City of Bozeman and Montana State University

Stormwater Management Plan

2017 - 2021 MS4 General Permit Term

Version 8

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1.0 Program Administration

Image 1.0.1: 2013 Colorado urban flooding. Source: theatlantic.com

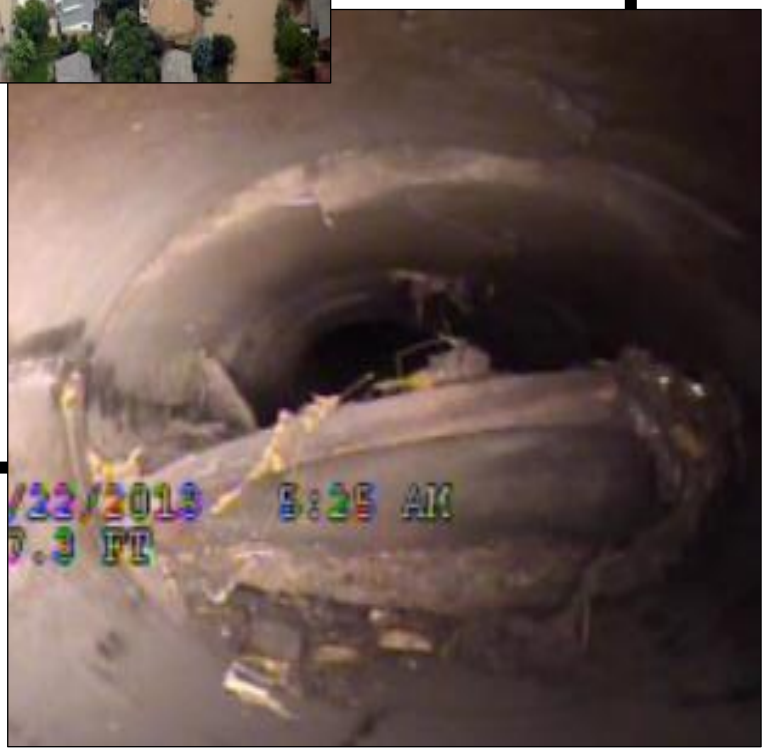


Image 1.0.2: Failed stormwater pipe

1.1 Introduction

This Stormwater Management Plan (SWMP) describes the City of Bozeman (City) and Montana State University's (University) planned structural, programmatic, and administrative Best Management Practices (BMPs) required to comply with the Montana Department of Environmental Quality's (MDEQ) 2017-2021 Municipal Separate Storm Sewer System General Permit (MS4 General Permit). The City and University are collectively referred to as the MS4. The MS4 plans to engineer, implement, maintain, and enforce BMPs to the maximum extent practicable, with the overarching goal of improving the quality of stormwater discharges into the MS4's waterways.

The MS4 also refers to this SWMP as the Stormwater Master Plan. This SWMP is an iterative and evolving document. Updates and additions occur annually.

1.2 Strategic Vision

The MS4 manages stormwater discharging into Bozeman's waterways through tailored education, innovative solutions, enforcement response, and progressive infrastructure projects to achieve the following goals:

1. Protect and improve water quality
2. Facilitate regulatory compliance
3. Protect human and environmental health
4. Improve flood resiliency
5. Influence policies at local, state, and federal levels

1.3 Major Program Initiatives

The MS4 plans to complete the following initiatives during the MS4 General Permit term:

1. Develop a Stormwater Design Manual and update existing Municipal Ordinances.
2. Create a policy to enforce maintenance of stormwater basins in HOA subdivisions.
3. Evolve erosion and sediment control practices in the construction industry through training, inspections, and enforcement cases.
4. Formalize relationship between the City and University with a Memorandum of Understanding (MOU).
5. Establish a targeted water quality-monitoring program that tracks trends and measures BMP effectiveness to evaluate MS4 pollutant loading to receiving waterbodies.
6. Balance staffing with required workload and level of service goals.
7. Optimize operation and maintenance field activities to extend infrastructure asset life cycles.

1.4 Regulatory Overview

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 beneficial uses of United States' Waters. The U.S. Environmental Protection Agency (EPA) is the lead organization tasked with implementing and oversight of the CWA. In Montana, the MDEQ has assumed authority for developing water quality standards and issuing discharge permits, allowing for further state-scale interpretation, enactment, and enforcement of CWA requirements.

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 focus of this SWMP is the MS4 General Permit, which requires regulated entities to develop, implement, and maintain a

stormwater management program, adhering to requirements of the following six minimum control measures:

1. Public Education and Outreach
2. Public Involvement/Participation
3. Illicit Discharge Detection and Elimination
4. Construction Site Stormwater Management
5. Post-Construction Stormwater Management
6. Pollution Prevention and Good Housekeeping for Municipal Operations

In 2014, the MDEQ proposed a new and more comprehensive MS4 General Permit. The regulated entities of Montana expressed concern over its contained language and asked that the MDEQ postpone its issuance for two years. An MS4 Work Group formed, which included representatives from the regulated communities, MDEQ, EPA, and environmental groups. Representatives participated in monthly meetings and worked together to draft new MS4 General Permit language, resulting in the MS4 General Permit issued January 1, 2017.

