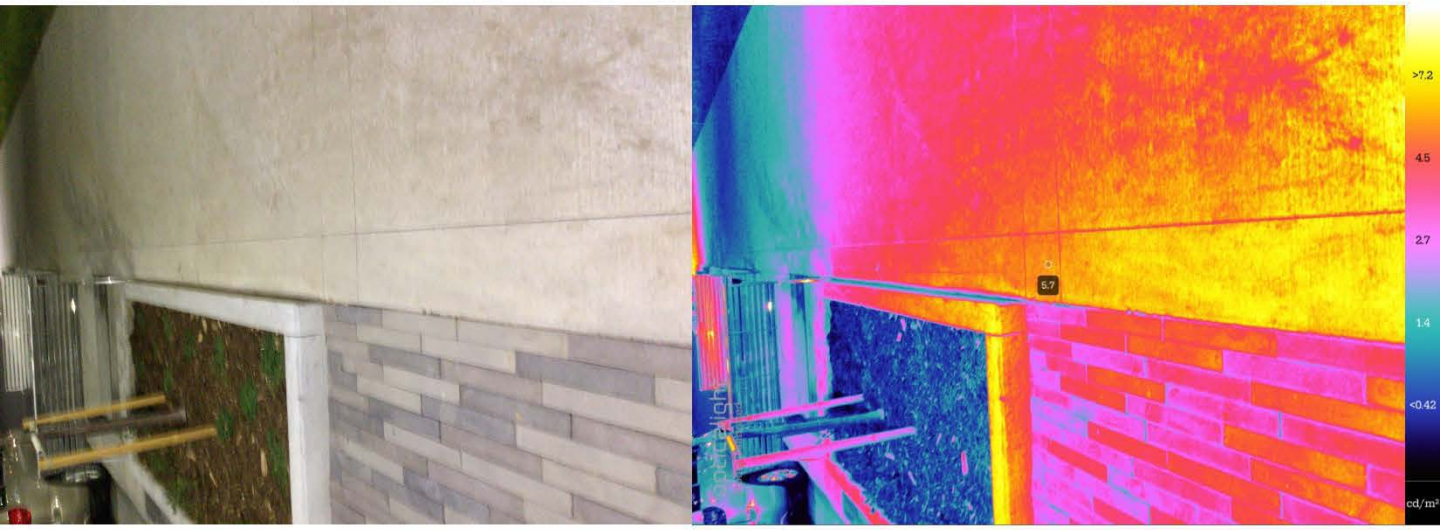


City of Bozeman – Street Lighting

Luminance Method of Measurement

OpticaLight Application Luminance Mapped Images



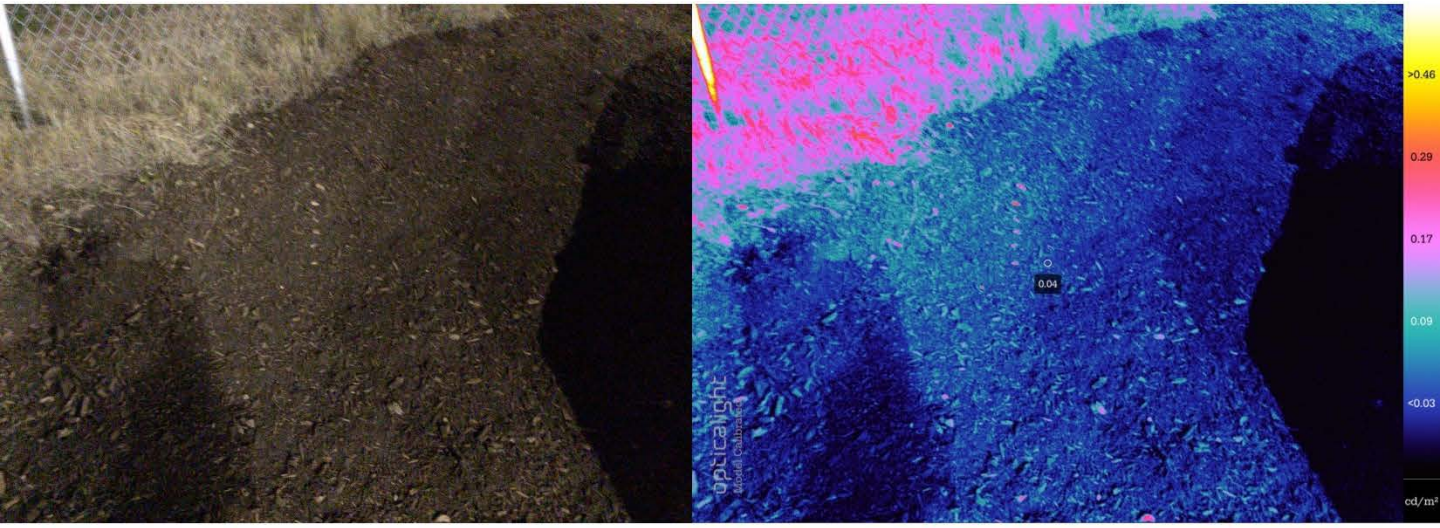




City of Bozeman – Street Lighting

Luminance Method of Measurement

OpticaLight Application Luminance Mapped Images



Good Housekeeping Program

See SWMP Section 7.0 for more information related to the MS4's Good Housekeeping Program.

The following Facility Stormwater Pollution Prevention Plans (FSWPPP) are attached:

1. City Shops Complex
2. Vehicle Maintenance Facility
3. Laurel Glen Operations Facility
4. Water Treatment Plant
5. Water Reclamation Facility
6. East Gallatin Storage Area
7. Landfill
8. Snow Storage Facility
9. Bozeman Public Safety Facility

The following Activity Stormwater Pollution Prevention Plans (ASWPPP) are attached:

1. Emergency Main Break
2. Sanitary Sewer Overflows
3. Trenching and Excavation
4. Roadway Traction Sand Application
5. Solid Waste Collection

Facility Stormwater Pollution Prevention Plan

City Shops Complex

814 North Bozeman Avenue
Bozeman, Montana 59715

2020 Update

1.0 OVERVIEW

This Facility Stormwater Pollution Prevention Plan (FSWPPP) includes Standard Operating Guidelines (SOG) developed to mitigate pollutants generated at the City Shops Complex (Facility).

2.0 STORMWATER TEAM

The following Staff members are responsible for the FSWPPP's implementation:

a. Leader: John Alston, Water, Sewer, and Storm Superintendent
b. Leader: John Vandelinder, Streets Superintendent
c. Leader: Thom White, Parks Superintendent
d. Leader: Mike Gray, Facilities Superintendent
e. Offsite Coordinator: Kayla Mehrens, Stormwater Program Coordinator

3.0 SITE DESCRIPTION

The Facility includes buildings, parking lots, and staging areas that support the Streets, Parks, Facility, and Water/Sewer/Storm Divisions. The Facility has three distinct drainage basins, including:

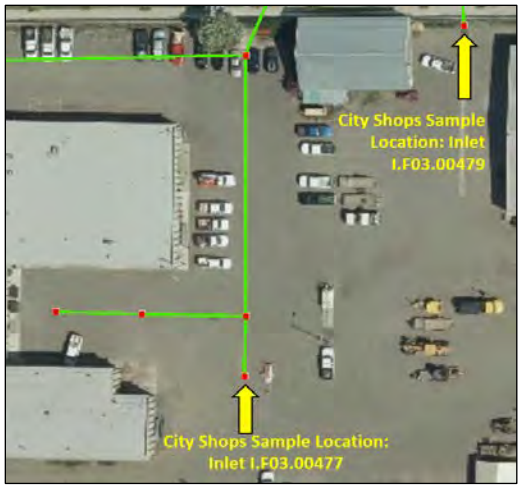
a. Drainage Basin #1: 2.52 acres with 89% impervious cover. Drainage system components include six inlets, 550 feet of storm sewer, and a four-foot diameter Contech CDS mechanical separation unit. Basin #1 discharges into a storm sewer beneath Tamarack St. to the north, which dumps into Bozeman Creek at Outfall OF.E03.00450.
b. Drainage Basin #2: 0.56 acres with 98% impervious cover. Drainage system components include a valley gutter, inlet, and 20 feet of storm sewer. Basin #2 discharges into a storm sewer beneath Tamarack St. to the north, which dumps into Bozeman Creek at Outfall OF.E03.00450.
c. Drainage Basin #3: 0.82 acres with 90% impervious cover. Drainage system components include four inlets, 144 feet of storm sewer, and an underground infiltration facility. Basin #3 discharges to to an underground infiltration facility.

4.0 IMPAIRED WATERBODIES

The Facility discharges to Sourdough Creek, aka Bozeman Creek, at Outfall OF.E03.00450. The Montana Department of Environmental Quality classifies Bozeman Creek as a 303(d) listed impaired waterbody because it does not fully support aquatic life and primary contact/recreation beneficial uses. Bozeman Creek's impairments include: Alterations in stream-side or littoral vegetative covers, Chlorophyll-a, E Coli, Nitrogen (Total), and Sedimentation-Siltation.

5.0 SAMPLING

Staff conducted baseline sampling on April 20 and 26, 2019, at the following locations:



Graphic 5.0: Sampling Location Map.

Staff analyzed the following parameters and compiled the results:

a. Total Suspended Solids (TSS), mg/L
b. Chemical Oxygen Demand (COD), mg/L
c. Total Nitrogen (TN), mg/L
d. Total Phosphorus (TP), mg/L
e. Copper (Cu), mg/L
f. Lead (Pb), mg/L
g. Zinc (Zn), mg/L
h. Oils and Greases, mg/L
i. pH, standard units

Sampling Date	TSS (mg/L)	Oil & Grease (mg/L)	Total Nitro. (mg/L)	Phosp. (mg/L)	Zinc (mg/L)	Lead (mg/L)	Copper (mg/L)	COD (mg/L)	pH
April 20, 2019	1,930	11.0	5.56	3.07	1.560	0.122	0.245	1350	7.5
April 26, 2019	14,100	5.0	8.70	4.28	1.940	0.153	0.352	548	8.0
Median	**8,015**	**8.0**	**7.13**	**3.68**	**1.750**	**0.138**	**0.299**	**1450**	**7.8**

Graphic 5.1: Facility sampling results.

The data shows the Facility yields high concentrations of TSS, oils and grease, phosphorous, zinc, lead, copper, and COD.

6.0 POLLUTION IDENTIFICATION

Following is a list of identified pollutants and an assessment of likely sources at the Facility:

a. Total Suspended Sediment (TSS): Uncontained vehicle and equipment washing, organics
b. Oil and Grease: Fueling, vehicle leaks, uncontained vehicle and equipment washing
c. Total Nitrogen: Fertilizer transfers, uncontained vehicle and equipment washing, organics
d. Phosphorus: Fertilizer transfers, uncontained vehicle and equipment washing, organics
e. Zinc: Steel surfaces, brake dust, uncontained vehicle and equipment washing
f. Lead: Brake dust, uncontained vehicle and equipment washing
g. Copper: Brake dust, uncontained vehicle and equipment washing
h. COD: Vehicle and equipment leaks, uncontained vehicle and equipment washing
i. CRF: Stored chemical

7.0 SITE ASSESSMENT

Section 7.0 outlines the City's Facility Minimum Standards (Standards) applicable to this Facility. All Standards are listed in the City's Stormwater Management Plan (SWMP).

7.1 Standard: Wash bays and interior floor drains connected to the sanitary sewer with pretreatment.

a. Site Components and Compliance Assessment:
   - North Complex Building Floor Drains
     - Compliant: Connected to the sanitary sewer with P-trap
   - South Complex Building Floor Drains
     - Compliant: Connected to the sanitary sewer with sand-oil separator
   - Green Shed Floor Drains
     - Not Compliant: Connected to infiltration drain system without pretreatment
   - Wash Bay #1 Drain System
     - Not Compliant: Connected to storm sewer (infiltration facility downline)
   - Wash Bay #2 Drain System
     - Not Compliant: Connected to storm sewer (mechanical separation downline)

b. Standard Operating Guidelines:
   - Annual inspection (condition, debris depth, accumulated pollutants)
   - Schedule maintenance as needed to maintain the intended function

c. Corrective Action(s):
   - ~~2019: Retrofit Green Shed floor drains or provide enhanced spill kit materials. Retrofit Wash Bay #1 drain system. Retrofit or relocate Wash Bay #2 drain system.~~
   - 2020: Retrofit Green Shed floor drains, or provide enhanced spill kit materials. Retrofit Wash Bay #1 drain system. Retrofit or relocate Wash Bay #2 drain system.

7.2 Standard: Chemicals stored under cover and within secondary containment.

a. Site Components and Compliance Assessment:
   - CRF storage tank
     - Not Compliant: Stored outside without secondary containment

b. Standard Operating Guidelines:
   - Inspect storage containers weekly for leaks
   - If a leak is detected, implement Spill Response Plan provided in Section 8.0

c. Corrective Action(s):
   - ~~2019: Install secondary containment for CRF tank~~
   - 2020: Install secondary containment for CRF tank

7.3 Standard: Fuel tanks protected by secondary containment.

a. Site Components and Compliance Assessment:
   - 500-gallon fuel tank
     - Compliant: Double-walled tank

b. Standard Operating Guidelines:
   - Insert nozzle securely into the vehicle fuel tank before engaging the pump
   - Stay with vehicle or equipment during fueling to reduce the chance of tank overflows
   - Shut off pump before removing nozzle from vehicle fuel tank
   - Securely place nozzle back into fuel tank cradle
   - Clean up spills immediately using SOGs provided in Section 8.0
   - Inspect secondary containment annually per manufacturer's recommendation

c. Corrective Action(s):
   - ~~2019: None~~
   - 2020: None

7.4 Standard: Tracking prevented at all entries, exits, and within parking areas.

a. Site Components and Compliance Assessment:
   - Parking Areas, East Entrance, West Entrance, and South Entrance
     - Compliant: Asphalt surfaces
   - Wash Bays #1 and #2
     - Not Compliant: Prolonged debris accumulation

b. Standard Operating Guidelines:
   - Inspect paved surfaces for debris accumulation, sweep once present

c. Corrective Action(s):
   - ~~2019: Improve operational controls and increased street sweeping~~
   - 2020: None

7.5 Standard: Spill kits stocked with instructions, disposal bags, PPE, absorbents, and inlet barriers.

a. Site Components and Compliance Assessment
   - Green Shed Spill Kit
     - Not Compliant: No instructions, disposal bags, PPE, or inlet barrier
   - South Complex Building Spill Kit and North Complex Building Spill Kit
     - Not Compliant: No response plan, disposal bags, or PPE
   - Fuel Tank Spill Kit
     - Not Compliant: No response plan or inlet barrier

b. Standard Operating Guidelines:
   - Inspect and purchase missing items annually

c. Corrective Action(s):
   - ~~2019: Purchase inlet barrier mats for Green Shed and Fuel Tank spill kits. Place a copy of the spill response plan with each spill kit. Provide disposal bags and PPE for the spill kits in the Green Shed, South Complex Building, and North Complex Buildings. Purchase spill kit for the fuel tank.~~
   - 2020: None

7.6 Standard: Preventative maintenance performed on equipment and vehicles.

a. Site Components and Compliance Assessment
   - Water/Sewer/Storm, Street, Parks, and Facility's Equipment and Vehicles
     - Compliant: Vehicles and equipment inspected and maintained regularly, preventative maintenance documentation filed in CityWorks

b. Standard Operating Guidelines:
   - Visual inspection of all vehicles and equipment before use
   - Complete maintenance and repairs at the Vehicle Maintenance Facility
   - Document inspections, maintenance, and repair per Division specific guidelines

c. Corrective Action(s):
   - ~~2019: None~~
   - 2020: None

7.7 Standard: Vehicles and equipment washed in designated locations.

a. Site Components and Compliance Assessment
   - Wash Bay #1
     - Compliant: Designated wash location
   - Wash Bay #2
     - Not Compliant: See Section 7.1

b. Standard Operating Guidelines:
    - Wash vehicles and equipment in Wash Bay #1
c. Corrective Action(s):
    - ~~2019: Switch degreasers and soaps to EPA approved Safer Choice Products.~~
    - 2020: Switch degreasers and soaps to EPA approved Safer Choice Products.

7.8 Standard: Maintain above and below ground stormwater infrastructure.

a. Site Components and Compliance Assessment:
    - 11 Inlets and 714 Feet of Storm Sewer
        - Compliant: Maintained once every five years
    - Mechanical Separator Treatment Unit
        - Compliant: Maintained annually
    - Underground Infiltration Facility
        - Not Compliant: Unmaintainable due to design and installation flaw
b. Standard Operating Guidelines:
    - Maintenance schedules include:
        - Maintain treatment storm infrastructure annually
        - Maintain conveyance storm infrastructure once every five years
c. Corrective Action(s):
    - ~~2019: See Section 11.0~~
    - 2020: See Section 11.0

8.0 SPILL RESPONSE PLAN

The following is the City's spill response plan, including response, mitigation, and reporting protocols.

8.1 Small and Medium Spills: Typically, major dimension is less than 6' and can be contained, cleaned, and eliminated using onsite personnel, spill kits or the Public Works vehicle.

a. Locate spill kit and put on PPE.
b. In necessary, deploy Public Works spill response vehicle.
c. Control spill by stopping or securing the source.
d. Protect all storm drain inlets near the spill using absorbent booms or inlet barrier.
e. Identify spilled material.
f. Clean spill using appropriate absorbents or other methods. *Never wash spills down the drain!*
g. Place spill material and absorbents in secure containers.
h. Consult with Stormwater Team Leader and the SDS for spill and waste disposal procedures.
i. Dispose of spilled material and the absorbent in compliance with state and federal regulations.
j. Consult with Stormwater Team Leader for appropriate reporting procedures.

8.2 Large and Continuous Spills: Typically, major dimension is greater than 6', continuous flow, and cannot be contained, cleaned, and eliminated using onsite personnel.

a. Leave the area and notify Emergency Responders (911).
b. Give the operator the spill location, chemical name, and approximate amount.
c. If safe, protect nearby storm drain inlets using absorbent booms or inlet barrier.
d. Provide SDS information for the spilled chemical to emergency responders.
e. Advise responders of any absorbents, containers, or spill control equipment that is available.
f. Consult with Stormwater Team Leader for appropriate reporting procedures.

8.3 Spill Reporting

a. Report all chemical spills, regardless of size, to a Stormwater Team Leader.

9.0 TRAINING

Staff receives training related to this Facility per the requirements within the Citys MS4 Permit and maintains training documentation in the SWMP.