1.5 Waterways

The MS4 contains hundreds of outfalls that discharge into ≈100 miles of waterways and irrigation ditches within its municipal boundary. Staff used the Draft 2016 Integrated Report available at the MDEQ's Clean Water Act Information Center, EPA-approved 2013 Lower Gallatin Planning Area TMDL document, and City GIS databases to compile the following information:

1. Baxter Creek
    - Total Outfalls: 11
    - Approved TMDL: No
    - Impairments: None
    - MS4 Waste Load Allocation: None
2. Bozeman (aka Sourdough) Creek
    - Total Outfalls: 61
    - Approved TMDL: Yes
    - Impairments: E. Coli, Total Nitrogen, Sediment, Chlorophyll-a, and Alteration in streamside cover
    - MS4 Waste Load Allocation: TN = 0 lb/day; E. Coli = 0 cfu/day; sediment = 81 tons/year
3. Bridger Creek
    - Total Outfalls: 2
    - Approved TMDL: Yes
    - Impairments: Chlorophyll-a and Nitrate/Nitrite (Nitrite + Nitrate as N)
    - MS4 Waste Load Allocation: N/N = 0 lbs./day
4. East, West and Main Forks of Catron Creek
    - Total Outfalls: 80
    - Approved TMDL: No
    - Impairments: None
    - MS4 Waste Load Allocation: None
5. Cattail Creek

- Total Outfalls: 42
- Approved TMDL: No
- Impairments: None
- MS4 Waste Load Allocation: None

6. East Gallatin River
    - Total Outfalls: 16
    - Approved TMDL: Yes
    - Impairments: Total Nitrogen and Total Phosphorous
    - MS4 Waste Load Allocation: TN = 0 lbs./day; TP = 0 lbs./day
7. Farmers Canal
    - Total Outfalls: 47
    - Approved TMDL: No
    - Impairments: None
    - MS4 Waste Load Allocation: N/A
8. Figgins Creek
    - Total Outfalls: 24
    - Approved TMDL: No
    - Impairments: None
    - MS4 Waste Load Allocation: N/A
9. Flat Creek
    - Total Outfalls: 11
    - Approved TMDL: No
    - Impairments: None
    - MS4 Waste Load Allocation: N/A
10. Mandeville Creek
    - Total Outfalls: 49
    - Approved TMDL: Yes
    - Impairments: Total Nitrogen and Total Phosphorous
    - MS4 Waste Load Allocation: TN = 0 lbs./day; TP = 0 lbs./day
11. Matthew Bird Creek
    - Total Outfalls: 32
    - Approved TMDL: No
    - Impairments: None
12. Maynard Border Ditch
    - Total Outfalls: 12
    - Approved TMDL: No
    - Impairments: None
    - MS4 Waste Load Allocation: N/A
13. Middle Creek Ditch
    - Total Outfalls: 36

- Approved TMDL: No
- Impairments: None
- MS4 Waste Load Allocation: N/A

14. Mill Ditch

    - Total Outfalls: 0
    - Approved TMDL: No
    - Impairments: None
    - MS4 Waste Load Allocation: N/A

15. Nash Spring Creek

    - Total Outfalls: 2
    - Approved TMDL: No
    - Impairments: None
    - MS4 Waste Load Allocation: N/A

16. Rocky Creek

    - Total Outfalls: 1
    - Approved TMDL: Yes
    - Impairments: Alteration in Streamside Vegetative Cover, Other Anthropogenic Substrate Alterations, Physical Substrate Habitat Alterations, and Sedimentation/Siltation
    - MS4 Waste Load Allocation: N/A

17. Story Ditch

    - Total Outfalls: 11
    - Approved TMDL: No
    - Impairments: None
    - MS4 Waste Load Allocation: N/A

18. West Gallatin Canal

    - Total Outfalls: 30
    - Approved TMDL: No
    - Impairments: None
    - MS4 Waste Load Allocation: N/A

19. Unnamed Irrigation Canals

    - Total Outfalls: 9
    - Approved TMDL: No
    - Impairments: None
    - MS4 Waste Load Allocation: N/A

20. Unnamed Tributaries

    - Total Outfalls: 113
    - Approved TMDL: No
    - Impairments: None
    - MS4 Waste Load Allocation: N/A

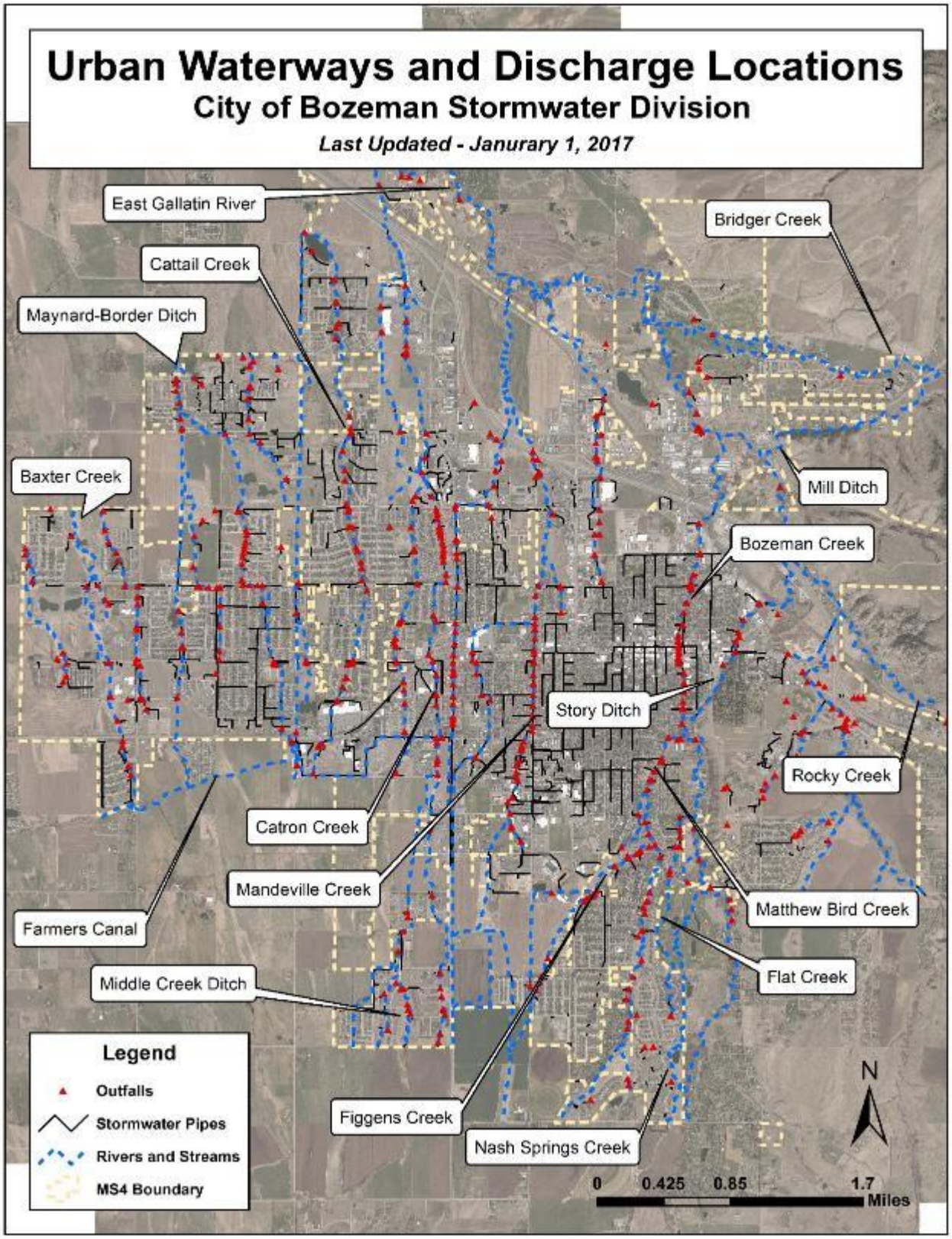
Waterways receiving stormwater discharges from the MS4 will benefit from the strategies outlined in this SWMP and the BMPs implemented throughout the MS4 General Permit term. The MS4 plans to

implement specific infrastructure and targeted programmatic efforts to address 303(d) listed water quality impairments to the maximum extent practicable given available resources. For purposes of this MS4 General Permit term, the MS4 designates Bozeman Creek as its highest priority waterway and Mandeville Creek as its second highest priority for pollution reduction efforts.

Bozeman Creek is the highest priority because of its total outfalls, known impairments, degraded state, and, most importantly, it is the only waterway with a non-zero MS4 Waste Load Allocation (WLA). According to the TMDL, Total Suspended Solids (*TSS, a measure of sediment concentrations in water)* contributions from the MS4 to Bozeman Creek require a 37% WLA, requiring a reduction of 81 tons/year.

Mandeville Creek is the second highest priority waterway because of its total outfalls, known impairments, shared responsibilities between co-permittees, and its degraded state. The MS4 has previously made investments to reduce loads to Mandeville Creek and plans to continue pollution reduction efforts as this MS4 General Permit term progresses.

Three other impaired waterways exist and will be the focus of targeted efforts as opportunities arise during this and future MS4 General Permit terms: (1) East Gallatin River, (2) Bridger Creek, and (3) Rocky Creek. The East Gallatin will benefit from BMPs implemented throughout the MS4.



Map 1.5.1: Bozeman's receiving waterways

1.6 Permittee

The City of Bozeman contains urbanized areas defined by the U.S Census Bureau's 2010 survey. ARM 17.30.1102(23)(b) designates the City of Bozeman as a small MS4, and the MS4 General Permit extends permit coverage for the entirety of the City's incorporated boundary. Montana DEQ considers the City of Bozeman to be a Traditional MS4 for purposes of the MS4 General Permit that is required to:

1. Prepare and submit a Notice of Intent (NOI) for authorization to discharge stormwater under the fourth generation Montana Pollution Discharge Elimination System (MPDES) General Permit for Stormwater Discharges Associated with Small MS4s.
2. Receive authorization to discharge stormwater from the MDEQ by January 1, 2017.
3. Prepare and submit Annual Reports to the MDEQ.
4. Develop, implement, and update a SWMP throughout the MS4 General Permit term.
5. Execute a Memorandum of Understanding (MOU) with the University, designating roles and responsibilities for the MS4 General Permit term.

On June 25, 2012, the City adopted Ordinance 1831 creating a stormwater utility, providing for the collection of rates and charges that generate revenue 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 stormwater infrastructure. This effort was in response to findings identified during a 2011 MDEQ audit of the MS4, which included one permit violation, 16 program deficiencies, and 23 recommendations for improvement.

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

On April 21, 2014, the City presented three level of service options. Each level differed primarily on the timeline required to address known issues and the annual funding level. City Commissioners decided to implement a program, which included a total funding level of $1.2 million annually for operations, maintenance, treatment upgrades, and deferred maintenance.

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

On December 1, 2015, the City implemented the final piece of the new rate model allowing the Stormwater Utility to be fully funded and functional for the first time in its history.