10.0 INSPECTIONS

The Offsite Coordinator completes an annual inspection at the Facility to determine compliance with the City's Facility Minimum Standards listed in the SWMP. Updates to this FSWPPP occur based on the results.

a. 2019: Completed on March 21
b. 2020: Completed on September 18

11.0 INFRASTRUCTURE IMPROVEMENTS

Staff identified the following project needs and plans to propose to the City Commission during the development of future Capital Improvement Plans (CIP):

a. Public Works Facility Space and Needs Assessment
    - Cost: ~$180,000
    - Timeline: 2020
b. Wash Bay #2 Drain System Retrofit or Relocation
    - Cost: $25,000
    - Timeline: Propose in CIP
c. Basin #2 Inlet Treatment Installation
    - Cost: $1,000
    - Timeline: 2021 Completion
d. Infiltration Facility Maintenance Access Modification
    - Cost: $15,000
    - Timeline: Propose in CIP

~~e. Facility Surfacing and Stormwater Upgrades (CDS Unit, ADS Infiltration System, and Wash Pad)~~
    - ~~Cost: $250,000~~
    - ~~Timeline: Completed in 2016~~

12.0 RECORD KEEPING AND REPORTING

Staff maintains copies of this FSWPPP at the Facility and the Stormwater Division Office.

Appendix A: Site Map



Facility Stormwater Pollution Prevention Plan

Vehicle Maintenance Facility

1812 North Rouse Avenue
Bozeman, Montana 59715

2020 Update

1.0 OVERVIEW

This Facility Stormwater Pollution Prevention Plan (FSWPPP) includes Standard Operating Guidelines (SOG) developed to mitigate pollutants generated at the Vehicle Maintenace Facility (Facility).

2.0 STORMWATER TEAM

The following Staff members are responsible for the FSWPPP's implementation:

a. Leader: John Vandelinder, Streets Superintendent
b. Leader: Alex Nordquest, Forestry Division Manager
c. Leader: John Alston, Water, Sewer, and Storm Superintendent
d. Leader: Mike Gray, Facility Manager
e. Leader: Josh Waldo, Fire Chief
f. Offsite Coordinator: Kayla Mehrens, Stormwater Program Coordinator

3.0 SITE DESCRIPTION

The Facility includes buildings, parking lots, and staging areas that support the Street, Forestry, Facility, Fire, and Water/Sewer/Storm Divisions. The Facility has one drainage basin, including:

a. Drainage Basin #1: 8.4 acres with 62.5% impervious cover, including office and equipment storage buildings, parking areas, material storage, and equipment staging. Basin #1's drainage system components include seven inlets, 1,125 feet of storm sewer, and a detention basin. Basin #1 discharges into a storm sewer beneath Griffin Drive, which outlets into the East Gallatin River.

4.0 IMPAIRED WATERBODY

The Vehicle Maintenance Facility discharges to the East Gallatin River at Outfall OF.E01.00050. The Montana Department of Environmental Quality classifies the East Gallatin River as a 303(d) listed impaired waterbody because it does not fully support the aquatic life and primary contact/recreation beneficial uses. East Gallatin River impairments include: Nitrogen (Total) and Phosphorous (Total).

5.0 SAMPLING

Staff conducted baseline sampling on August 22, 2019, at the following location:



Graphic 5.0: Sampling Location Map.

Staff analyzed the following parameters and compiled the results:

a. Total Suspended Solids (TSS), mg/L
b. Chemical Oxygen Demand (COD), mg/L
c. Total Nitrogen (TN), mg/L
d. Total Phosphorus (TP), mg/L
e. Copper (Cu), mg/L
f. Lead (Pb), mg/L
g. Zinc (Zn), mg/L
h. Oils and Greases, mg/L
i. pH, standard units

Sampling Date	TSS (mg/L)	Oil & Grease (mg/L)	Total Nitro. (mg/L)	Phosp. (mg/L)	Zinc (mg/L)	Lead (mg/L)	Copper (mg/L)	COD (mg/L)	pH
August 22, 2019	139	2.0	7.6	0.540	0.260	0.010	0.042	548	6.6

Graphic 5.1: Facility sampling results.

The data shows the Facility yields high concentrations of COD.

6.0 POLLUTION IDENTIFICATION

Following is a list of identified pollutants and an assessment of likely sources at the Facility:

a. Total Suspended Solids (TSS): Traction sand storage, equipment, unstabilized areas, organics
b. Oil and Grease: Vehicle and equipment leaks, stored chemicals
c. Total Nitrogen: Organics, traction sand
d. Phosphorus: Fertilizer transfers, organics, traction sand
e. Zinc: Steel surfaces, brake dust
f. Lead: Brake dust
g. Copper: Brake dust
h. COD: Vehicle and equipment leaks, traction sand
i. Magnesium Chloride: Stored chemical
j. Spent Antifreeze: Stored chemical

7.0 SITE ASSESSMENT

Section 7.0 outlines the City's Facility Minimum Standards (Standards) applicable to this Facility. The complete list of standards are contained in the City's Stormwater Management Plan (SWMP).

7.1 Standard: Wash bays and interior floor drains connected to the sanitary sewer with pretreatment

a. Site Components and Compliance Assessment:
    - Vehicle Maintenance Building
        - Compliant: Connected to the sanitary sewer with sand-oil separator
    - Vehicle Maintenance Building Wash Bay (east side of HRDC building)
        - Compliant: Connected to the sanitary sewer with sand-oil separator
b. Standard Operating Guidelines:
    - Annual inspection (condition, debris depth, accumulated pollutants)
    - Schedule maintenance as needed to maintain the intended function
c. Corrective Actions:
    - ~~2019: None~~
    - 2020: None

7.2 Standard: Chemicals stored under cover and within secondary containment

a. Site Components and Compliance Assessment:
    - 1,000-gallon used oil tank

        - Compliant: Double-walled tank
    - Small metal used oil tank
        - Compliant: Inside storage (2020)
    - Spent antifreeze tank
        - Compliant: Double-walled tank
    - Spent antifreeze bottles
        - Compliant: Covered with secondary containment (2020)
    - 10,000-gallon magnesium chloride tank
        - Not Compliant: No secondary containment
    - SumaGrow Barrel
        - Compliant: Inside storage (2020)
b. Standard Operating Guidelines:
    - Inspect storage containers weakly for leaks
    - If a leak is detected, implement Spill Response Plan provided in Section 8.0
c. Corrective Actions:
    - ~~2019: Install secondary containment for small metal used oil tank, spent antifreeze bottles, magnesium chloride tank, and SumaGrow barrel~~
    - 2020: Install secondary containment for magnesium chloride tank. Design is underway for 2021 construction.

7.3 Standard: Tracking prevented at all entries, exits, and within parking areas

a. Site Components and Compliance Assessment:
    - South Parking Lot, Fire Department Training Area, North Parking Lot, Forestry Entrance, West Entrance
        - Compliant: Asphalt surface
    - Forestry Parking Lot
        - Not Compliant: Unimproved lot
    - Sand Storage Area
        - Not Compliant: Road mix surface
b. Standard Operating Guidelines:
    - Inspect paved surfaces for debris accumulation, sweep once present
c. Corrective Action:
    - ~~2019: See Section 11.0.a~~
    - 2020: See Section 11.0.a

7.4 Standard: Spill kits stocked with instructions, disposal bags, PPE, absorbents, and inlet barriers

a. Site Components and Compliance Assessment
    - Vehicle Maintenance Building Spill Response Materials
        - Compliant
    - Spill Response Vehicle Spill Kit
        - Compliant
b. Standard Operating Guidelines:
    - Inspect and purchase missing items annually
c. Corrective Actions:
    - ~~2019: Purchase inlet barrier mats for Vehicle Maintenance Building and Spill Response Vehicle, place a copy of the Facility FSWPPP with each spill kit, and purchase spill kit for used oil/spent antifreeze deposition area~~
    - 2020: None

7.5 Standard: Preventative maintenance performed on equipment and vehicles

a. Site Components and Compliance Assessment
   - Water/Sewer/Storm, Street, Parks, and Facility's Equipment and Vehicles
     - Compliant: Vehicles and equipment inspected and maintained regularly, preventative maintenance documentation filed in CityWorks

b. Standard Operating Guidelines:
   - Visual inspection of all vehicles and equipment before use
   - Complete maintenance and repairs at the Vehicle Maintenance Facility
   - Document inspections, maintenance, and repair per Division specific guidelines

c. Corrective Action(s):
   - ~~2019: None~~
   - 2020: None

7.6 Standard: Vehicles and equipment washed in designated locations

a. Site Components and Compliance Assessment
   - Wash Bay
     - Compliant: Designated wash location

b. Standard Operating Guidelines:
   - Wash vehicles and equipment at the Wash Bay

c. Corrective Actions:
   - ~~2019: None~~
   - 2020: None

7.7 Standard: Maintain above and below ground stormwater infrastructure

a. Site Components and Compliance Assessment:
   - Storm Conveyance Infrastructure
     - Compliant: Mapped and maintained (2020)
   - Stormwater Detention Facility
     - Compliant: Maintained (2020)

b. Standard Operating Guidelines:
   - Maintenance schedules include:
     - Stormwater retention basin vegetation maintained every fall
     - Maintain conveyance storm infrastructure every five years

c. Corrective Actions:
   - ~~2019: Install a barrier on the south edge of the detention facility, dredge deposited materials, remove silt fence, clear inlet pipe and accumulated debris in the detention facility, map storm infrastructure, place on maintenance schedule~~
   - 2020: None

8.0 SPILL RESPONSE PLAN

The following is the City's spill response plan, including response, mitigation, and reporting protocols.

8.1 Small and Medium Spills: Typically, major dimension is less than 6' and can be contained, cleaned, and eliminated using onsite personnel, spill kits or the Public Works vehicle.

a. Locate spill kit and put on PPE.
b. In necessary, deploy Public Works spill response vehicle.
c. Control spill by stopping or securing the source.
d. Protect all storm drain inlets near the spill using absorbent booms or inlet barrier.

e. Identify spilled material.
f. Clean spill using appropriate absorbents or other methods. *Never wash spills down the drain!*
g. Place spill material and absorbents in secure containers.
h. Consult with Stormwater Team Leader and the SDS for spill and waste disposal procedures.
i. Dispose of spilled material and the absorbent in compliance with state and federal regulations.
j. Consult with Stormwater Team Leader for appropriate reporting procedures.

8.2 Large and Continuous Spills: Typically, major dimension is greater than 6', continuous flow, and cannot be contained, cleaned, and eliminated using onsite personnel.

a. Leave the area and notify Emergency Responders (911).
b. Give the operator the spill location, chemical name, and approximate amount.
c. If safe, protect nearby storm drain inlets using absorbent booms or inlet barrier.
d. Provide SDS information for the spilled chemical to emergency responders.
e. Advise responders of any absorbents, containers, or spill control equipment that is available.
f. Consult with Stormwater Team Leader for appropriate reporting procedures.

8.3 Spill Reporting

a. Report all chemical spills, regardless of size, to a Stormwater Team Leader.

9.0 TRAINING

Staff receives training related to this Facility the the City's training software platform per the requirements within the Citys MS4 Permit and maintains training documentation in the SWMP.

10.0 INSPECTIONS

The Offsite Coordinator completes an annual inspection at the Facility to determine compliance with the City's Facility Minimum Standards listed in the SWMP. Updates to this FSWPPP occur based on the results.

a. Initial site inspection completed on August 6, 2019
b. Completed reinspection and updated FSWPPP on September 9, 2020

11.0 INFRASTRUCTURE IMPROVEMENTS

Staff identified the following project needs and plans to propose to the City Commission during the development of future Capital Improvement Plans (CIP):

a. Public Works Facility Space and Needs Assessment
    - Cost: ~$180,000
    - Timeline: 2020
b. Stabilize Forestry Parking Lot and Sand Storage Area
    - Cost: TBD
    - Timeline: Propose in CIP
c. Magnesium Chloride Secondary Containment
    - Cost: $75,000
    - Timeline: Propose in CIP
~~d. Used Oil Secondary Containment~~
    - ~~Cost: $15,000~~
    - ~~Timeline: Propose in 2022-2026 CIP~~
~~e. Spent Antifreeze Secondary Containment~~
    - ~~Cost: $15,000~~
    - ~~Timeline: Propose in 2022-2026 CIP~~

f. ~~Suma Grow Secondary Containment~~
   - ~~Cost: $15,000~~
   - ~~Timeline: Propose in 2022-2026 CIP~~

12.0 RECORD KEEPING AND REPORTING

Staff maintains copies of this FSWPPP at the Facility and the City's Stormwater Division office.

Appendix A: Site Map



Facility Stormwater Pollution Prevention Plan

Laurel Glen Operations Facility

5521 Saxon Way
P.O. Box 1230
Bozeman, Montana 59771

Updated: 2020

1.0 OVERVIEW

This Facility Stormwater Pollution Prevention Plan (FSWPPP) includes Standard Operating Guidelines (SOG) developed to mitigate pollutants generated at the Laurel Glen Operations Facility (Facility).

2.0 STORMWATER TEAM

The following Staff members are responsible for the FSWPPP's implementation:

a. Leader: John Alston, Water, Sewer, and Stormwater Superintendent
b. Leader: Josh Watson, Signs and Signals Foreman
c. Offsite Coordinator: Kayla Mehrens, Stormwater Program Coordinator

3.0 SITE DESCRIPTION

The Facility contains a vehicle/equipment storage building and sewer lift station accessed by a gravel driveway and parking area. One drainage basin exists:

a. Drainage Basin #1: 2.3 acres with 6% impervious cover, including a building and concrete pads.

4.0 WATERBODY

The Facility discharges to a subdivision detention basin that outfalls to Aakjer Creek.

5.0 SAMPLING

The facility does not contain any storm sewer, as such Staff did not conduct sampling.

6.0 POLLUTION IDENTIFICATION

Following is a list of identified pollutants and an assessment of likely sources at the Facility:

a. Total Suspended Solids: Organics (ex. Grass clippings)
b. Oil and Grease: Vehicle leaks
c. Total Nitrogen: Organics
d. Phosphorus: Organics
e. Zinc: Metal surfaces and brake dust
f. Lead: Brake dust and exhaust
g. Copper: Brake dust and exhaust
h. Floatables: Litter

7.0 SITE ASSESSMENT

Section 7.0 outlines the City's Facility Minimum Standards (Standards) applicable to this Facility. All Standards are listed in the City's Stormwater Management Plan (SWMP).

7.1 Standard: Tracking controlled at all entries, exits, and within parking areas

a. Site Components and Compliance Assessment:
    - Gravel access and parking areas.
        - Compliant: Compacted gravel surface.
b. Standard Operating Guidelines:
    - Inspect area for trash. If present, collect and dispose.
    - Sweep Saxon Way when noticeable accumulation of tracked debris occurs.

c. Corrective Action(s):
    - 2020: None

7.2 Standard: Spill kits stocked with instructions, disposal bags, PPE, absorbents, and inlet barriers.

a. Site Components and Compliance Assessment:
    - Vehicle/Equipment Building
        - Compliant: Spill kit located next to flammable cabinet.
b. Standard Operating Guidelines:
    - Inspect spill kit and purchase missing items annually.
c. Corrective Action(s):
    - 2020: None

7.3 Standard: Preventative maintenance performed on equipment and vehicles.

a. Site Components and Compliance Assessment:
    - Water/Sewer/Storm, Street Equipment, and Vehicles
        - Compliant: Vehicles and equipment inspected and maintained regularly, preventative maintenance documentation filed in CityWorks
b. Standard Operating Guidelines:
    - Visual inspection of all vehicles/equipment before use.
    - Complete minor maintenance and repair of equipment indoors. Complete more extensive work at the Vehicle Maintenance Facility.
    - Document inspections, maintenance, and repair per Division specific guidelines.
c. Corrective Action(s):
    - 2020: None

7.4 Standard: Vehicles and equipment washed in designated locations.

a. Site Components and Compliance Assessment
    - Compliant: Vehicles/Equipment washed off site at the Vehicle Maintenance Facility.
b. Standard Operating Guidelines:
    - Wash vehicles at the Vehicle Maintenance Facility in the designated location.
c. Corrective Action(s):
    - 2020: none

7.5 Standard: Maintain above and below ground stormwater infrastructure

a. Site Components and Compliance Assessment:
    - Storm Conveyance Infrastructure
        - Compliant: All nearby infrastructure is mapped, all of which is off site.
b. Standard Operating Guidelines:
    - None, no infrastructure on premises.
c. Corrective Action(s):
    - The Facility is located within the Laurel Glen Homeowner's Association, which is responsible for the maintenance of the subdivision's post-construction stormwater basins. The City owns and maintains infrastructure in the public right-of-way adjacent to the Facility.

8.0 SPILL RESPONSE PLAN

The following is the City's spill response plan, including response, mitigation, and reporting protocols.

8.1 Small and Medium Spills: Typically, major dimension is less than 6' and can be contained, cleaned, and eliminated using onsite personnel, spill kits and/or the Public Works vehicle.

a. Locate spill kit and put on PPE.
b. If necessary, deploy Public Works spill response vehicle.

c. Control spill by stopping or securing the source.
d. Protect all storm drain inlets near the spill using absorbent booms or inlet barrier.
e. Identify spilled material.
f. Clean spill using appropriate absorbents or other methods. *Never wash spills down the drain!*
g. Place spill material and absorbents in secure containers.
h. Consult with Stormwater Team Leader and the SDS for spill and waste disposal procedures.
i. Dispose of spilled material and the absorbent in compliance with state and federal regulations.
j. Consult with Stormwater Team Leader for appropriate reporting procedures.

8.2 Large and Continuous Spills: Typically, major dimension is greater than 6', continuous flow, and cannot be contained, cleaned, and eliminated using onsite personnel.

a. Leave the area and notify Emergency Responders (911).
b. Give the operator the spill location, chemical name, and approximate amount.
c. If safe, protect nearby storm drain inlets using absorbent booms or inlet barrier.
d. Provide SDS information for the spilled chemical to emergency responders.
e. Advise responders of any absorbents, containers, or spill control equipment that is available.
f. Consult with Stormwater Team Leader for appropriate reporting procedures.

8.3 Spill Reporting

a. Report all chemical spills, regardless of size, to a Stormwater Team Leader.

8.4 Sanitary Sewer Overflow.

a. Lift station on site and bypass pumping equipment stored in the vehicle/equipment storage building. See the Water and Sewer Division's Sanitary Sewer Overflow standard operating guidelines for more details about emergency procedures.

9.0 TRAINING

Staff receives training related to this Facility per the requirements within the Citys MS4 Permit and maintains training documentation in the SWMP.

10.0 INSPECTIONS

The Offsite Coordinator completes an annual inspection at the Facility to determine compliance with the City's Facility Minimum Standards listed in the SWMP. Updates to this FSWPPP occur based on the results.

a. Initial site inspection completed September 24th, 2020

11.0 INFRASTRUCTURE IMPROVEMENTS

Staff identified the following project needs and plans to propose during the development of future Capital Improvement Plans (CIP):

a. Reoccurring: The Facility is located within the Laurel Glen Home Owner's Association, which is responsible for the maintenance of the subdivision's post-construction stormwater facilities. Upon request by the HOA, the City will likely have to contribute funding to complete maintenance-related work for the stormwater basin adjacent to the Facility and others in the subdivision.

12.0 RECORD KEEPING AND REPORTING

Staff store copies of this FSWPPP at the City Shops Facility and the Stormwater Division's Office.

Appendix A: Site Map



Facility Stormwater Pollution Prevention Plan

Water Treatment Plant

7024 Sourdough Canyon Rd
P.O. Box 1230
Bozeman, Montana 59771

2020 Update

1.0 OVERVIEW

This Facility Stormwater Pollution Prevention Plan (FSWPPP) includes Standard Operating Guidelines (SOG) developed to mitigate pollutants generated at the Water Treatment Plant (Facility).

2.0 STORMWATER TEAM

The following Staff members are responsible for the FSWPPP's implementation:

a. Leader: Jill Miller, Water Treatment Plant Superintendent
b. Stormwater Coordinator: Kayla Mehrens, Stormwater Program Coordinator

3.0 SITE DESCRIPTION

The Facility treats water before it is distributed to the City of Bozeman. The perimeter is fenced. The site includes buildings housing various equipment and lined basins used to settle fine particles while evaporating liquids. Three drainage basins exist, including:

a. Drainage Basin #1: 12-acres with 39% impervious cover, including parking lots and buildings.
b. Drainage Basin #2:11-acre closed basin primarily comprised of lawn area.
c. Drainage Basin #3: 10-acres with 18% impervious cover, including a 5.3 million gallon potable water storage tank.

The Facility operates under federal and state requirements for groundwater discharge, surface water discharge, and water treatment for municipal potable water supply. The Facility's equipment, chemicals, drains, water treatment controls, and membranes are contained within the interior of the Facility and compliant with governing regulations.

4.0 WATERBODY

The Facility lies above 68 Ditch, which drains to Bozeman Creek. The Facility was constructed in 2014 and includes modern drainage design meeting the City's water quality and flood control standards. Stormwater pollutant exposure and off site discharge risk is low.

5.0 SAMPLING

Staff conducted composite baseline sampling on Dec 2, 2020, at the following location:



Graphic 5.0: Sampling Location.

Staff analyzed the following parameters and compiled the results:

a. Total Suspended Solids (TSS), mg/L
b. Chemical Oxygen Demand (COD), mg/L
c. Total Nitrogen (TN), mg/L
d. Total Phosphorus (TP), mg/L
e. Copper (Cu), mg/L
f. Lead (Pb), mg/L
g. Zinc (Zn), mg/L
h. Oils and Greases, mg/L
i. pH, standard units

Sampling Date	TSS (mg/L)	Oil & Grease (mg/L)	Total Nitro. (mg/L)	Phosp. (mg/L)	Zinc (mg/L)	Lead (mg/L)	Copper (mg/L)	COD (mg/L)	pH
December 2, 2020	67	1.0 RL	1.3	0.239	0.04	0.002	0.007	61	6.8

Graphic 5.1: Facility sampling results

The data shows the Facility yields low concentrations of all pollutants.

6.0 POLLUTION IDENTIFICATION

Following is a list of identified pollutants and an assessment of likely sources at the Facility:

a. Total Suspended Solids: Organics
b. Oil and Grease: Vehicle leaks
c. Total Nitrogen: Organics
d. Phosphorus: Organics
e. Zinc: Metal surfaces and brake dust
f. Lead: Brake dust and exhaust
g. Copper: Brake dust and exhaust
h. Other: Treatment chemicals
i. Floatables: Litter

7.0 SITE ASSESSMENT

Section 7.0 outlines the City's Facility Minimum Standards (Standards) applicable to this Facility. All Standards are listed in the City's Stormwater Management Plan (SWMP).

7.1 Standard: Wash bays and interior floor drains connected to the sanitary sewer.

a. Site Components and Compliance Assessment:
    - Primary Building
        - Compliant: Drains are connected to an onsite septic.
b. Standard Operating Guidelines:
    - See Facility specific SOGs for sink and drain use.
c. Corrective Action(s):
    - 2020: None

7.2 Standard: Chemicals stored under cover and within secondary containment.

a. Site Components and Compliance Assessment:
    - Chemical storage
        - Compliant: Chemicals stored inside within secondary containment.
b. Standard Operating Guidelines:
    - Follow the Facility's SOG during chemical delivery.
    - Inspect chemical containment multiple times per day.
    - If a leak or spill is detected, implement the appropriate response per Facility SOGs.
a. Corrective Action(s):
    - 2020: None

7.3 Standard: Tracking controlled at all entries, exits, and within parking areas

a. Site Components and Compliance Assessment:

- Buildings, Sheds, and Parking Areas
  - Compliant: Primary entries, exits, and parking areas are paved with asphalt and controlled by a control gate and perimeter fencing. A few un-stabilized access points exist; however, are only used during infrequent or emergency operations.

b. Standard Operating Guidelines:
   - Sweep impacted paved areas if a noticeable accumulation of tracked debris occurs.

c. Corrective Action:
   - 2020: None

7.4 Standard: Spill kits stocked with instructions, disposal bags, PPE, absorbents, and inlet barriers.

a. Site Components and Compliance Assessment
   - Primary Building
     - Compliant: Chemicals rooms and the garage have spill kits.

b. Standard Operating Guidelines:
   - Inspect and purchase missing items any time a kit is used.

c. Corrective Action(s):
   - 2020: None

7.5 Standard: Preventative maintenance on equipment and vehicles

a. Site Components and Compliance Assessment
   - Water Treatment Plant Equipment and Vehicles
     - Compliant: Inspected and maintained regularly, documentation in place.

b. Standard Operating Guidelines:
   - Visual inspection of all vehicles and equipment before use.
   - Complete minor and preventative maintenance in the garage.
   - Complete significant repairs at the Vehicle Maintenance Facility.
   - Document inspections, maintenance, and repairs per Division specific guidelines.

c. Corrective Actions:
   - 2020: None

7.6 Standard: Vehicles and equipment washed in designated locations.

a. Site Components and Compliance Assessment
   - Main Parking Area (south of building)
     - Compliant: Occasional car washing occurs; however, activity is infrequent and insignificant.

b. Standard Operating Guidelines:
   - Wash vehicles indoors at the Vehicle Maintenance if a noticeable amount of pollutants are present.

c. Corrective Action(s):
   - 2020: None

7.7 Standard: Maintain stormwater facilities per the following frequencies: (1) Stormwater basins, annual vegetation and debris clearing, 10-15 year dredging; (2) Mechanical separators, annual vacuuming; (3) Infiltration facilities, annual flushing; (4) Permeable surfaces, as required; (5) Inlets, manholes, and pipes, five-year flushing, vacuuming, and inspection cycle.

a. Site Components and Compliance Assessment:
   - Not Compliant: 1500’ of pipe, ten inlets, six manholes and two stormwater basins exist without any maintenance schedule.

b. Standard Operating Guidelines:
   - Inspect and clear overgrown vegetation from stormwater basins annually.
   - Inspect and clean underground infrastructure every five-years.

c. Corrective Actions
    - 2020: Develop asset management program, add infrastructure to the maintenance district map to facilitate operations.

8.0 SPILL RESPONSE PLAN

The Water Treatment Plant contains hazardous materials. As such, EPA and OSHA protocols must be followed. Details about the sizes of spills, incident command, and types of response can be found in the Hazard Communication, Emergency Response Plan, and applicable documents stored onsite.

9.0 TRAINING

Staff receives training related to this Facility per the requirements within the City's MS4 Permit and maintains training documentation in the SWMP.

10.0 INSPECTIONS

The Offsite Coordinator completes an annual inspection at the Facility to determine compliance with the City's Facility Minimum Standards listed in the SWMP. Updates to this FSWPPP occur based on the results.

a. 2020: Completed on November 17

11.0 INFRASTRUCTURE IMPROVEMENTS

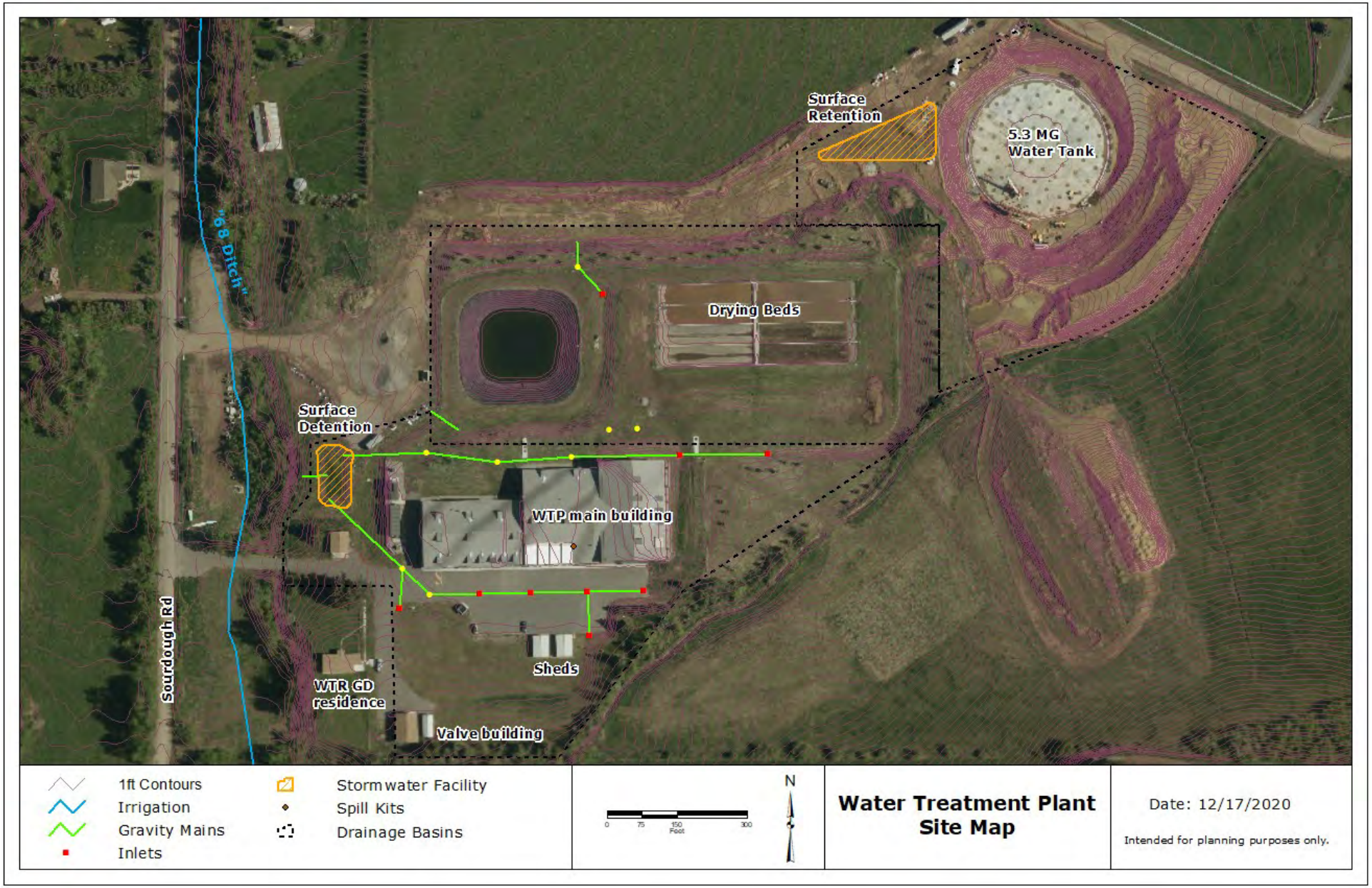
Staff identified the following project need and plans to propose to the City Commission during the development of future Capital Improvement Plans (CIP):

a. 2020: None

12.0 RECORD KEEPING AND REPORTING

Staff store copies of this FSWPPP at the Water Treatment Plant and the Stormwater Division's Office.

Appendix A: Site Map



Facility Stormwater Pollution Prevention Plan

Water Reclamation Facility
2245 Springhill Rd
P.O. Box 1230
Bozeman, Montana 59771

2020 Update

Mission Statement: Maintain a best in class facility that works to minimize, to the extent feasible, stormwater pollutant transport to adjacent waterbodies using historical knowledge and good engineering design. Operating principles include:

- Minimizing pollutant exposure;
- Sustaining an orderly and clean facility;
- Maintaining installed operational and structural controls;
- Reducing risk of leaks, spills, and other releases;
- Implementing pollution response and cleanup plans; and
- Mitigating the transport of sediment during ground disturbing activities

1.0 OVERVIEW

This Facility Stormwater Pollution Prevention Plan (Plan) outlines roles, responsibilities, and procedures for Staff operating the City of Bozeman's Water Reclamation Facility (WRF).

2.0 STORMWATER TEAM

Leader: Tom Radcliffe
Title: Water Reclamation Facility Superintendent
Office Phone: (406)582-2928
Cell Phone: (406)579-1489
Responsibilities: Oversees and makes decisions related to personnel, operations, and WRF investments.

Onsite Coordinator: Brian Carey
Title: Water Reclamation Facility Assistant Superintendent
Office Phone: (406)582-2935
Cell Phone: (406)570-5837
Responsibilities: Implements Plan, oversees personnel, and implements corrective actions

Offsite Coordinator: Kayla Mehrens
Title: Stormwater Program Coordinator
Office Phone: (406)582-2270
Cell Phone: (406)579-3971
Responsibilities: Provides technical support.

Administrator and Site Inspector: Frank Greenhill
Title: Stormwater Program Specialist
Office Phone: (406)582-2917
Cell Phone: (406)600-7928
Responsibilities: Provides technical support and completes inspections.

3.0 SITE DESCRIPTION

The WRF is an 8.5 million gallon per day five-stage bardenpho BNR process plant situated on a 138-acre land tract. The WRF consist of primarily permeable landscape and has eight acres of impervious area, which drains to five stormwater basins prior to discharging to the East

Gallatin River (four outfalls) and Catron Creek (one outfall).

The majority of the WRF's associated workflows occur in fully enclosed buildings and tanks. This Plan addresses how Staff manages pollutants generated from activities, processes, and operations that have the potential to negatively impact surface waters.

Major components of the WRF include:

1. Screening
2. Primary Settling
3. Biological Treatment
4. Secondary Clarification
5. Ultraviolet Treatment (effluent discharge)
6. Solids Handling and Disposal (loading and transfer to landfill)

4.0 POLLUTION ASSESSMENT

The following information describes the WRF's potential sources of pollution and Best Management Practices (BMPs) implemented to mitigate the pollution risk that exists and meet mission statement goals.

1. Site Drainage and Development Footprint

    a. Pollutant Quantity: Variable
    b. Stormwater Pollution Probability: Low
    c. Pollutant(s) of Concern: Sediment from atmospheric dust deposition, nutrients from lawn fertilizer use, and oils, greases, fuels, and metals from equipment movements.
    d. Deployed BMPs:
    Low impact development:

    - Vegetated boulevards adjacent to the majority of internal access roads and process equipment which receives and infiltrates sheet flow.
    - Five stormwater basins designed to capture, treat, and regulate stormwater discharge flowing from the WRF's connected impervious area.
    - Two dry well systems designed to capture and infiltrate stormwater discharge flowing from the WRF's impervious area.

    Infrastructure maintenance:

    - Designate the bottom of basins as "no mow zones" throughout the growing season.
    - Eliminate any and all fertilizer use adjacent to or near any stormwater feature.
    - Sickle mow basins every fall to 6" and remove all clipped vegetation.
    - Inspect basins annually for a buildup of debris and sediment.
    - Vacuum out dry wells once infiltration rates noticeably decline.

    Street sweeping:

    - Contact Street's Division for sweeping assistance when a noticeable amount of dust or debris is deposited on drive aisles and parking areas.

2. Fleet Storage and Management

    a. Pollutant Quantity: Variable
    b. Stormwater Pollution Probability: Low
    c. Pollutant(s) of Concern: Gas, diesel, oil, grease, detergents, wash water, and metals
    d. Deployed BMPs:

    Preventative fleet maintenance:

    - Inspect equipment before every use.
    - Utilize pans to capture dripping fluids.

- Follow preventative maintenance schedules.
- Notify supervisor to schedule a repair with City Mechanic if an issue occurs.
- Spot clean stained asphalt or concrete using onsite spill kit and procedures.

Equipment washing:

- Complete major washing activities (soaps and degreasers) at the Stormwater Waste Disposal Facility, which drains to a lined pond.
- Complete minor washing activities (no soaps and degreasers) outside the maintenance building, which drains to a permeable area and dry well.

3. Gasoline and Diesel Storage and Fueling

   a. Quantity: 1,000 gallons maximum
   b. Stormwater Contact Probability: Low
   c. Pollutant(s) of Concern: Hydrocarbons, benzene, toluene, xylene, and lead
   d. Deployed BMPs:

      Double walled fuel tank:

      - Inspect semi-annually for leaks into secondary containment per manufacture's recommendation. If leak is found, contact Stormwater Team immediately.

      Fueling procedure:

      - Inspect hoses, caps, tanks, and nozzles for leaks before fueling.
      - Watch all fueling activities.
      - Spot clean drips or noticeable stains on road surface using spill kit, dispose generated waste in dumpster.

4. Oil, Grease, and Hydraulic Fluid Storage

   a. Quantity: <350 gallons
   b. Stormwater Contact Probability: Low
   c. Pollutant(s) of Concern: Varied
   d. Deployed BMPs:

      Inside storage:

      - Inspect hoses, caps, oil pans, valves, tanks, and nozzles for leaks before use.
      - Watch all filling and draining activities, complete inside.
      - Spot clean drips or noticeable stains on surfaces using spill kit, dispose generated waste in dumpster.

5. Magnesium Hydroxide Delivery, Chemical, Paints, and Solvents Storage

   a. Quantity: 4,000 gallons
   b. Pollutant(s) of Concern: $Mg(OH)_2$, High PH, others vary on necessity at given time
   c. Stormwater Contact Probability: Low
   d. Deployed BMPs:

      Inside storage:

      - Inspect tanks frequently.
      - Oversee all drop-off and transfer activities.