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

1. $450,000 annually for deferred maintenance, which includes costs associated with the replacement of failed pipes, cleaning clogged infrastructure and upgrading old system components.
2. $550,000 annually for operations and maintenance, which includes costs related to personnel, reoccurring system maintenance, supplies, and equipment.
3. $200,000 annually for system enhancements, which includes costs associated with projects that provide stormwater treatment to remove pollutants of concern before discharging to receiving waterways.

The City's rate model has three distinct guiding principles:

1. Flat Charge - Charged evenly across the service area and pays for deferred maintenance costs. Properties with a water meter receive a flat monthly charge of $3.23 per meter. Properties that have impervious area, but do not have a water meter also receive a flat monthly charge.
2. 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 swaths result in an increased impact on public infrastructure and local waterways.
3. 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 Stormwater, Building, GIS, and Finance Divisions work collaboratively to update the stormwater utility rate model. The workflow includes:

1. Developer submits development plans electronically to the Building Division
2. Stormwater Staff reviews and uploads site plan to group folder
3. GIS Staff checks folder and draws impervious area for new project
4. Finance Staff sends water meter notice to Stormwater Staff when the project is complete
5. Stormwater Staff reviews impervious area data and calculates ERU totals
6. Stormwater Staff provides Finance Staff with an ERU value and credit value
7. Finance Staff updates software and generates a bill for customers

1.7 Stormwater Management Team

The City spends approximately 10,000 hours annually developing and working on stormwater-related programs. Staff uses Cityworks Asset Management Software (Cityworks) to track daily work activities, providing data for analysis, reports, and resource allocation.

1. Staff
    - (1) Stormwater Program Coordinator (Primary SWMP Coordinator): Develops and manages the implementation of SWMP and MS4 General Permit compliance activities, administers environmental compliance programs, manages personnel, prepares budgets, develops policies, coordinates infrastructure projects, and maintains rate model databases. This position's primary permit responsibilities include:
        - Community Outreach and Education
        - Public Involvement and Participation
        - Construction-Site Management
        - Post-Construction Management
        - Illicit Discharge Detection and Elimination
        - Project Management
        - Good Housekeeping
        - Training
        - Water Quality Sampling and Analysis
    - (1) Stormwater Program Specialist: Develops and implements best practice solutions related to water quality compliance monitoring, BMP effectiveness research, and data analysis. This position's primary permit responsibilities include:
        - Water Quality Sampling and Analysis
        - Industrial Stormwater Permits (Water Reclamation Facility and Landfill)

- (1) Stormwater Program Technician: Provides support for SWMP implementation and MS4 General Permit compliance activities, environmental compliance programs, sampling, training, inspections, permit reviews, data collection, reporting, and equipment management. This position's primary permit responsibilities include:
    - Construction-Site Management
    - Post-Construction Management (inspection and maintenance)
    - Illicit Discharge Detection and Elimination
- (.5) Development Review Engineers: Reviews submitted development applications and ensure compliance with City Engineering Standards. Completes post-construction inspections to ensure contractors install infrastructure per approved design. This position's primary permit responsibility includes:
    - Post-Construction Management (site and subdivision plan review)
- (1) Stormwater Operations Foreman: Manages reoccurring stormwater infrastructure maintenance, structural inspections, repairs, and replacements.
- (2) Stormwater Operators: Completes stormwater infrastructure related work under the guidance and supervision of the Operations Foreman.

2. Future Additions
    - Stormwater Program Technician: Provides support for environmental compliance programs, sampling, training, inspections, permit reviews, data collection, reporting, and equipment management.
    - Internship: Completes short-term projects, such as stormwater sampling, outfall reconnaissance inventories, infrastructure mapping, and condition studies.