      Labels:

      - Create and maintain clear schemes for spill kits, pollutants, and disposal bins.

6. Sludge and Bar Screening Grit Waste Disposal

a. Quantity: Varied
b. Pollutant(s) of Concern: Biosolids and solid waste
c. Stormwater Contact Probability: Low
d. Deployed BMPs:

Inside loading and watertight containers:

- Inspect trash and roll off bins for leaks and drips daily.
- Keep lids closed.
- Dispose of waste streams at landfill.
- Wash roll-off trucks at the Sediment Disposal Facility if splatter from the loading or dumping process occurs.

7. Primary Digester Bio-Solids Removal

a. Quantity: 500 yards
b. Pollutant(s) of Concern: Stabilized treated bio-solids accumulated in digester.
c. Stormwater Contact Probability: Low
d. Deployed BMPs:

Secured transfer:

- Hire third party contractor to vacuum out of digester.
- Transport to dumping area west of main facility.

Contained storage:

- Dump in contained area.
- Let dry prior to disposal at landfill.
- Haul to landfill for use as cover.

8. Erosion and Sediment Control

a. Quantity: Varied dependent on project
b. Pollutant(s) of Concern: Sediment
c. Stormwater Contact Probability: Low
d. Deployed BMPs:

Stormwater Division Permitting Program:

- Require contractor to complete Stormwater Permit for all construction activities.

5.0 SPILL RESPONSE PLAN

The following is the City's spill response plan, including response, mitigation, and reporting protocols.

1. Small and Medium Spills: Typically, major dimension is less than 6' and can be contained, cleaned, and eliminated using onsite personnel, spill kits or the Public Works vehicle.

a. Locate spill kit and put on PPE.
b. In necessary, deploy Public Works spill response vehicle.
c. Control spill by stopping or securing the source.
d. Protect all storm drain inlets near the spill using absorbent booms or inlet barrier.
e. Identify spilled material.
f. Clean spill using appropriate absorbents or other methods.
g. Place spill material and absorbents in secure containers.
h. Consult with Stormwater Team Leader and the SDS for spill and waste disposal procedures.

i. Dispose of spilled material and the absorbent in compliance with state and federal regulations.
j. Consult with Stormwater Team Leader for appropriate reporting procedures.

2. Large and Continuous Spills: Typically, major dimension is greater than 6', continuous flow, and cannot be contained, cleaned, and eliminated using onsite personnel.

   a. Leave the area and notify Emergency Responders (911).
   b. Give the operator the spill location, chemical name, and approximate amount.
   c. If safe, protect nearby storm drain inlets using absorbent booms or inlet barrier.
   d. Provide SDS information for the spilled chemical to emergency responders.
   e. Advise responders of any absorbents, containers, or spill control equipment that is available.
   f. Consult with Stormwater Team Leader for appropriate reporting procedures.

3. Spill Reporting

   a. Report all chemical spills, regardless of size, to a Stormwater Team Leader.
   b. Record spilled materials and cleanup procedures in Appendix A.

6.0 TRAINING

Staff receive training annually using the City's software application that includes the following:

1. Stormwater Overview Video: Stormwater in Bozeman – The Big Picture, which includes a Broad view of Bozeman's stormwater system and information about the importance of mitigating stormwater pollution

2. Facility Operations Training Video (30 minutes): Rain Check, which includes detailed Best Management Practices related to the following activities:

   - Good Housekeeping and Spill Prevention
   - Spill Control and Response
   - Vehicle Fueling
   - Vehicle and Equipment Maintenance
   - Vehicle and Equipment Washing
   - Materials Management
   - Waste Management
   - Facility Maintenance
   - Landscaping

3. FSWPPP Review: A portion of the training requires staff to review an updated version of this document.

Staff completed the following training:

Table 6.1: Training Program Results

Permit Year	Date	Type	Trainer	Attendees
2017	December 13, 2017	In-Person Group	Frank Greenhill	14 Staff
2018	November - December	Individual	Web Application	9 Staff
2019	December 11, 2019	In-Person Group	Frank Greenhill	14 Staff
2020	December	Individual	Web Application	14 Staff

Stormwater Team members participate in reoccurring informal meetings to cover corrective actions and the content contained within this Plan, typically after site inspections.

7.0 IMPAIRED WATERBODY DISCHARGE

Four of the WRF's five outfalls discharge stormwater to the East Gallatin River. The East

Gallatin has the following impairments:

1. Alterations in stream-side or littoral vegetative covers
    a. Source: Grazing in riparian or shoreline zones, irrigated crop production
    b. TMDL: N/A
    c. WRF Stormwater Input: None
    d. Applicable BMPs: None
2. Excess Algae Growth
    a. Source: Grazing in riparian or shoreline zones, municipal point source discharges, yard maintenance
    b. TMDL: N/A
    c. WRF Stormwater Input: Minor, landscape maintenance
    d. Applicable BMPs: Low Impact Site Development and stormwater basins
3. Low Flow Alterations
    a. Source: Irrigated Crop Production
    b. TMDL: N/A
    c. WRF Stormwater Input: None
    d. Applicable BMPs: None
4. Nitrogen (Total)
    a. Source: Yard maintenance, Municipal Point Source Discharges, grazing in riparian or shoreline zones
    b. TMDL: Yes
    c. WRF Stormwater Input: Minor, landscape maintenance
    d. Applicable BMPs: Low Impact Site Development and stormwater basins
5. Phosphorus (Total)
    a. Source: Municipal Point Source Discharges, grazing in riparian or shoreline zones
    b. TMDL: Yes
    c. WRF Stormwater Input: Minor, landscape maintenance
    d. Applicable BMPs: Low Impact Site Development and stormwater basins
6. pH
    a. Source: Municipal Point Source Discharges
    b. TMDL: Yes
    c. WRF Stormwater Input: Minor, spills
    d. Applicable BMPs: Spill prevention procedures

Catron Creek contains the remaining outfall, which has no identified impairments from MDEQ.

8.0 SELF-MONITORING REQUIREMENTS

The WRF is classified under Sector T, Which does not include industry specific benchmark parameters or require monitoring of stormwater discharges.

9.0 INSPECTIONS

The following information outlines inspection type and frequency timelines:

1. Routine/Quarterly Inspection: An inspector completes four times annually. Inspections occur once during each of the following timespans: January – March, April –June, July – September, and October – December. Inspector compiles report and communicates corrective actions with WRF leadership within 24-hours of the inspection, immediately if

there is a significant risk of pollution. Inspection locations include: site perimeter, entry and exit points, high-priority areas detailed in Section 4 of this Plan, post-construction control measures, outfalls, areas with historical issues, and obvious concerns identified during the site visit. One quarterly inspection must be completed during a period of time that a stormwater discharge is occurring, or, in the case of the WRF where discharges happen infrequently, during a time of wet weather.

2. Significant Storm Event: Qualified inspector completes as necessary dependent on rainfall totals. Inspectors conduct site visits within 72 hours after rain events that exceed .5" or more of precipitation or snowmelt events that produce a visible discharge. The inspector tracks rainfall totals using the rain gauge located at the Bozeman Airport - http://w1.weather.gov/obhistory/KBZN.html.

   The inspector compiles report and communicates corrective actions with WRF leadership within 24-hours of the inspection, immediately if there is a significant risk of pollution. Inspection locations include: site perimeter, entry and exit points, high-priority areas detailed in Section 4 of this Plan, post-construction control measures, outfalls, areas with historical issues, and obvious concerns identified during site visit.

Staff completed the following inspections:

Table 9.1: 2018 Inspections

Date	Type	Inspector	Weather	Corrective Actions
March 20, 2018	Routine/Quarterly	Frank Greenhill	Sunny, 55°F	6
April 25, 2018	Routine/Quarterly, Significant Storm Event	Kyle Mehrens	Sunny, 55°F	0
May 31, 2018	MDEQ Inspection	Lisa-Kaa, MDEQ	Rain, 50°F	1
June 4, 2018	Significant Storm Event	Frank Greenhill	Rain, 80°F	1
June 18, 2018	Significant Storm Event	Frank Greenhill	Sunny, 55°F	0
June 29, 2018	Significant Storm Event	Frank Greenhill	Sunny, 65°F	0
August 28, 2018	Significant Storm Event	Frank Greenhill	Overcast, 43°F	0
September 13, 2018	Routine/Quarterly	Frank Greenhill	Rain, 60°F	0
October 30, 2018	Routine/Quarterly	Frank Greenhill	Overcast, 35°F	0

Table 9.2: 2019 Inspections

Date	Type	Inspector	Weather	Corrective Actions
March 22, 2019	Routine/Quarterly	Frank Greenhill	Sunny, 19°F	0
April 10, 2019	Routine/Quarterly	Frank Greenhill	Rain, 36°F	0
April 23, 2019	Significant Storm Event	Frank Greenhill	Overcast, 68°F	0
May 20, 2019	Significant Storm Event	Frank Greenhill	Overcast, 45°F	0
June 11, 2019	Significant Storm Event	Frank Greenhill	Overcast, 60°F	0
June 20, 2019	Significant Storm Event	Frank Greenhill	Overcast, 45°F	0
August 19, 2019	Routine/Quarterly	Frank Greenhill	Sunny, 88°F	0
September 9, 2019	Significant Storm Event	Frank Greenhill	Overcast, 60°F	0
September 23, 2019	Significant Storm Event	Kyle Mehrens	Sunny, 70°F	1
December 13, 2019	Routine/Quarterly	Frank Greenhill	Overcast, 35°F	0

Table 9.3: 2020 Inspections				
Date	**Type**	**Inspector**	**Weather**	**Corrective Actions**
March 26, 2020	Routine/Quarterly	Frank Greenhill	Sunny, 19°F	0
June 8, 2020	Routine/Quarterly, Significant Storm Event	Frank Greenhill	Overcast, 55°F	1
June 17, 2020	Significant Storm Event	Frank Greenhill	Overcast, 55°F	0
August 28, 2020	Routine/Quarterly	Frank Greenhill	Sunny, 58°F	0
October 29, 2020	Routine/Quarterly	Frank Greenhill	Overcast, 33°F	1

10.0 RECORD KEEPING AND REPORTING

Annual Report Forms are prepared and submitted to DEQ by February 1, including:

1. DEQ Annual Report Form
2. Routine/Quarterly and Significant Storm Event Inspection Forms
3. Facility Maps (Appendix A)
4. Facility Vicinity Maps (Appendix B)
5. Corrective Actions Tracking (Appendix C)
6. Non-Compliance Tracking (Appendix E)
7. Spills and Leaks Tracking (Appendix D)
8. Revisions to FSWPPP (Appendix F)

Staff retains record for a minimum of five years from the date of creation. Staff updates the Plan annually as the WRF expands its operations, adds personnel, and changes procedures.

11.0 CERTIFICATIONS

The information in this Plan, to the best of my knowledge and the amount feasible, is accurate and will be carried out by Staff at the WRF.

_____

WRF Superintendent (Print Name)

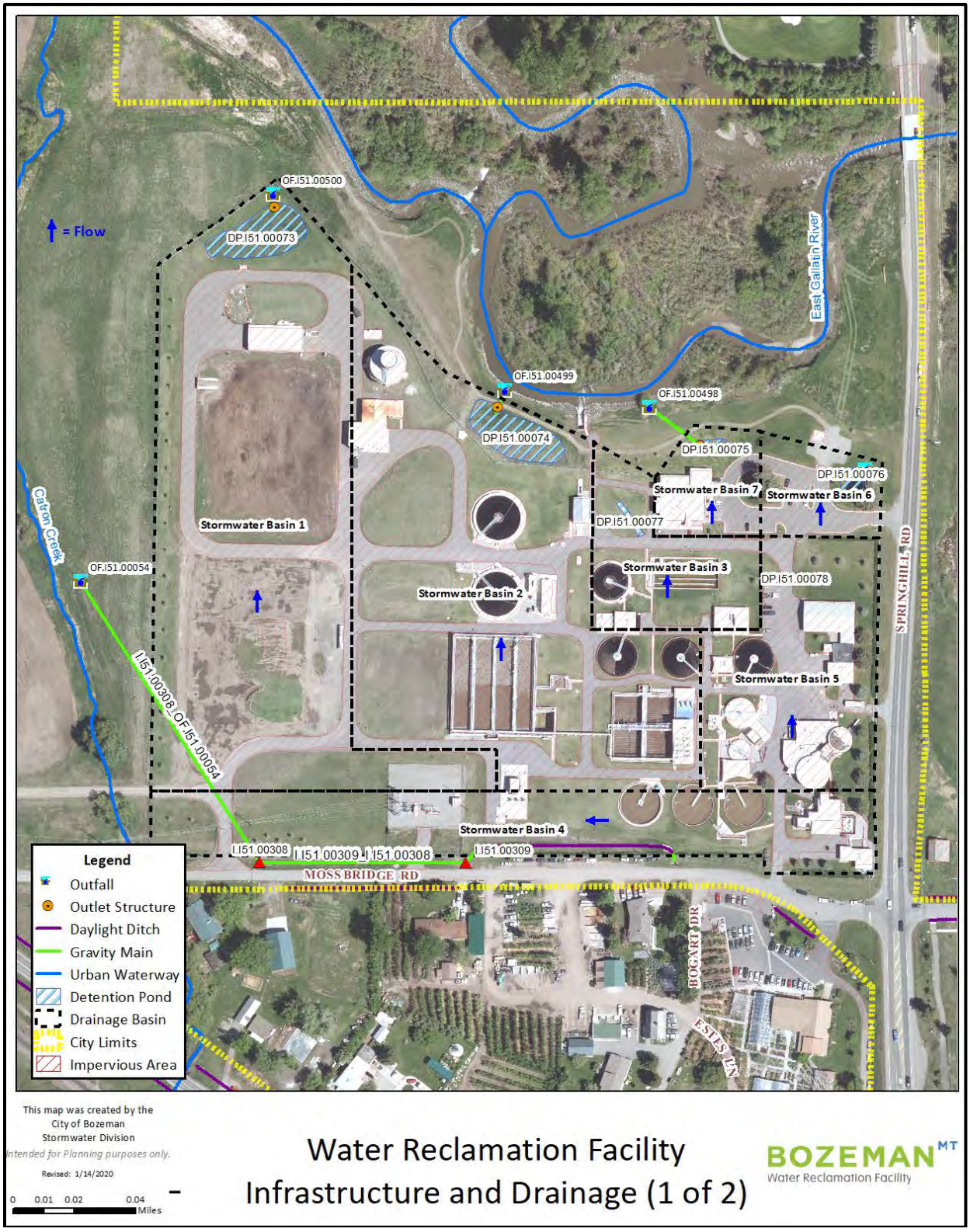
_____

WRF Superintendent (Signature)

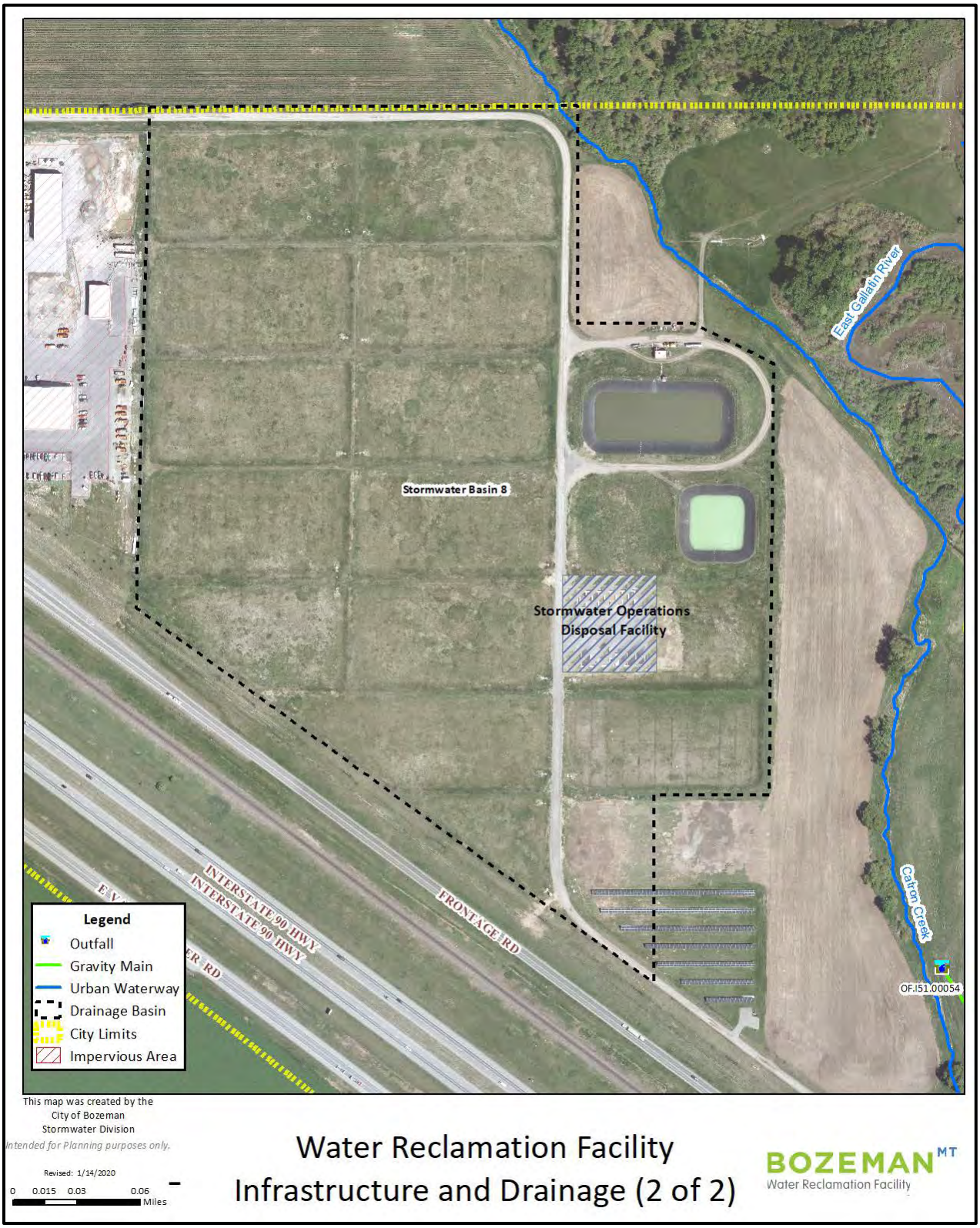
_____

Date

Appendix A: Facility Maps



Appendix A: Facility Maps



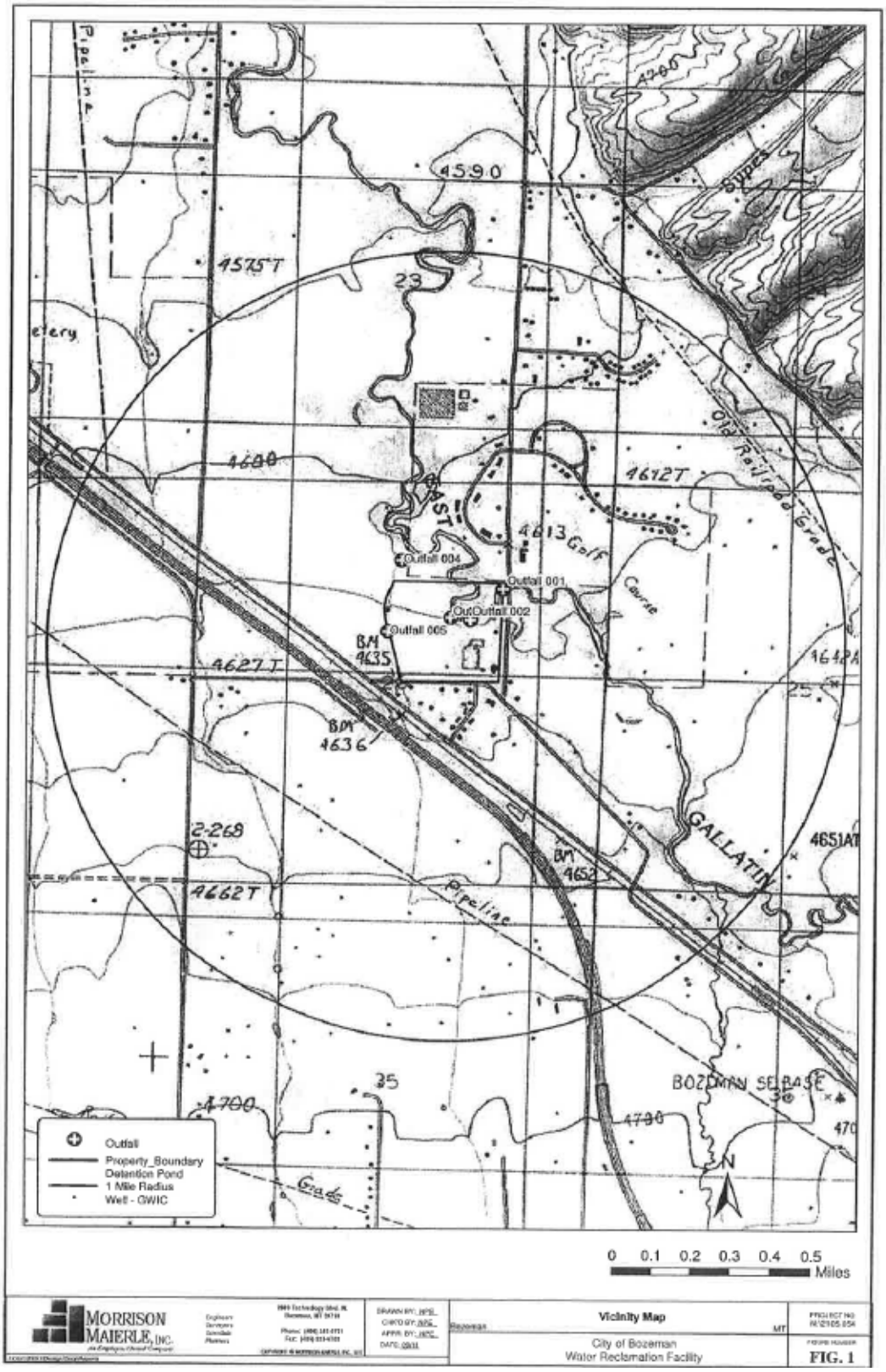
Appendix A: Facility Maps



Appendix A: Facility Maps



Appendix B: Facility Vicinity Map



Appendix C: Corrective Action Tracking Sheet

#	Date	Description of Issue & Required Corrective Action	Responsible Party	Corrective Action Description	Date Completed
1	3/20/2018	Sweep roads around stockpile removal area.	Streets Dept.	Streets Division swept roads with street sweeper after mulch was spread.	3/23/2018
2	3/20/2018	Stabilize disturbed area with remaining mulch.	Kevin Handelin	Solid Waste Division spread remaining mulch.	3/23/2018
3	3/20/2018	Spot clean spills from contractor staging area.	Brian Carey	Contractor cleaned spills.	4/1/2018
4	3/20/2018	Require contractor to contain or cover fuel and chemicals stored outdoors.	Brian Carey	Contractor contained fuel and chemicals.	4/1/2018
5	3/20/2018	Require contractor to prevent leaks and spills from equipment.	Brian Carey	Contractor cleaned spills and removed equipment from facility.	11/1/2018
6	3/20/2018	Label spill kit and provide clean up and disposal instructions.	Brian Carey	Spill kit was labeled and spill response plan was included with spill kit.	5/1/2018
7	6/4/2018	Sweep roads around stockpile storage area.	Brian Carey	Roads were swept after stockpiles were removed.	6/20/2018
8	6/19/2018	Include stormwater basin and rock garden installation details in SWPPP.	Frank Greenhill	All details were added to SWPPP.	7/17/2018
9	9/23/2019	Fall vegetation maintenance for all post-construction facilities is required	Brian Carey	Ponds had vegetation cut and removed.	11/08/2019
10	6/8/2020	Diesel tank fuel nozzle has a minor leak / drip.	Brian Carey	Nozzle replaced and spill is cleaned	6/15/2020
11	10/29/2020	Stabilize COP Construction job trailer parking/staging area.	Tom Radcliffe	Contractor closed job trailer parking/staging area and surface roughened.	11/2/2020

Appendix D: Spills and Leak Tracking Sheet

Date	Spill	Leak	Source and Location	Description			Response Procedures	Measures Taken to Prevent Reoccurrence
	(check one)			Material	Quantity	Reason		
~~5/14/2018~~	~~X~~		~~Hydraulic hose on skid steer~~	~~Hydraulic Fluid~~	~~>10 gals.~~	~~Hose ruptured~~	~~Immediate implementation of spill response plan.~~	~~Preventative maintenance on equipment and spill response training.~~
~~6/8/2020~~		~~X~~	~~Leaking fuel tank nozzle~~	~~Diesel fuel~~	~~>0.1 gals~~	~~Leaking nozzle~~	~~Notified Brian Carey and spill cleaned immediately.~~	~~Brian Carey replaced leaking nozzle.~~

Appendix E: Non-Compliance Tracking Sheet

#	Date	Description of Issue	Responsible Party	Corrective Action Description	Date Completed
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					

Appendix F: FSWPPP Revisions Tracking Sheet

#	Date	Description of Revision	Responsible Party
1	1/10/2020	Sec. 9.0 Inspections: Added 2018 & 2019 inspection summary	Frank Greenhill
2	1/10/2020	Sec. 10.0 Record Keeping & Reporting: Added Spills and Leak Tracking sheet and clarified inspection frequency language.	Frank Greenhill
3	1/10/2020	Added Corrective Action, Spills and Leaks, Non-Compliance, and FSWPPP Revisions Tracking Sheets	Frank Greenhill
4	1/10/2020	Sec. 6.0 Training: Added 2018 and 2019 training summaries.	Frank Greenhill
5	6/22/19	Updated Appendix C & D	Frank Greenhill
6	1/5/2021	Updated Sections 6.0 and 9.0 with 2020 information. Deleted ORI Dry Weather Screening inspections.	Frank Greenhill
7	1/14/2021	Changed document font, updated the offsite coordinator's name, updated the spill response plan, converted narrative inspection and training content into tables, updated the description of the training application, updated and corrected language throughout the document, and updated the facility maps.	Kayla Mehrens
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			

Facility Stormwater Pollution Prevention Plan

East Gallatin Storage Area

2300 Block of North Rouse Ave
P.O. Box 1230
Bozeman, Montana 59771

Updated: 2020

1.0 OVERVIEW

This Facility Stormwater Pollution Prevention Plan (FSWPPP) includes Standard Operating Guidelines (SOG) developed to mitigate pollutants generated at the East Gallatin Storage Area (Facility).

2.0 STORMWATER TEAM

The following Staff members are responsible for the FSWPPP's implementation:

a. Leader: John Vandelinder, Streets Superintendent
b. Leader: Alex Nordquest, Forestry Superintendent
c. Offsite Coordinator: Kayla Mehrens, Stormwater Program Coordinator

3.0 SITE DESCRIPTION

The Facility provides storage for materials such as rock chips, street sweepings, cut boulevard trees, and fill. One drainage basin exists:

a. Drainage Basin #1: Nine acres with a minor amount of impervious area near the Facility's entrance. A new access road is currently under construction along the Facility's southern boundary, which will be included once complete.

4.0 IMPAIRED WATERBODY

The Facility is adjacent to the East Gallatin River, which is impaired for nutrients; however, existing topography holds water on site where it infiltrates and/or evaporates. The risk of stormwater discharge from the Facility is low and unlikely.

5.0 SAMPLING

There is no stormwater infrastructure on this site or runoff to the City's stormwater system. As such, Staff did not complete sampling. Topography and permeability prevent the depth and discharge of stormwater that would make sampling possible.

6.0 POLLUTION IDENTIFICATION

Following is a list of identified pollutants and an assessment of likely sources at the Facility:

a. Total Suspended Solids: Traction sand and organics (ex. tree trimmings and mulch)
b. Oil and Grease: Vehicle leaks
c. Total Nitrogen: Organics
d. Phosphorus: Traction sand and organics
e. Zinc: Metal surfaces and brake dust
f. Lead: Brake dust and exhaust
g. Copper: Brake dust and exhaust
h. pH: Concrete washout
i. Floatables: Litter

7.0 SITE ASSESSMENT

Section 7.0 outlines the City's Facility Minimum Standards (Standards) applicable to this Facility. All Standards are listed in the City's Stormwater Management Plan (SWMP).

7.1 Standard: Tracking controlled at all entries, exits, and within parking areas

a. Site Components and Compliance Assessment:
    - Gravel lot
        - Compliant: Asphalt entrance and compacted gravel lot.
b. Standard Operating Guidelines:
    - Sweep paved entryway if a noticeable accumulation of debris occurs.
c. Corrective Action(s):
    - 2020: None

7.2 Standard: Preventative maintenance on equipment and vehicles

a. Site Components and Compliance Assessment:
    - Water/Sewer/Storm, Forestry, and Street Division Equipment and Vehicles
        - Compliant: Vehicles and equipment inspected and maintained regularly, preventative maintenance documentation filed in CityWorks.
b. Standard Operating Guidelines:
    - Visual inspection of all vehicles/equipment before use.
    - Complete minor maintenance and repair of equipment indoors. Complete more extensive work at the Vehicle Maintenance Facility.
    - Document inspections, maintenance, and repair per Division specific guidelines.
c. Corrective Action(s):
    - 2020: None

7.3 Standard: Stabilize disturbed areas

a. Site Components and Compliance Assessment:
    - Ongoing construction of the access road from the southwest includes erosion and sediment control BMPs, and will be stabilized post-construction.
        - Compliant
b. Standard Operating Guidelines:
    - None
c. Corrective Action(s):
    - 2020: None

7.4 Standard: Store chemicals under cover and within secondary containment

a. Site Components and Compliance Assessment:
    - Water containers are stored on site, no chemicals stored at the Facility.
        - Compliant
    - Uncontained concrete washout on the ground.
        - Not Compliant
b. Standard Operating Guidelines:
    - Contain concrete washout in a lined capture area, let liquids dry/evaporate, and dispose solids in a dumpster or haul directly to the landfill.
c. Corrective Action(s):
    - 2020: Construct a temporary or permanent concrete washout.

8.0 SPILL RESPONSE PLAN

The following is the City's spill response plan, including response, mitigation, and reporting protocols.

8.1 Small and Medium Spills: Typically, major dimension is less than 6' and can be contained, cleaned, and eliminated using onsite personnel, spill kits and/or the Public Works vehicle.

a. Locate spill kit and put on PPE.

b. If necessary, deploy Public Works spill response vehicle.
c. Control spill by stopping or securing the source.
d. Protect all storm drain inlets near the spill using absorbent booms or inlet barrier.
e. Identify spilled material.
f. Clean spill using appropriate absorbents or other methods. *Never wash spills down the drain!*
g. Place spill material and absorbents in secure containers.
h. Consult with Stormwater Team Leader and the SDS for spill and waste disposal procedures.
i. Dispose of spilled material and the absorbent in compliance with state and federal regulations.
j. Consult with Stormwater Team Leader for appropriate reporting procedures.

8.2 Large and Continuous Spills: Typically, major dimension is greater than 6', continuous flow, and cannot be contained, cleaned, and eliminated using onsite personnel.

a. Leave the area and notify Emergency Responders (911).
b. Give the operator the spill location, chemical name, and approximate amount.
c. If safe, protect nearby storm drain inlets using absorbent booms or inlet barrier.
d. Provide SDS information for the spilled chemical to emergency responders.
e. Advise responders of any absorbents, containers, or spill control equipment that is available.
f. Consult with Stormwater Team Leader for appropriate reporting procedures.

8.3 Spill Reporting

a. Report all chemical spills, regardless of size, to a Stormwater Team Leader.

9.0 TRAINING

Staff receives training related to this Facility per the requirements within the Citys MS4 Permit and maintains training documentation in the SWMP.

10.0 INSPECTIONS

The Offsite Coordinator, or their designated representative, completes an annual inspection at the Facility to determine compliance with the City's Facility Minimum Standards listed in the SWMP. Updates to this FSWPPP occur based on the results.

a. The initial site inspeciton was completed September 22, 2020.

11.0 INFRASTRUCTURE IMPROVEMENTS

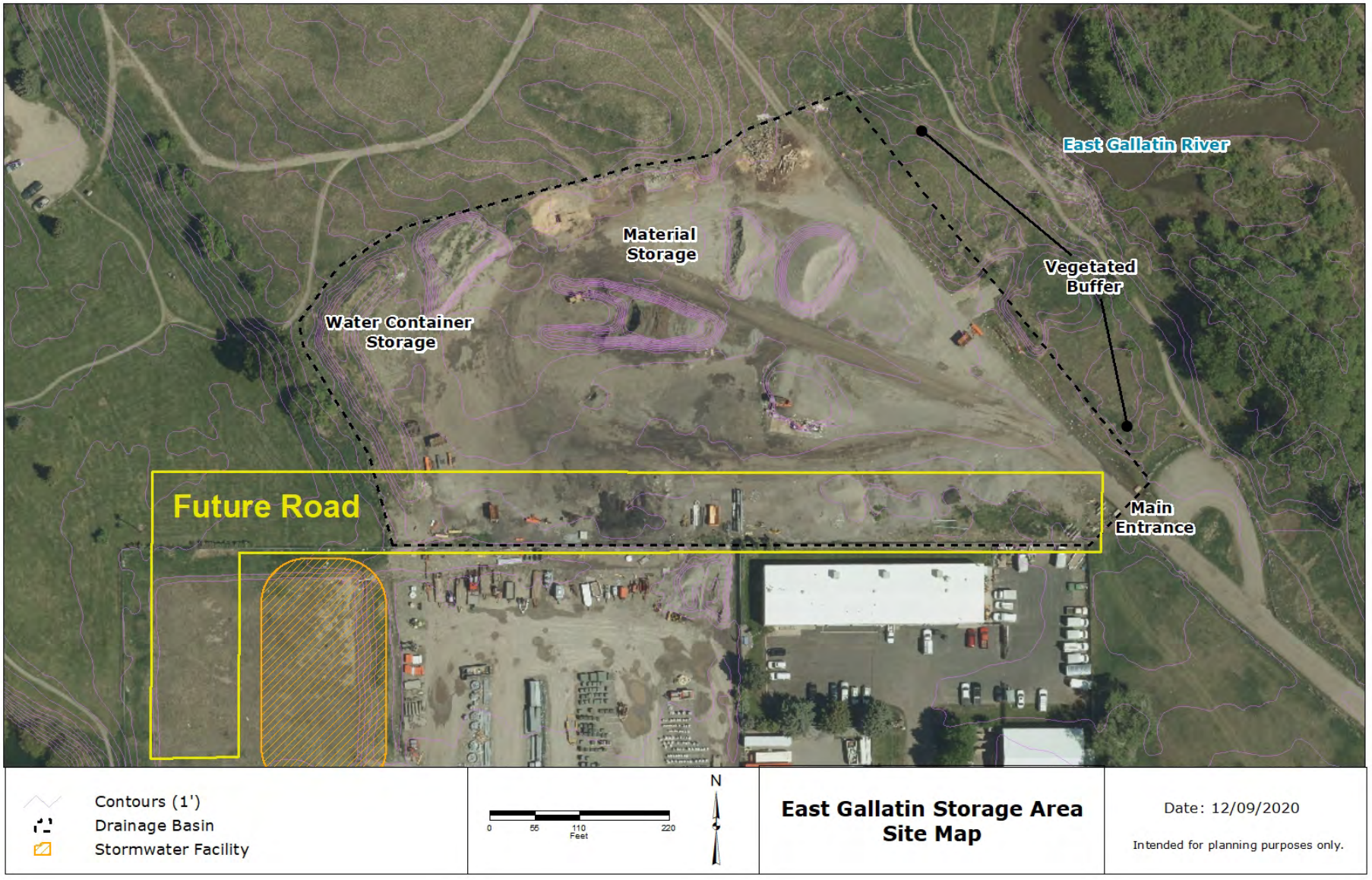
Staff identified the following project needs and plans to propose during the development of future Capital Improvement Plans (CIP):

a. None

12.0 RECORD KEEPING AND REPORTING

Staff store copies of this FSWPPP at the City Shops Facility and the Stormwater Division's Office.

Appendix A: Site Map



Facility Storm Water Pollution Prevention Plan

Solid Waste Landfill
2143 Story Mill Rd
P.O. Box 1230
Bozeman, Montana 59771

2020 Update

Mission Statement: Maintain a best in class facility that works to minimize, to the extent feasible, stormwater pollutant transport to adjacent waterbodies using historical knowledge and good engineering design. Operating principles include:

- *Minimizing pollutant exposure;*
- *Sustaining an orderly and clean facility;*
- *Maintaining installed operational and structural controls;*
- *Reducing risk of leaks, spills, and other releases;*
- *Implementing pollution response and cleanup plans; and*
- *Mitigating the transport of sediment during ground disturbing activities.*

1.0 OVERVIEW

This Stormwater Pollution Prevention Plan (Plan) outlines roles, responsibilities, and procedures for Staff operating the City of Bozeman's Solid Waste Landfill (Facility).