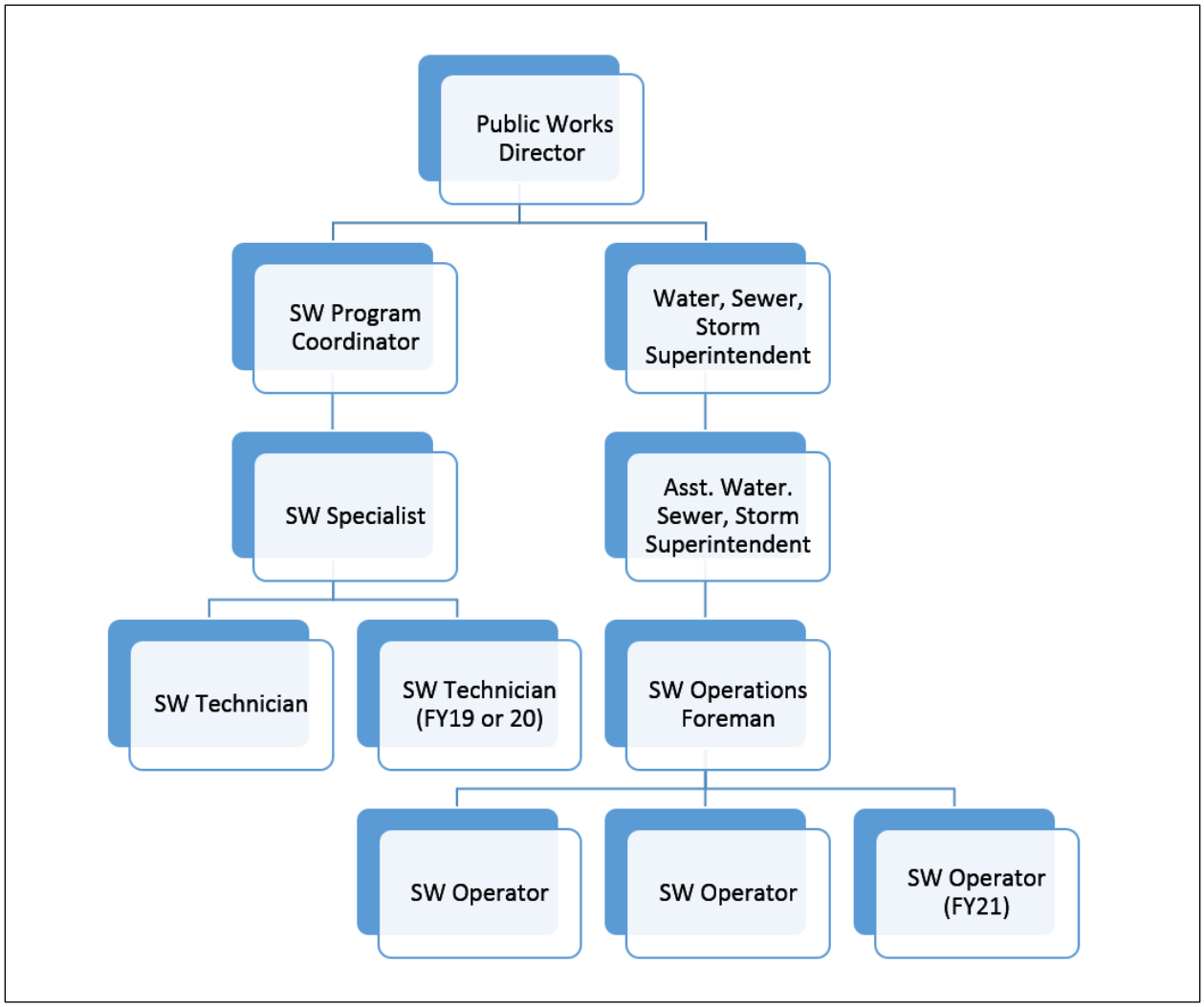


Figure 1.6.1: Staff structure

The following representatives make up the City's Stormwater Management Team (SWMT). Regular communication and coordination occur via recurring meetings, allowing for the exchange of necessary information:

1. Kyle Mehrens, Stormwater Program Coordinator (*Primary SWMP Coordinator*)
2. Frank Greenhill, Stormwater Program Specialist
3. Cody Flammond, Stormwater Program Technician *(Hazwoper Certification)*
4. Mike Dilbeck, Stormwater Operations Foreman

The following representatives are Subject Matter Experts (SMEs). SMEs provide guidance on specific issues, projects, plans, and policy changes upon request.

1. Craig Woolard P.E., Public Works Director
2. Brian Heaston P.E., Project Engineer
3. Shawn Kohtz P.E., Development Review Manager
4. Griffin Nielsen E.I., Development Review Engineer
5. Kellen Gamradt P.E., Project Engineer
6. Richard Hixson P.E., City Engineer

7. Jon Henderson, GIS Manager
8. John Alston, Water/Sewer/Storm Superintendent
9. Nick Pericich, Water/Sewer/Storm Assistant Superintendent
10. John Vandelinder, Streets Superintendent
11. Matt Workman, Streets Assistant Superintendent
12. Katherine Maines, Public Works Technician

1.8 Co-Permittee

The University is an educational facility designated as a Non-Traditional Phase II MS4 per ARM 17.30.1102(23)(d) and is integrated into the City's Program. The University is a co-permittee authorized to discharge under the City's MS4 General Permit. The University is required to:

1. Prepare and submit a Notice of Intent (NOI) for authorization to discharge stormwater under the fourth generation Montana Pollution Discharge Elimination System (MPDES) General Permit for Stormwater Discharges Associated with Small MS4s
2. Receive authorization to discharge stormwater from the MDEQ by January 1, 2017.
3. Develop and execute an MOU with the City, designating roles and responsibilities for the MS4 General Permit term.
4. Provide the City with annual reporting data and programmatic information.
5. Implement applicable content of this SWMP throughout the MS4 General Permit term subject to a Memorandum of Understanding.

In 2011, as a co-permittee, the University participated in the MDEQ audit of the City's Stormwater Program. The University based efforts through the permit cycle on the findings of that audit. The University has completely mapped its system; record keeping and compliance issues have been coordinated with the City; and BMPs have been instituted and documented.

In the current permit cycle, the University has done four projects of an acre or larger in size which have influenced stormwater quantity and quality. Additionally, one project specific to water quality was also done in this period. Because of these projects, MSU has reduced water quantity and improved water quality on 562,743 square feet (12.9 acres) of stormwater drainage area. Of this square footage, 78,035 (1.8 acres) is new construction, and the remaining square footage is improvements to conditions.

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

The University currently devotes approximately 640 hours annually 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 General Permit compliance.

1. Current Staff
    - Engineering and Utility Manager: High-level directional and political support (*40 hours per year*)
    - Environmental Services Manager (Primary SWMP Coordinator): 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:

- Megan Sterl, Engineering and Utility Manager
    a. Program Administration
- EJ Hook, Environmental Services Manager *(Primary SWMP Coordinator)*
    a. Community Outreach and Education
    b. Public Involvement and Participation
    c. Construction-Site Management
    d. Post-Construction Management
    e. Illicit Discharge Detection and Elimination
    f. Project Management
    g. Good Housekeeping
    h. Training

1.9 Additional Regulatory Responsibilities

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

1. 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 Sec. 5.0
2. Multi-Sector General Permit for 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.
3. General Permit for Construction Dewatering (MTG070000): The Water and Sewer Division completes main break repairs and preventative maintenance in high groundwater areas, both requiring dewatering activities. Pumped water is land applied whenever possible to avoid any potential impacts from this activity and the need for permit coverage.
4. General Permit for Disinfected Water and Hydrostatic Testing (MTG770000): The Water and Sewer Division flow hydrants to flush the water distribution pipe network and test hydrants.