2.0 STORMWATER TEAM

Leader & Onsite Coordinator: Kevin Handelin
Title: Solid Waste Superintendent
Office Phone: (406)582-3238
Email: khandelin@bozeman.net
Responsibilities: Oversees and makes decisions related to personnel, operations, and Solid Waste Landfill investments. Implements plan, oversees personnel, and implements corrective actions.

Offsite Coordinator: Kayla Mehrens
Title: Stormwater Program Coordinator
Office Phone: (406)582-2270
Cell Phone: (406)579-3971
Responsibilities: Provides technical support.

FSWPPP Administrator and Site Inspector: Frank Greenhill
Title: Stormwater Program Specialist
Office Phone: (406)582-2917
Cell Phone: (406)600-7928
Responsibilities: Provides technical support and completes inspections.

3.0 SITE DESCRIPTION

The Facility has been operating as a Class II landfill since the late 1970's. As of 2010, the Facility no longer excepts Class II municipal solid waste for permanent disposal. The Facility currently operates under a Montana DEQ Minor Class IV permit.

Located on the north end of the City, west of Story Mill Road, the Facility covers approximately 200 acres, of which approximately 12 acres is used for solid waste disposal and operations, including a five acre municipal compost area, a one acre convenience site, and six acres for operations and staging. Forty acres of the Facility has been permenantly converted to a dog park. Customers are allowed to bring Class II waste to the convenience site located at the

Story Mill Rd. entrance, where it is stored in dumpsters and then transported to the Logal Landfill in Gallatin County for disposal. The Facility consist of primarily permeable landscape and has approximately eight acres of impervious area.

The Facility controls stormwater runoff with three stormwater basins, including two retention basins and one detention basin. One retention basin collects sheet-flow runoff from the municipal compost area, while the other retention basin collect run-off from a portion of the Solid Waste Operations area. The detention basin collects runoff from closed and capped Class I, Class II, and Class IV cells. Stormwater is conveyed to the detention basin via vegetated swales.

Major components of the Facility include:

1. Convenience Site
2. Municpal Composte Disposal Area
3. Solid Waste Operations

4.0 POLLUTION ASSESSMENT

The Facility is a closed Class II facility with low risk of stormwater pollution. The following information describes the Facility's potential sources of pollution and Best Management Practices (BMPs) implemented to mitigate the pollution risk include:

1. Site Drainage and Development Footprint

    a. Pollutant Quantity: Variable
    b. Stormwater Pollution Probability: Low
    c. Pollutant(s) of Concern: Sediment from atmospheric dust deposition and gravel roads, oils, greases, fuels, and metals from vehicle and equipment movements, and floatables
    d. Deployed BMPs:

    Low impact development:

    - Vegetated swales and culverts adjacent to internal roads receive sheet flow and direct runoff to two retention basins and one detention pond.
    - One detention basin designed to capture and regulate stormwater discharge flowing from the connected impervious areas and closed municipal waste cells.
    - One retention basin designed to capture and infiltrate runoff from a portion of the Solid Waste Operations area.
    - One retention basin designed to capture and infiltrate runoff from the Municipal Compost Area.

    Infrastructure maintenance:

    - Designate the bottom of basins as a "no mow zone" during the growing season.
    - Eliminate any and all fertilizer use adjacent to or near any stormwater feature.
    - Sickle mow basins every fall to 6" and remove all clipped vegetation.
    - Inspect basins annually for a buildup of debris and sediment.
    - Remove accumulated debris and vegetation from around all culverts.

    Street sweeping:

    - Contact Street's Division for sweeping assistance when a noticeable amount of dust or debris is deposited on drive aisles and parking areas.

2. Fleet Storage and Management

    a. Pollutant Quantity: Variable
    b. Stormwater Pollution Probability: Low
    c. Pollutant(s) of Concern: Gas, diesel, oil, grease, detergents, wash water, and metals

d. Deployed BMPs:

Preventative fleet maintenance:

- Inspect equipment before every use.
- Conduct vehicle maintenance indoors.
- Utilize pans to capture dripping fluids.
- Follow preventative maintenance schedules.
- Notify supervisor to schedule a repair with Vehicle Maintenance if an issue occurs.
- Spot clean stained asphalt or concrete using onsite spill kit and procedures.

Equipment washing:

- Complete major washing activities (i.e. those that include the use of soaps and degreasers) inside the vehicle and equipment maintenance building ensuring all wash water drains into sanitary system.

3. Waste Transportation

a. Pollutant Quantity: Variable
b. Stormwater Pollution Probability: Low
c. Pollutant(s) of Concern: Oils and greases and floatables
d. Deployed BMPs:

Leak proof transportation vehicles:

- Transportation of municipal solid waste is conducted using leak-proof vehicles preventing the discharge, dumping, spilling, or leaking from the transport vehicle.

Off-Site Spill Response Plan

- Contact Vehicle Maintenance immediately if an oil, grease, hydraulic fluid, etc. spill occurs. Vehicle Maintenance deploys a spill response vehicle and cleans and disposes of spilled material.

4. Gasoline and Diesel Storage and Fueling

a. Quantity: Two, 1,000 gallon fuel tanks (2,000 gallons maximum)
b. Stormwater Contact Probability: Low
c. Pollutant(s) of Concern: Hydrocarbons, benzene, toluene, xylene, and lead
d. Deployed BMPs:

Double walled fuel tanks:

- Inspect semi-annually for leaks into secondary containment per manufacture's recommendation. If leak is found, contact Stormwater Team immediately.

Fueling procedure:

- Inspect hoses, caps, tanks, and nozzles for leaks before fueling.
- Watch all fueling activities.
- Spot clean drips or noticeable stains on road surface using spill kit, dispose generated waste in dumpster.

5. Oil and Grease Storage

a. Quantity: < 25 gallons
b. Stormwater Contact Probability: Low
c. Pollutant(s) of Concern: Oils and Greases
d. Deployed BMPs:

Inside storage:

- Inspect hoses, caps, oil pans, valves, tanks, and nozzles for leaks before use.
- All filling and draining activities are completed at the Vehicle Maintenance facility.
- Spot clean drips or stains using the spill kit, dispose generated waste in dumpster

6. Erosion and Sediment Control

   a. Quantity: Varied dependent on project
   b. Pollutant(s) of Concern: Sediment
   c. Stormwater Contact Probability: Hi
   d. Deployed BMPs:

   Stormwater Division Permitting Program:

   - Require contractor to complete Stormwater Permit for all construction activities.

7. Dumpster Storage

   a. Quantity: Varied.
   b. Pollutant(s) of Concern: Oils and greases, floatables
   c. Stormwater Contact Probability: Low
   d. Deployed BMPs:

   - Clean dumpsters and residential totes indoors, with wash water draining into the sanitary system. Store dumpsters with lids closed.

5.0 SPILL RESPONSE PLAN

The following is the City's spill response plan, including response, mitigation, and reporting protocols.

1. Small and Medium Spills: Typically, major dimension is less than 6' and can be contained, cleaned, and eliminated using onsite personnel, spill kits or the Public Works vehicle.

   a. Locate spill kit and put on PPE.
   b. In necessary, deploy Public Works spill response vehicle.
   c. Control spill by stopping or securing the source.
   d. Protect all storm drain inlets near the spill using absorbent booms or inlet barrier.
   e. Identify spilled material.
   f. Clean spill using appropriate absorbents or other methods.
   g. Place spill material and absorbents in secure containers.
   h. Consult with Stormwater Team Leader and the SDS for spill and waste disposal procedures.
   i. Dispose of spilled material and the absorbent in compliance with state and federal regulations.
   j. Consult with Stormwater Team Leader for appropriate reporting procedures.

2. Large and Continuous Spills: Typically, major dimension is greater than 6', continuous flow, and cannot be contained, cleaned, and eliminated using onsite personnel.

   a. Leave the area and notify Emergency Responders (911).
   b. Give the operator the spill location, chemical name, and approximate amount.
   c. If safe, protect nearby storm drain inlets using absorbent booms or inlet barrier.
   d. Provide SDS information for the spilled chemical to emergency responders.
   e. Advise responders of any absorbents, containers, or spill control equipment that is available.

f. Consult with Stormwater Team Leader for appropriate reporting procedures.

3. Spill Reporting

   a. Report all chemical spills, regardless of size, to a Stormwater Team Leader.
   b. Record spilled materials and cleanup procedures in Appendix A.

6.0 TRAINING

Staff receive training annually using the City's software application that includes the following:

1. Stormwater Overview Video: Stormwater in Bozeman – The Big Picture, which includes a Broad view of Bozeman's stormwater system and information about the importance of mitigating stormwater pollution
2. Facility Operations Training Video (30 minutes): Rain Check, which includes detailed Best Management Practices related to the following activities:
   - Good Housekeeping and Spill Prevention
   - Spill Control and Response
   - Vehicle Fueling
   - Vehicle and Equipment Maintenance
   - Vehicle and Equipment Washing
   - Materials Management
   - Waste Management
   - Facility Maintenance
3. FSWPPP Review: A portion of the training requires staff to review an updated version of this document.

Staff completed the following training:

Table 6.1: Training Program Results

Permit Year	Date	Type	Trainer	Attendees
2017	April, December	Individual	Web Application	16 Staff
2018	November - December	Individual	Web Application	17 Staff
2019	December 20, 2019	In-Person Group	Frank Greenhill	16 Staff
2020	December	Individual	Web Application	19 Staff

Stormwater Team members participate in reoccurring informal meetings to cover corrective actions and the content contained within this Plan, typically after site inspections.

7.0 IMPAIRED WATERBODY DISCHARGE

The Landfill's one (1) outfall discharges stormwater to an un-named tributary of the East Gallatin River. The East Gallatin has the following impairments:

1. Alterations in stream-side or littoral vegetative covers

   a. Source: Grazing in riparian or shoreline zones, irrigated crop production
   b. TMDL: N/A
   c. Landfill Stormwater Input: None
   d. Applicable BMPs: None

2. Excess Algae Growth

   a. Source: Grazing in riparian or shoreline zones, municipal point source discharges, yard maintenance
   b. TMDL: N/A
   c. Landfill Stormwater Input: Minor, landscape maintenance

d. Applicable BMPs: Low Impact Site Development and stormwater basins

3. Low Flow Alterations

    a. Source: Irrigated Crop Production
    b. TMDL: N/A
    c. Landfill Stormwater Input: None
    d. Applicable BMPs: None

4. Nitrogen (Total)

    a. Source: Yard maintenance, Municipal Point Source Discharges, grazing in riparian or shoreline zones
    b. TMDL: Yes
    c. Landfill Stormwater Input: Minor, landscape maintenance
    d. Applicable BMPs: Low Impact Site Development and stormwater basins

5. Phosphorus (Total)

    a. Source: Municipal Point Source Discharges, grazing in riparian or shoreline zones
    b. TMDL: Yes
    c. Landfill Stormwater Input: Minor, landscape maintenance
    d. Applicable BMPs: Low Impact Site Development and stormwater basins

6. pH

    a. Source: Municipal Point Source Discharges
    b. TMDL: Yes
    c. Landfill Stormwater Input: Minor, spills
    d. Applicable BMPs: Spill prevention procedures

8.0 SELF MONITORING REQUIREMENTS

The Solid Waste Landfill is classified under Sector L, which requires monitoring of stormwater discharges and includes the following industry specific benchmark parameters:

- Total Suspended Solids (TSS): Benchmark monitoring concentration: 100 mg/L
- Total Iron: Benchmark monitoring concentration: 1 mg/L

Onsite personnel have not observed a stormwater discharge since 1991. Since, the detention basin has been enlarged and all active cells have been capped and vegetated. Staff will continue to monitor, but does not expect to see a discharge.

Table 8.1: 2018 Discharge Monitoring Summary

Term	Submittal Date	Result
Quarter 1	4/5/2018	No Discharge
Quarter 2	7/9/2018	No Discharge
Quarter 3	10/5/2018	No Discharge
Quarter 4	1/9/2019	No Discharge

Table 8.1: 2019 Discharge Monitoring Summary

Term	Submittal Date	Result
Quarter 1	4/11/2019	No Discharge
Quarter 2	7/11/2019	No Discharge
Quarter 3	11/5/2019	No Discharge
Quarter 4	1/7/2020	No Discharge

Table 8.1: 2020 Discharge Monitoring Summary		
Term	**Submittal Date**	**Result**
Quarter 1	5/13/2020	No Discharge
Quarter 2	8/5/2020	No Discharge
Quarter 3	11/5/2020	No Discharge
Quarter 4	1/5/2021	No Discharge

9.0 INSPECTIONS

The following information outlines inspection type and frequency timelines:

1. Routine/Quarterly Inspection: An inspector completes four times annually. Inspections occur once during each of the following timespans: January – March, April –June, July – September, and October – December. Inspector compiles report and communicates corrective actions with WRF leadership within 24-hours of the inspection, immediately if there is a significant risk of pollution. Inspection locations include: site perimeter, entry and exit points, high-priority areas detailed in Section 4 of this Plan, post-construction control measures, outfalls, areas with historical issues, and obvious concerns identified during the site visit. One quarterly inspection must be completed during a period of time that a stormwater discharge is occurring, or, in the case of the WRF where discharges happen infrequently, during a time of wet weather.

2. Significant Storm Event: Qualified inspector completes as necessary dependent on rainfall totals. Inspectors conduct site visits within 72 hours after rain events that exceed .5" or more of precipitation or snowmelt events that produce a visible discharge. The inspector tracks rainfall totals using the rain gauge located at the Bozeman Airport - http://w1.weather.gov/obhistory/KBZN.html.

   The inspector compiles report and communicates corrective actions with WRF leadership within 24-hours of the inspection, immediately if there is a significant risk of pollution. Inspection locations include: site perimeter, entry and exit points, high-priority areas detailed in Section 4 of this Plan, post-construction control measures, outfalls, areas with historical issues, and obvious concerns identified during site visit.

Staff completed the following inspections:

Table 9.1: 2018 Inspections				
Date	**Type**	**Inspector**	**Weather**	**Corrective Actions**
March 20, 2018	Routine/Quarterly	Frank Greenhill	Sunny, 38°F	2
April 25, 2018	Routine/Quarterly, Significant Storm Event	Frank Greenhill	Sunny, 60°F	3
May 31, 2018	MDEQ Inspection	Lisa-Kaa, MDEQ	Rain, 50°F	1
June 4, 2018	Significant Storm Event	Frank Greenhill	Overcast, 80°F	4
June 19, 2018	Significant Storm Event	Frank Greenhill	Sunny, 52°F	5
June 29, 2018	Significant Storm Event	Frank Greenhill	Sunny, 70°F	0
August 28, 2018	Significant Storm Event	Frank Greenhill	Overcast, 52°F	6
September 13, 2018	Routine/Quarterly	Frank Greenhill	Rain, 60°F	6
October 30, 2018	Routine/Quarterly	Frank Greenhill	Overcast, 37°F	5

Table 9.2: 2019 Inspections				
Date	**Type**	**Inspector**	**Weather**	**Corrective Actions**
March 22, 2019	Routine/Quarterly	Frank Greenhill	Sunny, 20°F	3
April 10, 2019	Routine/Quarterly	Frank Greenhill	Snow, 35°F	3
April 23, 2019	Significant Storm Event	Frank Greenhill	Overcast, 68°F	4
May 20, 2019	Significant Storm Event	Frank Greenhill	Overcast, 45°F	4
June 7, 2019	Significant Storm Event	Frank Greenhill	Overcast, 60°F	5
June 20, 2019	Significant Storm Event	Frank Greenhill	Overcast, 45°F	0
August 27, 2019	Routine/Quarterly	Frank Greenhill	Sunny, 74°F	2
September 9, 2019	Significant Storm Event	Frank Greenhill	Overcast, 45°F	2
September 23, 2019	Significant Storm Event	Kyle Mehrens	Sunny, 70°F	0
December 13, 2019	Routine/Quarterly	Frank Greenhill	Overcast, 35°F	2

Table 9.3: 2020 Inspections				
Date	**Type**	**Inspector**	**Weather**	**Corrective Actions**
March 26, 2020	Routine/Quarterly	Frank Greenhill	Sunny, 40°F	3
June 8, 2020	Routine/Quarterly, Significant Storm Event	Frank Greenhill	Partly Sunny, 54°F	2
June 19, 2020	Significant Storm Event	Frank Greenhill	Sunny, 68°F	2
August 28, 2020	Routine/Quarterly	Frank Greenhill	Sunny, 58°F	1
October 29, 2020	Routine/Quarterly	Frank Greenhill	Overcast, 33°F	1

10.0 RECORD KEEPING AND REPORTING

Annual Report Forms are prepared and submitted to DEQ by February 1, including:

1. DEQ Annual Report Form
2. Routine/Quarterly and Significant Storm Event Inspection Forms
3. Facility Maps (Appendix A)
4. Facility Vicinity Maps (Appendix B)
5. Corrective Actions Tracking (Appendix C)
6. Non-Compliance Tracking (Appendix E)
7. Spills and Leaks Tracking (Appendix D)
8. Revisions to FSWPPP (Appendix F)

Staff retains record for a minimum of five years from the date of creation. Staff updates the Plan annually as the WRF expands its operations, adds personnel, and changes procedures.

11.0 CERTIFICATIONS

The information in this Plan, to the best of my knowledge and the amount feasible, is accurate and will be carried out by Staff at the Facility.