1.10 Affiliations

The MS4 works with the following partners, but does not share any specific permitting responsibilities:

1. Montana Stormwater Association (MSWA): An organization formed in 2016 comprised of representatives from the regulated Phase II MS4s in Montana. The MSWA provides a unified voice for state scale policy changes, rules, issues, and initiatives. The MSWA meets as necessary to cover relevant topics and plans to formalize in the next five years, including the development of a mission statement, budget, and structure. The MS4 intends to be a lead contributor.
2. National Municipal Stormwater Alliance (NMSA): An organization formed in 2015 comprised of MS4 regulated entities nationwide. The NMSA provides a unified voice for national scale policy

changes, rules, issues, and initiatives. The NMSA meets annually at the WEFTech Conference. The MS4 plans to increase its participation in the next five years.

3. Gallatin Local Water Quality District: A Gallatin County agency that provides contract-based water quality sampling and education services for the MS4.
4. Montana State Extension Water Quality: A University Extension agency that provides contract-based water quality sampling and education services for the MS4.
5. 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. As of 2016, the MWEA is forming a Stormwater Board, intended to educate and provide technical assistance for members of Montana. These efforts align closely with WEF's efforts on the national scale, raising the bar of technical, infrastructure, policy, and science surrounding stormwater at the national level. The MS4 plans to help develop and serve on the Stormwater Board once created.
6. Greater Gallatin Watershed Council: An educational organization working to improve waterway health throughout the Gallatin Valley.

1.11 Memorandum of Understanding

The MS4 does not have a formalized MOU that outlines specific roles and responsibilities at this time; however, the MS4 does work collaboratively on various programs and initiatives. Leadership in both organizations support and recognize the value of the MS4's close relationship. Specific efforts include:

1. Participation in monthly meetings
2. Monthly payment of City Stormwater Utility fees by MSU
3. Inclusion of MSU's primary SWMP Coordinator at Bozeman Stormwater Team meetings
4. Joint level of service analysis, performance tracking, and reporting
5. Cooperative project development and implementation, such as S. 11th treatment unit
6. Collaborative infrastructure operation procedures and pollution response
7. Shared inspection forms, training, methodologies, and program documentation
8. Collective sampling and evaluation

The MS4's goal is to have an MOU in place but plans to develop and troubleshoot the draft contents over the next few years to ensure a sufficient document once formalized.

1.12 Annual Report

The MS4 submits an individual Annual Report Form, this SWMP, and relevant documents to the MDEQ by March 1st each year of the MS4 General Permit term.

2.0 Division Performance

Image 2.0.1: Stormwater treatment unit installation

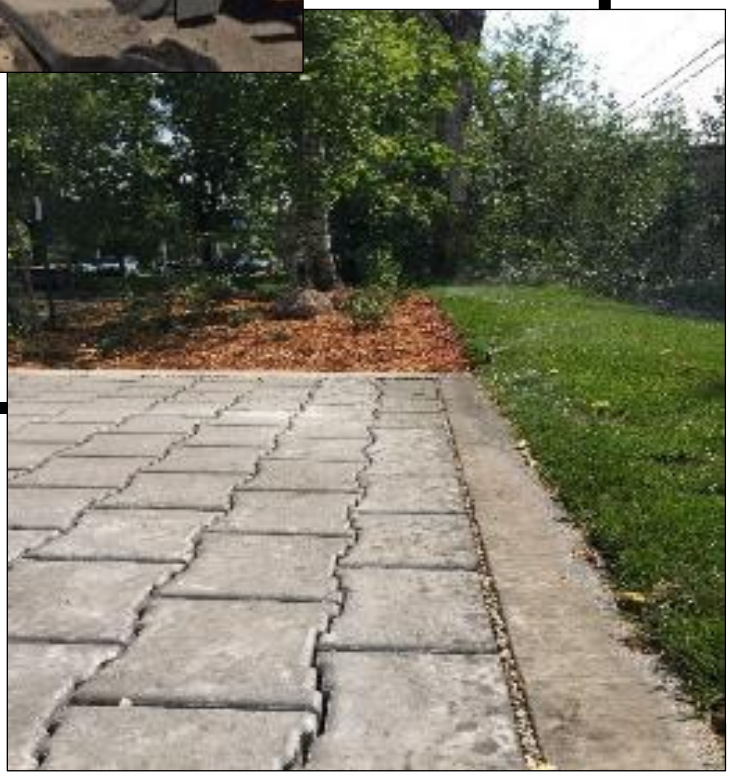


Image 2.0.2: Permeable pavers

2.1 Introduction

The City Commission sets the MS4's annual operating and capital budgets. The following sections detail the MS4's current and future investment strategies, projects, performance tracking mechanisms, and pollutant reduction totals.