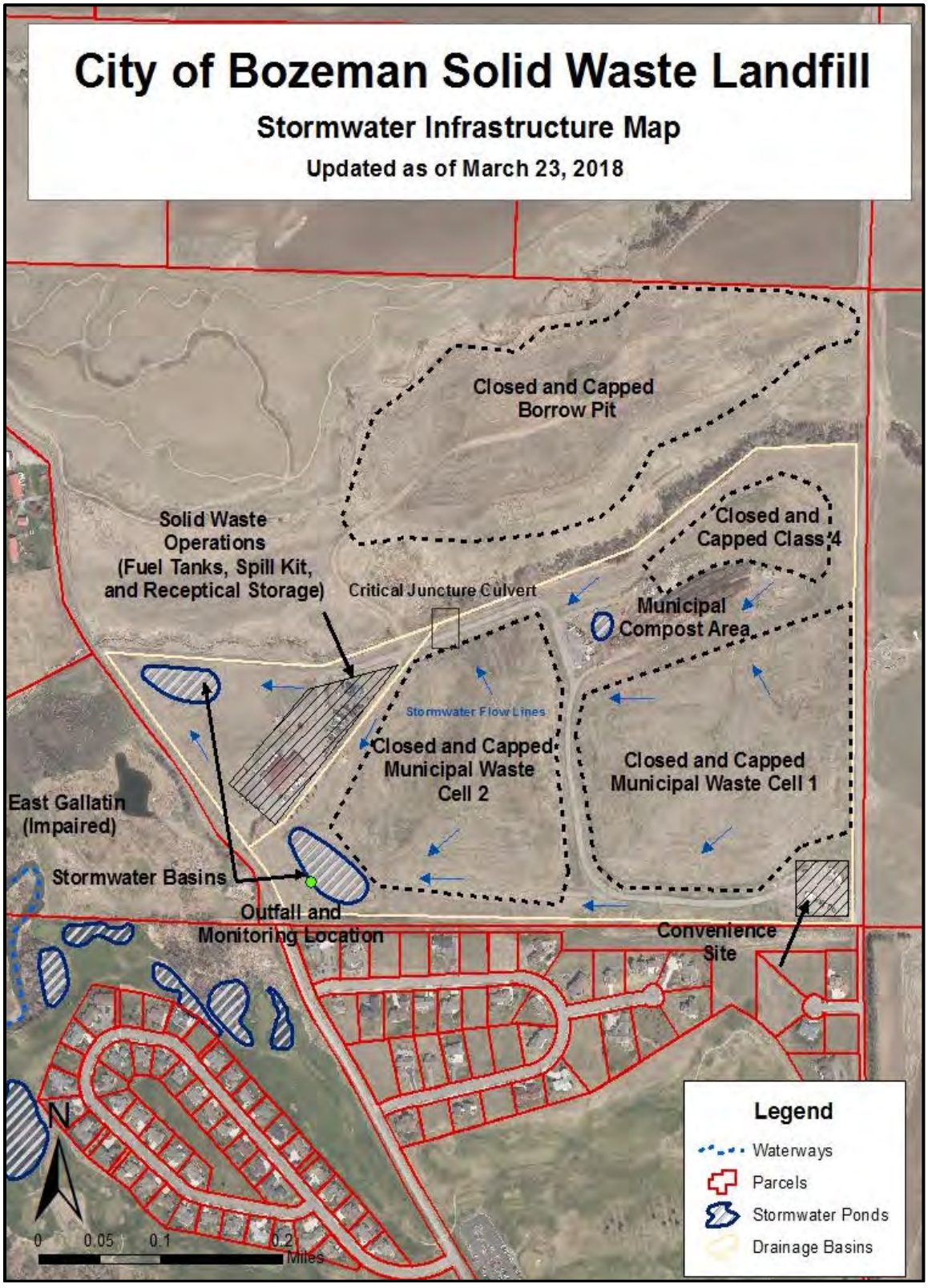
_____ _____

Solid Waste Superintendent (Print Name) Date

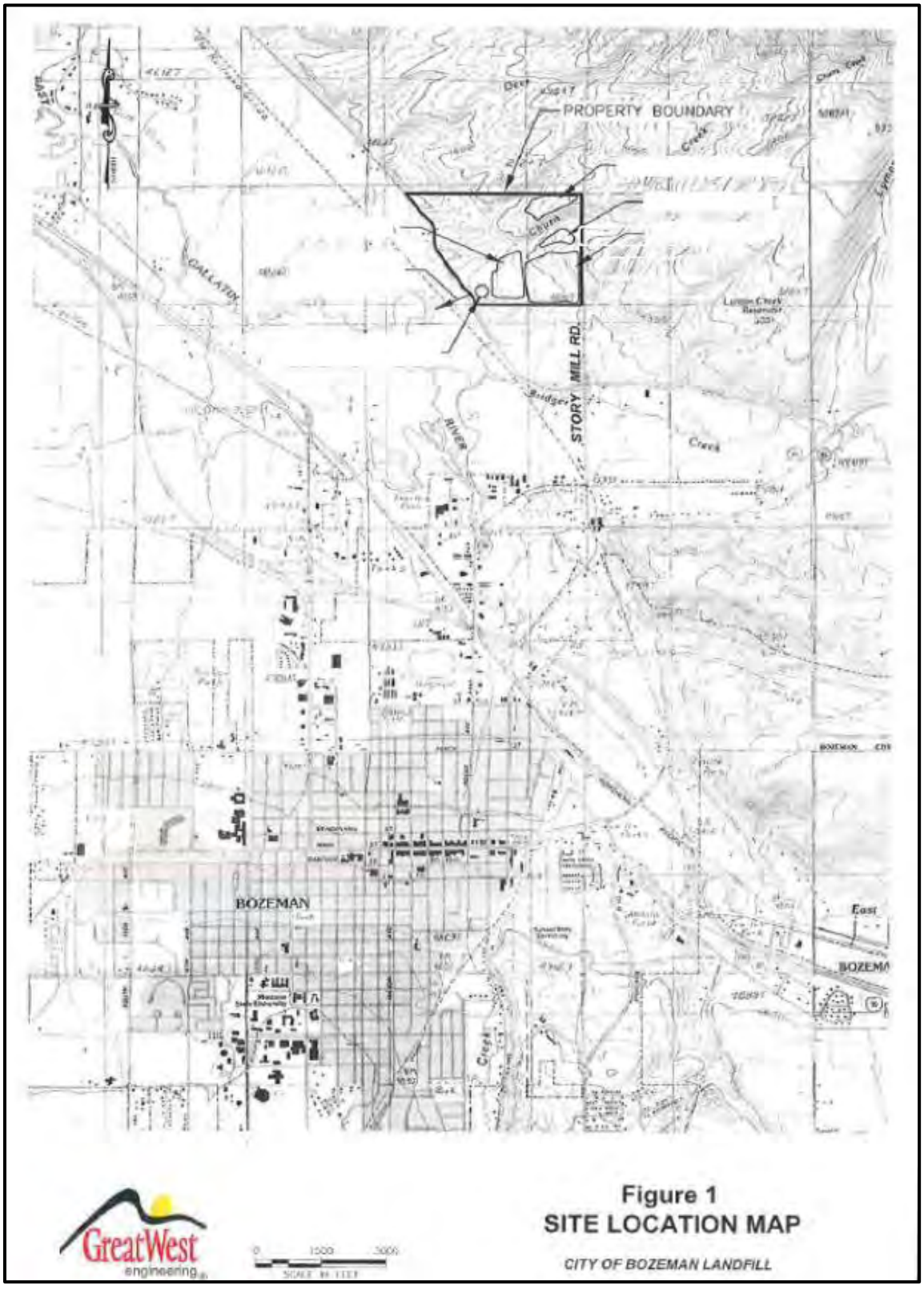
_____

Solid Waste Superintendent (Signature)

Appendix A: Facility Map



Appendix B: Facility Vicinity Map



Appendix C: Corrective Action Tracking Sheet

#	Date	Description of Issue & Required Corrective Action	Responsible Party	Corrective Action Description	Date Completed
~~1~~	~~3/20/2018~~	~~Repair / remove broken detention basin outlet pipe from basin south of the admin. building.~~	~~Russ Ward and Kevin Handelin~~	~~Pipe removed.~~	~~8/15/2019~~
~~2~~	~~3/20/2018~~	~~Remove debris from obstructed culverts along main access road.~~	~~Mike Dilbeck and Jim Tell~~	~~Excavated around culverts and lined with cobble.~~	~~6/12/2018~~
~~3~~	~~4/25/2018~~	~~Maintain silt fence at access road to capped and closed borrow pit.~~	~~Russ Ward~~	~~Silt fence replaced~~	~~8/12/2019~~
~~4~~	6/4/2018 3/26/2020 6/8/2020	Stabilize access road leading to closed and capped borrow pit.	Russ Ward	KH, RW, KM, & FG met on 7/1/18 to begin corrective action responses.	~~Pending~~
5	6/19/2018	Coordinate with Gallatin County to maintain broken secondary containment surrounding oil, grease, battery, and chemical disposal area.	Kevin Handelin	KH, RW, KM, & FG met on 7/1/18 to begin corrective action responses.	Pending
~~6~~	~~6/19/2018~~	~~Cover battery, oil, and grease disposal area.~~	~~Kevin Handelin~~	~~Replaced container with a covered container that also provides secondary containment.~~	~~8/13/2019~~
~~7~~	~~6/19/2018~~	~~Eliminate erosion along access road beginning at transfer site.~~	~~Kevin Handelin~~	~~Road was graded, eliminating erosion~~	~~7/17/2018~~
~~8~~	~~8/28/2018~~	~~Remove and dispose of spent absorbent at battery disposal area.~~	~~Russ Ward~~	~~Absorbent was removed and disposed~~	~~9/13/2018~~
9	~~9/13/2018~~	~~Remove old chemical containers from ponded water adjacent to main fueling station.~~	~~Russ Ward~~	~~Containers moved to dry area that does not pond water~~	~~11/1/2018~~
10	~~4/10/2019~~	~~Eliminate erosion along access road beginning at transfer site.~~	~~Russ Ward~~	~~Road was graded, eliminating erosion~~	~~7/1/2019~~
11	~~6/21/2019~~	~~Spilled diesel fuel not cleaned at fueling station~~	~~Kevin Handelin~~	~~Kevin Handelin was notified and cleaned up immediately.~~	~~6/21/2019~~
12	12/13/2019 3/26/2020 6/8/2020 6/22/2020 8/28/2020	Silt fence along access is not installed nor maintained to installation detail.	Russ Ward	Pending	Pending
13					
14					

Appendix D: Spills and Leak Tracking Sheet

Date	Spill (check one)	Leak (check one)	Source and Location	Description			Response Procedures	Measures Taken to Prevent Reoccurrence
				Type of Material	Quantity	Reason		
5/29/2018	X		Ruptured hydraulic hose. W. Beall St. (N. 7th Ave – N. 3rd Ave.)	Hydraulic fluid	70 gals.	Ruptured hose	152 bags of absorbent and street sweeping.	Preventative maintenance
4/10/2019		X	Battery and oil disposal containment	Oils & grease	< 0.1 gals	Leaking containment	Immediately fixed leak and used absorbent to clean spill.	Repaired leaking drain plug.
6/21/2019	X		Fueling Station	Diesel fuel	< 1 gal	Spilled while fueling	Spilled cleaned with absorbent	Reviewed spill response plane during annual training
2/10/2020	X		Over-turned garbage truck on access road north of Admin. Building.	Engine & Hydraulic oils	< 20 gals	Garbage truck slid off snow covered road and spilled oil and hydraulic fluid.	Righted the truck. Collected contaminated snow and contained in a lined dumpster. Disposed of contaminated snow at Disposal Facility.	N/A

Appendix E: Non-Compliance Tracking Sheet

#	Date	Description of Issue	Responsible Party	Corrective Action Description	Date Completed
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					

Appendix F: FSWPPP Revisions Tracking Sheet

#	Date	Description of Revision	Responsible Party
1	9/13/18	Add rock run-down, adjacent to compost area, installation detail.	Frank Greenhill
2	1/10/20	Sec. 9.0 Inspections: Added 2018 & 2019 inspection summary	Frank Greenhill
3	1/10/20	Sec. 10.0 Record Keeping & Reporting: Added spill tracking and updated inspection language.	Frank Greenhill
4	1/10/20	Added corrective action, spill, non-compliance, and FSWPPP revisions tracking sheets	Frank Greenhill
5	1/10/20	Sec. 6.0 Training: Added 2018 and 2019 training summary	Frank Greenhill
6	1/5/21	Sec. 6 Training: Added 2020 training summary and deleted ORI Dry Weather Screening inspection.	Frank Greenhill
7	1/14/2021	Changed document font, updated the offsite coordinator's name, updated the spill response plan, converted narrative inspection and training content into tables, updated the description of the training application, and updated and corrected language throughout the document.	Kayla Mehrens
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			

Facility Stormwater Pollution Prevention Plan

Snow Storage Facility

501 Haggerty Lane
P.O. Box 1230
Bozeman, Montana 59771

2020 Update

1.0 OVERVIEW

This Facility Stormwater Pollution Prevention Plan (FSWPPP) includes Standard Operating Guidelines (SOG) developed to mitigate pollutants generated at the Snow Storage Facility (Facility).

2.0 STORMWATER TEAM

The following Staff members are responsible for the FSWPPP's implementation:

a. Leader: John Vandelinder, Streets Superintendent
b. Offsite Coordinator: Kayla Mehrens, Stormwater Program Coordinator

3.0 SITE DESCRIPTION

The Facility is an asphalt parking lot used for municipal snow storage during winter and spring. One drainage basin exists, including:

a. Drainage Basin #1: Four acres with 54% impervious cover, including asphalt parking area.

4.0 IMPAIRED WATERBODY

The Facility discharges to Tributary SWWW_00040, which then empties into a second tributary before its confluence with Rocky Creek north of I-90.

The Montana Department of Environmental Quality (MDEQ) classifies Rocky Creek as a 303(d) listed impaired waterbody because it does not fully support the aquatic life beneficial use. Rocky Creek's impairments include: Alteration in Stream-Side or Littoral Cover, Other Anthropogenic Substrate Alterations, Physical Substrate Habitat Alterations, and Sedimentation-Siltation.

5.0 SAMPLING

Staff conducted composite baseline sampling on April 9 and 24, 2019, at the following location:



Graphic 5.0: Sampling Location Map.

Staff analyzed the following parameters and compiled the results:

a. Total Suspended Solids (TSS), mg/L
b. Chemical Oxygen Demand (COD), mg/L
c. Total Nitrogen (TN), mg/L
d. Total Phosphorus (TP), mg/L
e. Copper (Cu), mg/L
f. Lead (Pb), mg/L
g. Zinc (Zn), mg/L
h. Oils and Greases, mg/L
i. pH, standard units

Sampling Date	TSS (mg/L)	Oil & Grease (mg/L)	Total Nitro. (mg/L)	Phosp. (mg/L)	Zinc (mg/L)	Lead (mg/L)	Copper (mg/L)	COD (mg/L)	pH
April 9, 2019	430	4	0.800	0.510	0.100	0.013	0.022	152.0	7.9
April 24, 2019	1,640	5	3.900	1.860	0.380	0.049	0.077	696.0	7.9

Graphic 5.1: Sampling results.

The data shows the Facility yields high concentrations of TSS and lead.

6.0 POLLUTION IDENTIFICATION

Following is a list of identified pollutants and an assessment of likely sources at the Facility:

a. Total Suspended Solids: Traction sand and organics (ex. Grass clippings)
b. Oil and Grease: Vehicle leaks
c. Total Nitrogen: Organics
d. Phosphorus: Traction sand and organics
e. Zinc: Metal surfaces and brake dust
f. Lead: Brake dust and exhaust
g. Copper: Brake dust and exhaust
h. Floatables: Litter

7.0 SITE ASSESSMENT

Section 7.0 outlines the City's Facility Minimum Standards (Standards) applicable to this Facility. All Standards are listed in the City's Stormwater Management Plan (SWMP).

7.1 Standard: Tracking controlled at all entries, exits, and within parking areas

a. Site Components and Compliance Assessment:
    - Snow storage area
        - Compliant: Asphalt surface
    - Northwest Parking lot
        - Compliant: Asphalt surface
b. Standard Operating Guidelines:
    - Inspect asphalt for debris accumulation, sweep once present
    - Periodically clean around the Facility during melting (handpick and sweep as necessary)
c. Corrective Action:
    - ~~2019: None~~
    - 2020: None

7.2 Standard: Preventative maintenance on equipment and vehicles

a. Site Components and Compliance Assessment
    - Street Division Equipment and Vehicles
        - Compliant: Inspected and maintained regularly, documentation in place
b. Standard Operating Guidelines:
    - Visual inspection of all vehicles and equipment before use
    - Maintenance and repairs completed at the Vehicle Maintenance Facility
    - Document inspections, maintenance, and repairs per Division specific guidelines
c. Corrective Actions:

- ~~2019: None~~
- 2020: None

7.3 Standard: Stabilize disturbed areas

a. Site Components and Compliance Assessment:
   - Gully northeast of the Facility
     - Not Compliant: Eroded slope from concentrated flows
b. Standard Operating Guidelines:
   - See Section 11.0
c. Corrective Actions:
   - ~~2019: See Section 11.0, remove the eastern boundary silt fence~~
   - 2020: See Section 11.0, remove the eastern boundary silt fence

8.0 SPILL RESPONSE PLAN

The following is the City's spill response plan, including response, mitigation, and reporting protocols.

8.1 Small and Medium Spills: Typically, major dimension is less than 6' and can be contained, cleaned, and eliminated using onsite personnel, spill kits and/or the Public Works vehicle.

a. Locate spill kit and put on PPE.
b. If necessary, deploy Public Works spill response vehicle.
c. Control spill by stopping or securing the source.
d. Protect all storm drain inlets near the spill using absorbent booms or inlet barrier.
e. Identify spilled material.
f. Clean spill using appropriate absorbents or other methods. *Never wash spills down the drain!*
g. Place spill material and absorbents in secure containers.
h. Consult with Stormwater Team Leader and the SDS for spill and waste disposal procedures.
i. Dispose of spilled material and the absorbent in compliance with state and federal regulations.
j. Consult with Stormwater Team Leader for appropriate reporting procedures.

8.2 Large and Continuous Spills: Typically, major dimension is greater than 6', continuous flow, and cannot be contained, cleaned, and eliminated using onsite personnel.

a. Leave the area and notify Emergency Responders (911).
b. Give the operator the spill location, chemical name, and approximate amount.
c. If safe, protect nearby storm drain inlets using absorbent booms or inlet barrier.
d. Provide SDS information for the spilled chemical to emergency responders.
e. Advise responders of any absorbents, containers, or spill control equipment that is available.
f. Consult with Stormwater Team Leader for appropriate reporting procedures.

8.3 Spill Reporting

a. Report all chemical spills, regardless of size, to a Stormwater Team Leader.

9.0 TRAINING

Staff receives training related to this Facility per the requirements within the Citys MS4 Permit and maintains training documentation in the SWMP.