2.2 Budget

1. City: FY18 Approved Budget (July 1, 2017, through June 30, 2018)
    - Source: Municipal Enterprise Fund
        - Rate Model Type: Impervious Area
        - Percent Allocation: 100%
        - Resource Justification: Budget approval process completed June 26, 2017
        - Program Effectiveness: Effective, see SWMP Sec. 2.6
        - Resource Allocation Variation: Addition of one administrative FTE (Specialist)
        - Success Determination: Successful, the MS4 has either met performance goals or successfully acquired resources to lessen deficits.
    - Staff: 6.5 FTEs
    - Budget: $1,488,360
        - Salaries and Benefits: $451,548
        - Operating Budget: $161,466
        - Capital: $650,000
        - Debt Service: $225,346
        - Transfers: $0.00
2. MSU: FY18 Approved Budget (July 1, 2017, through June 30, 2018)
    - Source: Facility's Budget
        - Rate Model Type: Part of Facilities Services Major maintenance budget
        - Percent Allocation: 100%
        - Resource Justification: Budget approval process completed June 29, 2017
        - Program Effectiveness: Effective, see SWMP Sec. 2.6
        - Resource Allocation Variation: Addition of approximately $25,000 for College and 11th stormwater improvement project
        - Success Determination: Successful, the MS4 has either met performance goals or successfully acquired resources to lessen deficits.
    - Staff: 0.3 FTEs
    - Budget: $124,000
        - Salaries and Benefits: n/a
        - Operating Budget: $124,000
        - Capital: n/a
        - Debt Service: n/a
        - Transfers: n/a

2.3 TMDL Action Plan

The MS4 allocates $650,000 per year towards structural and treatment infrastructure projects to improve the integrity of the stormwater collection network, expand system conveyance, and meet water quality requirements. The MS4 plans to target pollutants of concern for its impaired waterbodies by taking the following project identification and prioritization strategy:

1. Mitigate major impacts through industry standard structural treatment technologies, such as mechanical separation, confirmed to achieve 80% TSS removal under certain conditions through independent certification programs. This step allows the MS4 to "triage" the system, installing effective, maintainable, and economical treatment systems near stormwater discharge points for the MS4's large urban drainage areas currently lacking treatment before discharge.
2. Develop and implement operation and education-based programs and initiatives, such as street sweeping, infrastructure cleaning, and targeted community outreach, that target pollutants of concern for the MS4's impaired waterbodies. This step allows the MS4 to reduce the pollutants of concern by implementing economic and sustainable administrative and operational activities.
3. Collect and analyze stormwater runoff, in-stream water quality, BMP effectiveness, and long-term monitoring data using an array of industry standard gages and equipment to plan future investments, education-based initiatives, and infrastructure operations. This step allows the MS4 to monitor its pollutants of concern reductions, impaired waterbody improvement, and investment and program self-evaluation.
4. Enhance pollutant reductions using targeted green infrastructure and low impact development projects, such as boulevard bio-retention swales and dispersion, verified to achieve 100% TSS removal through the process of capture and infiltration of the water quality event (2-year storm). This step allows the MS4 to "fine-tune" the stormwater system to optimize treatment efficiencies in larger urban watersheds and treat stormwater in smaller urban watersheds not suitable for larger projects.

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

1. Urban Watershed Priority: The MS4 has two distinct regions of development. Urban areas built before 1980 and after 1980. Areas constructed before 1980 contain direct discharge urban watersheds that include infrastructure collection and conveyance systems that discharge stormwater into receiving water bodies without treatment or volume control. The MS4 classifies those that exceed 30-acres as high-priority and targets them for regional treatment projects.

   Areas built after 1980 contain indirect discharge urban watersheds, which include infrastructure collection and conveyance systems that discharge stormwater into receiving water bodies after it travels through post-construction BMPs, such as stormwater basins. The majority of post-construction BMPs are owned and maintained by Home Owner Associations or private companies. The MS4, through its Post-Construction Program, educates, inspects, and enforces maintenance of these BMPs. Staff classifies indirect discharge urban watersheds as low-priority.
2. Development and Land Use: Development types and land-use occurring in urban watersheds affects stormwater pollution levels. The MS4 accounts for expected pollutant types and influent concentrations. For example, an urban watershed that includes industrial activities contains high levels of TSS, metals, and oils from the activities and properties that exist. Examples of

contributing land uses activities include gravel staging areas, equipment storage areas, and refueling stations. Residential urban watersheds contain high levels of nutrients, Total Sediment Solids, and E.coli. Example contributors include lawns and pets.

3. Waterway Impairments: Treatment projects that target total suspended sediment reductions in stormwater discharges to Bozeman and Mandeville Creeks constitute the majority of CIP expenditures.
4. Budget Constraints: Alignment of projects, so annual expenditures are equal to utility income.
5. Other Projects: Combining planned projects with other MS4 initiatives, such as road reconstructions, reduces costs.

2.4 Capital Projects

The MS4 plans to complete the following approved capital projects:

1. Mechanical Separation Units - Downtown Stormwater Treatment Phase 2
    - ID: STRM13
    - Year: FY19
    - Budget: $350,000
    - Description: This project includes the installation of four (4) stormwater mechanical separation units near the following intersections: N. Black and E. Main, N. Bozeman and E. Main, N. Rouse and E. Main, and Westridge and Overbrook. Staff proposes to target these locations because the roads, parking lots, yards, driveways, and drainage systems contained within their urban watersheds have a direct connection to Bozeman and Matthew Bird Creeks, meaning no removal of stormwater pollutants currently occurs.
    - Alternatives Considered: Staff has not identified any alternative stormwater treatment approaches with comparable maintenance requirements, construction footprints, and/or pollutant removal efficiencies, especially considering the large size of the drainage basins targeted.
    - Advantages of Approval: The four (4) units will treat stormwater flowing from 162 urban acres, collecting an estimated 12 tons of sediment, litter, oil, and metals annually. Pollutant removal will improve public safety, help restore Bozeman and Matthew Bird Creeks' aquatic habitat, decrease infrastructure degradation, and provide the City a measurable step towards municipal stormwater discharge permit compliance.
    - Additional Operating Cost in the Future: Stormwater Operations Personnel will complete maintenance semi-annually, including the removal of collected debris using existing vacuuming equipment. Once collected, Staff will temporarily store and dry debris at the City's Stormwater Waste Management Facility before hauling to the landfill for final disposal.
    - Additional Funding Sources: None
2. Boulevard Infiltration Structures – Downtown Stormwater Treatment Phase 2
    - ID: STRM36