10.0 INSPECTIONS

The Offsite Coordinator completes an annual inspection at the Facility to determine compliance with the City's Facility Minimum Standards listed in the SWMP. Updates to this FSWPPP occur based on the results.

a. 2019: Completed on June 25
b. 2020: Completed on September 10

11.0 INFRASTRUCTURE IMPROVEMENTS

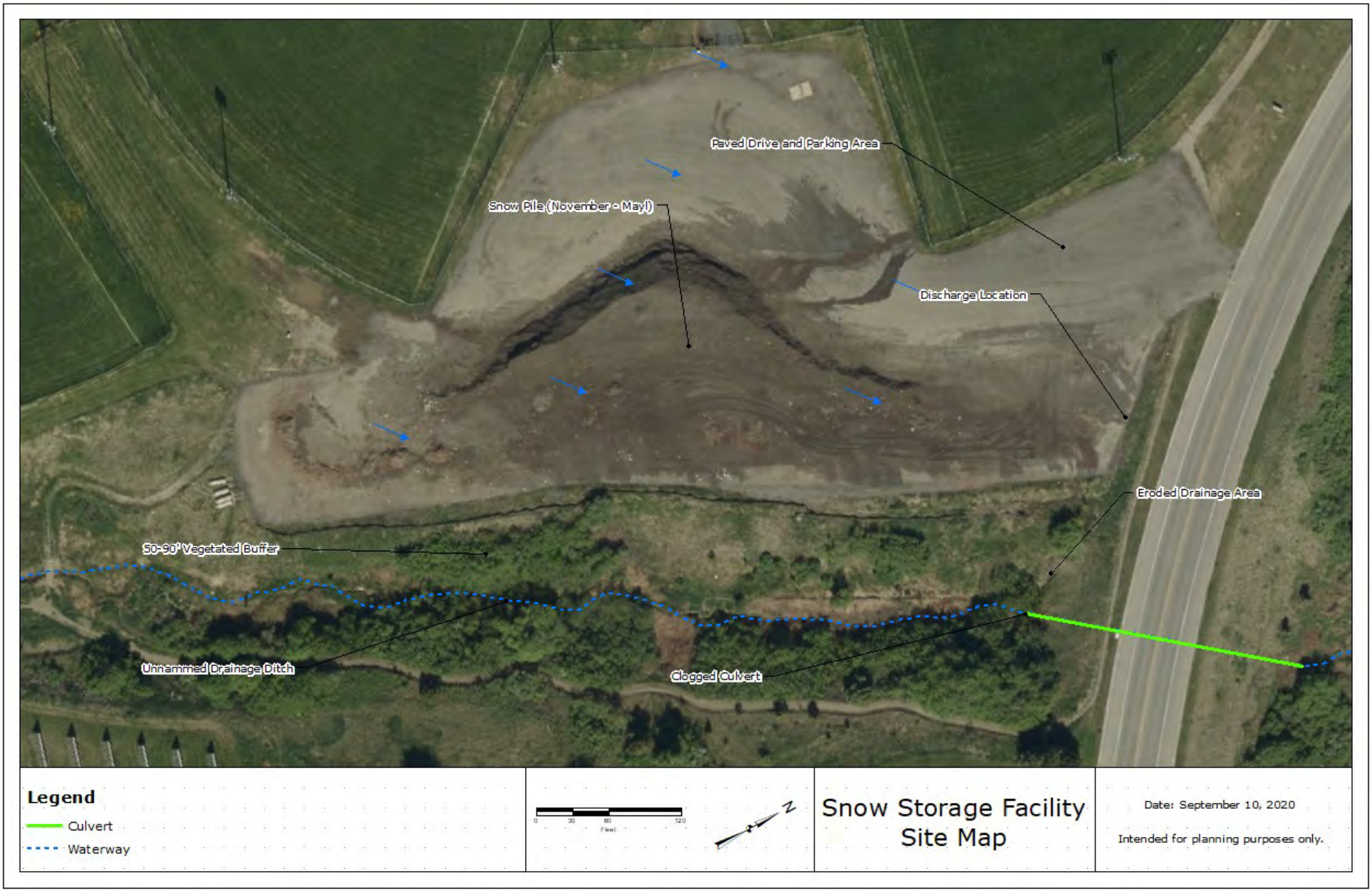
Staff identified the following project need and plans to propose to the City Commission during the development of future Capital Improvement Plans (CIP):

a. Sediment Basin Construction, Slope Stabilization, and Culvert Maintenance
    - Cost: ~$75,000
    - Timeline: Propose in CIP

12.0 RECORD KEEPING AND REPORTING

Staff store copies of this FSWPPP at the City Shops Facility and the Stormwater Division's Office.

Appendix A: Site Map



Facility Stormwater Pollution Prevention Plan

Bozeman Public Safety Facility

901 North Rouse Avenue
Bozeman, Montana 59771

2020 Update

1.0 OVERVIEW

This Facility Stormwater Pollution Prevention Plan (FSWPPP) includes Standard Operating Guidelines (SOG) developed to mitigate pollutants generated at the Bozeman Public Safety Facility (Facility).

2.0 STORMWATER TEAM

The following staff members are responsible for the FSWPPP's implementation:

a. Leader: Chuck Winn, Assistant City Manager
b. Leader: Mike Gray, Facilities Manager
c. Offsite Coordinator: Kayla Mehrens, Stormwater Program Coordinator

3.0 SITE DESCRIPTION

The Facility will include buildings and parking lots that support the Police, Fire, and Legal Divisions. The entire Facility is currenlty under construction. Staff will update the FSWPPP to address the new site conditions once construction is complete.

4.0 IMPAIRED WATERBODY

The Facility discharges to Sourdough Creek, aka Bozeman Creek, at Outfall OF.E03.00453. The Montana Department of Environmental Quality classifies Bozeman Creek as a 303(d) listed impaired waterbody because it does not fully support aquatic life and primary contact/recreation beneficial uses. Bozeman Creek's impairments include: Alterations in stream-side or littoral vegetative covers, Chlorophyll-a, E Coli, Nitrogen (Total), and Sedimentation-Siltation.

5.0 SAMPLING

Pending

6.0 POLLUTION IDENTIFICATION

Pending

7.0 SITE ASSESSMENT

Pending

8.0 SPILL RESPONSE PLAN

The following is the City's spill response plan, including response, mitigation, and reporting protocols.

8.1 Small and Medium Spills: Typically, major dimension is less than 6' and can be contained, cleaned, and eliminated using onsite personnel, spill kits and/or the Public Works vehicle.

a. Locate spill kit and put on PPE.
a. In necessary, deploy Public Works spill response vehicle.
b. Control spill by stopping or securing the source.
c. Protect all storm drain inlets near the spill using absorbent booms or inlet barrier.
d. Identify spilled material.
e. Clean spill using appropriate absorbents or other methods. *Never wash spills down the drain!*

f. Place spill material and absorbents in secure containers.
g. Consult with Stormwater Team Leader and the SDS for spill and waste disposal procedures.
h. Dispose of spilled material and the absorbent in compliance with state and federal regulations.
i. Consult with Stormwater Team Leader for appropriate reporting procedures.

8.2 Large and Continuous Spills: Typically, major dimension is greater than 6', continuous flow, and cannot be contained, cleaned, and eliminated using onsite personnel.

a. Leave the area and notify Emergency Responders (911).
b. Give the operator the spill location, chemical name, and approximate amount.
c. If safe, protect nearby storm drain inlets using absorbent booms or inlet barrier.
d. Provide SDS information for the spilled chemical to emergency responders.
e. Advise responders of any absorbents, containers, or spill control equipment that is available.
f. Consult with Stormwater Team Leader for appropriate reporting procedures.

8.3 Spill Reporting

a. Report all chemical spills, regardless of size, to a Stormwater Team Leader.

9.0 TRAINING

Pending

10.0 INSPECTIONS

The Offsite Coordinator completes an annual inspection at the Facility to determine compliance with the City's Facility Minimum Standards listed in the SWMP. Updates to this FSWPPP occur based on the results.

a. 2019: Completed on July 25
b. 2020: Completed on September 23

11.0 INFRASTRUCTURE IMPROVEMENTS

The new Facility will adhere to local and state water quality and flood control standards.

12.0 RECORD KEEPING AND REPORTING

Staff store copies of this FSWPPP at the Stormwater Division's Office.

Appendix A: Site Map



Activity Stormwater Pollution Prevention Plan

Emergency Water Main Break

1.0 OVERVIEW

This Activity Stormwater Pollution Prevention Plan (ASWPPP) includes Standard Operating Guidelines (SOGs) to mitigate stormwater pollutants generated during Emergency Water Main Breaks (Activity).

2.0 STORMWATER TEAM

The following Staff member is responsible for this ASWPPP's implementation:

a. Leader: John Alston - Water, Sewer, and Storm Superintendent

3.0 ACTIVITY DESCRIPTION

The Activity includes water main excavation, dewatering, repair, cleanup, and site restoration. Water and Sewer Division SOGs also exist for this Activity.

4.0 POLLUTION IDENTIFICATION

Following is a list of stormwater pollutants generated during this Activity:

a. Total Suspended Solids (TSS): Sediments from pressurized washout and dewatering.

5.0 STANDARDS ASSESSMENT

Section 5.0 outlines the City's Activity Minimum Standards applicable to this operation:

5.1 Standard: Protect street surfaces and inlets by deploying controls that capture, contain, and allow the disposal of generated pollutants, and treat dewatering flows to remove sediment to the maximum extent practicable before entering the storm sewer system or waterways.

a. Standard Operating Guidelines:
   - Reduce flows to water main as soon as possible by operating valves.
   - Direct dewatering discharges to permeable area (park or field), when available. If not, place multiple weighted wattles in the curb line above impacted inlets.
   - Sweep affected streets and clean storm sewers once the main is repaired.

b. Corrective Action(s):
   - Replace rock bags with manufactured weighted wattles.

5.2 Standard: Cover or contain material stockpiles.

a. Standard Operating Guidelines:
   - Excavate soil and place directly into dump trucks and dispose of the materials offsite.
   - Hydro-excavate soils and dispose of the materials offsite.

b. Corrective Action(s):
   - None

5.3 Standard: Contain or stabilize disturbed areas within 14 days of activities.

a. Standard Operating Guidelines:
   - Stabilized disturbed area with asphalt surfacing, temporary packed road base, steel plat cover, or low to grade backfill.

b. Corrective Action(s):
   - None

5.4 Standard: Capture and dispose concrete waste.

a. Standard Operating Guidelines:
   - Capture all concrete washout in an enclosed container or within the excavation.

b. Corrective Action(s):
   - Purchase concrete washout bags and stage in vehicles.

6.0 TRAINING

Applicable staff review annually using the City's training software.

7.0 RECORD KEEPING

Stored in the City's electronic files and training software.

Activity Stormwater Pollution Prevention Plan

Sanitary Sewer Overflows

1.0 OVERVIEW

This Activity Stormwater Pollution Prevention Plan (ASWPPP) includes Standard Operating Guidelines (SOGs) to mitigate stormwater pollutants generated during Sanitary Sewer Overflows (Activity).

2.0 STORMWATER TEAM

The following Staff member is responsible for this ASWPPP's implementation:

a. City Leader: John Alston, Water, Sewer, and Storm Superintendent
b. MSU Leader: EJ Hook, Director of Facilities Services

3.0 ACTIVITY DESCRIPTION

The Activity includes clearing the sewer obstruction and cleaning affected infrastructure. Water and Sewer Division SOGs also exist for this Activity.

4.0 POLLUTION IDENTIFICATION

Following is a list of pollutants generated during this Activity:

a. E. Coli: Municipal wastewater/sewage
b. Floatables: Municipal wastewater/sewage
c. Nutrients: Municipal wastewater/sewage

5.0 STANDARDS ASSESSMENT

Section 5.0 outlines the City's Activity Minimum Standards applicable to this Activity:

5.1 Standard: Protect street surfaces and inlets by deploying controls that capture, contain, and allow the disposal of generated pollutants

a. Standard Operating Guidelines:
   - Clean sewage and wash-waters from impacted storm sewers during and post-event.
   - Wash sanitary sewage from the street once the blockage is cleared.
   - Dispose of collected sewage at the Vehicle Maintenance Facility's dump station.
   - Contact County Health and MDEQ and follow provided mitigation measures.
b. Corrective Action(s):
   - None

6.0 TRAINING

Applicable staff review annually using the City's training software.

7.0 RECORD KEEPING

Stored in the City's electronic files and training software.

Activity Stormwater Pollution Prevention Plan

Trenching and Excavation

1.0 OVERVIEW

This Activity Stormwater Pollution Prevention Plan (ASWPPP) includes Standard Operating Guidelines (SOGs) to mitigate stormwater pollutants generated during trenching and excavation (Activity).

2.0 STORMWATER TEAM

The following Staff member is responsible for this ASWPPP's implementation:

a. Leader: John Alston - Water, Sewer, and Storm Superintendent

3.0 ACTIVITY DESCRIPTION

The Activity includes water main excavation, dewatering, infrastrucutre repair or installation, cleanup, and surface restoration.

4.0 POLLUTION IDENTIFICATION

Following is a list of stormwater pollutants generated during this Activity:

a. Total Suspended Solids (TSS): Dewatering and excavation.

5.0 STANDARDS ASSESSMENT

Section 5.0 outlines the City's Activity Minimum Standards applicable to this operation. All standards are listed in the City's Stormwater Management Plan.

5.1 Standard: Protect street surfaces and inlets by deploying controls that capture, contain, and allow the disposal of generated pollutants, and treat dewatering flows to remove sediment to the maximum extent practicable before entering the storm sewer system or waterways.

a. Standard Operating Guidelines:
   - Minimize the limits of disurbance to the extent practical.
   - Direct dewatering discharges to permeable area (park or field), when available. If not, place multiple weighted wattles in the curb line above impacted inlets.
   - Sweep affected streets and clean storm sewers once the main is repaired.

b. Corrective Action(s):
   - Replace rock bags with manufactured weighted wattles.

5.2 Standard: Cover or contain material stockpiles

a. Standard Operating Guidelines:
   - Excavate soil and place directly into dump trucks. Dispose of the materials offsite.
   - Hydro-excavate soils and dispose of the materials offsite.

b. Corrective Action(s):
   - None

5.3 Standard: Contain or stabilize disturbed areas within 14 days of activities

a. Standard Operating Guidelines:
   - Stabilized disturbed area with asphalt surfacing, temporary packed road base, steel plat cover, or low to grade backfill.

b. Corrective Action(s):
   - None

5.4 Standard: Implement tracking controls to prevent the offsite migration of debris

a. Standard Operating Guidelines:
   - Limit vehicle and equipment travel to stabilized surfaces.
   - Sweep or vac sediment from all affected roads and dispose of the materials offsite.

b. Corrective Action(s):
   - None

5.5 Standard: Capture and dispose concrete waste

a. Standard Operating Guidelines:
   - Remove concrete from excavation and stage separately from other fill materials.
   - Capture all concrete washout in an enclosed container or within the excavation.

b. Corrective Action(s):
   - Purchase concrete washout bags and stage in vehicles.

6.0 TRAINING

Applicable staff review nnnually using the City's training software.

7.0 RECORD KEEPING

Stored in the City's electronic files and training software.

Activity Stormwater Pollution Prevention Plan

Roadway Traction Sand Application

1.0 OVERVIEW

This Activity Stormwater Pollution Prevention Plan (ASWPPP) includes Standard Operating Guidelines (SOGs) to mitigate stormwater pollutants generated during roadway traction sand application (Activity).

2.0 STORMWATER TEAM

The following Staff member is responsible for this ASWPPP's implementation:

a. City Leader: John Vandelinder, Streets Superintendent
b. MSU Leader: EJ Hook, Director of Facilities Services

3.0 ACTIVITY DESCRIPTION

The Activity includes the application of sand to roads for vehicle and pedestrian traction during snow and freezing weather patterns. The City implements year-round street sweeping and storm sewer maintenance programs, in large part focused on picking up applied road sand.

4.0 POLLUTION IDENTIFICATION

Following is a list of stormwater pollutants generated during this Activity:

a. Total Suspended Solids (TSS): Road sand
b. Magnesium and Sodium Chlorides: Road sand mixtrues contain approximatly 10% sodium chloride and minor amounts of Magnesium Chloride to promote use and application.

5.0 STANDARDS ASSESSMENT

Section 5.0 outlines the City's Activity Minimum Standards applicable to this operation:

5.1 Standard: Protect street surfaces and inlets by deploying controls that capture, contain, and allow the disposal of generated pollutants.

c. Standard Operating Guidelines:
   - Apply traction sand at an appropriate rates and locations as directed by management.
   - Inspect equipment to ensure proper application rates are occouring.
   - Inspect Magnesium Chloride tanks for cracks and leaks.
   - Notify management of any equipment issues upon identification.

d. Corrective Action(s):
   - None

6.0 TRAINING

Applicable staff review annually using the City's training software.

7.0 RECORD KEEPING

Stored in the City's electronic files and training software.

Activity Stormwater Pollution Prevention Plan

Solid Waste Collection

1.0 OVERVIEW

This Activity Stormwater Pollution Prevention Plan (ASWPPP) includes Standard Operating Guidelines (SOGs) to mitigate stormwater pollutants generated during routine solid waste collection (Activity).

2.0 STORMWATER TEAM

The following Staff member is responsible for this ASWPPP's implementation:

a. City Leader: Kevin Handelin, Solid Waste Superintendent
b. MSU Leader: EJ Hook, Director of Facilities Services

3.0 ACTIVITY DESCRIPTION

Collectiion of solid waste from inidivdual containers and transport to the landfill for disposal.

4.0 POLLUTION IDENTIFICATION

Following is a list of stormwater pollutants generated during this Activity:

c. Floatables: Typical garbage items that do not fit or stay within the receptacle.
d. Various Chemical: Leaking household/commercial chemicals and pollutants.

5.0 STANDARDS ASSESSMENT

Section 5.0 outlines the City's Activity Minimum Standards applicable to this operation:

5.1 Standard: Protect street surfaces and inlets by deploying controls that capture, contain, and allow the disposal of generated pollutants.

a. Standard Operating Guidelines:
   - Visually inspect cans, dumpsters, and equipment for leaks, spills, and dangerous fluids/materials. If identified, report to your supervisor immediately, who will contact the appropriate agency for response and clean-up (City Vehicle Maintenance or City Fire - HazMat).
   - Inspect for rusty, broken, or damaged cans and dumpsters. If identified, leave in place and notify your supervisor, who will develop a plan for removal and replacement. Moving or lifting a cracked can or dumpster could result in a large and uncontrollable spill.
   - Upon route completion, haul solid waste directly to the Gallatin County Landfill for disposal.
   - Maintain a spill kit at the Solid Waste Facility that can be deployed, as necessary.

b. Corrective Action(s):
   - None

6.0 TRAINING

Applicable staff review annually using the City's training software.

7.0 RECORD KEEPING

Stored in the City's electronic files and training software.