- Year: FY19
- Budget: $50,000
- Description: This project includes the installation of two (2) stormwater boulevard infiltration structures near the intersection of N. 11th and W. Dickerson. Staff proposes to target this location because the roads, parking lots, yards, driveways, and drainage systems contained within its urban watershed have a direct connection to Mandeville Creek, meaning no removal of stormwater pollutants currently occurs.
- Alternatives Considered: Staff has not identified any alternative stormwater treatment approaches with comparable maintenance requirements, construction footprints, and/or pollutant removal efficiencies, especially considering the small size of the drainage basin targeted.
- Advantages of Approval: The two (2) structures will divert, capture, and infiltrate stormwater flowing from seven (7) urban acres, collecting over two (2) tons of sediment, litter, oil, and metals annually. Pollutant removal will improve public safety, help restore Mandeville Creek's aquatic habitat, decrease infrastructure degradation, and provide the City a measurable step towards municipal stormwater discharge permit compliance.
- Additional Operating Cost in the Future: Stormwater Operations Personnel will complete maintenance semi-annually, including the removal of collected debris using existing vacuuming equipment. Once collected, Staff will temporarily store and dry debris at the City's Stormwater Waste Management Facility before hauling to the landfill for final disposal.
- Additional Funding Sources: None

3. Pipe Replacement – N. 4th (W. Cottonwood to W. Peach)
   - ID: New
   - Year: FY19
   - Budget: $50,000
   - Description: This project includes the construction of 150' of 30" reinforced concrete pipe near the intersection of N. 4th and W. Peach, replacing a conveyance ditch and linking two existing pipe sections. Staff proposes to target this location because the ditch is clogged and reverse graded due to significant degradation. Staff secured an easement from the property owner in FY17 to facilitate the construction of this project and improve land records.
   - Alternatives Considered: Staff assessed the potential of rehabbing the conveyance ditch currently in place; however, decided to proceed with a pipe project after reviewing long-term maintenance cost and private property concerns.
   - Advantages of Approval: The pipe will convey stormwater originating from a 58-acre urban watershed, reducing flood risk for adjacent properties and improving water quality by mitigating past issues stemming from erosion and illegal dumping.
   - Additional Operating Cost in the Future: Stormwater Operations Personnel will complete maintenance annually, including the removal of collected debris using existing pipe flushing

equipment. Once collected, Staff will temporarily store and dry debris at the City's Stormwater Waste Management Facility before hauling to the landfill for final disposal.

- Additional Funding Sources: None

4. Administrative Staff Vehicle
    - ID: New
    - Year: FY19
    - Budget: $35,000
    - Description: This project includes the purchase of a new field work and inspection vehicle for Stormwater Division Administrative Staff, accommodating transportation needs for a new Specialist Position hired in FY18. The Stormwater Division has three administrative personnel who currently have one truck, and access to two shared Public Works cars. An additional truck is necessary for Staff to complete pollution event mitigation activities, sampling equipment transport, work within the public-right-of-way, and field inspections.
    - Alternatives Considered: Staff assessed the potential of sharing existing vehicles; however, determined that scheduling conflicts would present themselves frequently, affecting the Division's ability to achieve level of service goals.
    - Advantages of Approval: The purchase of an additional vehicle will allow Stormwater Division Staff to complete daily work activities timely, effectively, and safely.
    - Additional Operating Cost in the Future: Staff will budget for annual preventative maintenance completed by a mix of internal and external services, ensuring the vehicle stays in good working order.
    - Additional Funding Sources: None
5. Mechanical Separation Unit – College and S. 11th
    - ID: Montana State University Project
    - Year: FY19
    - Budget: $150,000
    - Description: This project includes the installation of a stormwater mechanical separation unit near the intersection of College and S. 11th. Staff proposes to target this location because the roads, parking lots, yards, driveways, and drainage systems contained within its urban watersheds have a direct connection to Mandeville Creek, meaning no removal of stormwater pollutants currently occurs.
    - Alternatives Considered: Staff has not identified any alternative stormwater treatment approaches with comparable maintenance requirements, construction footprints, and/or pollutant removal efficiencies, especially considering the large size of the drainage basins targeted.
    - Advantages of Approval: The unit will treat stormwater flowing from 60 urban acres, collecting over 3.6 tons of sediment, litter, oil, and metals annually. Pollutant removal will improve public

safety, help restore Mandeville Creeks' aquatic habitat, decrease infrastructure degradation, and provide the City a measurable step towards municipal stormwater discharge permit compliance.

- Additional Operating Cost in the Future: Stormwater Operations Personnel will complete maintenance semi-annually, including the removal of collected debris using existing vacuuming equipment. Once collected, Staff will temporarily store and dry debris at the City's Stormwater Waste Management Facility before hauling to the landfill for final disposal.
- Additional Funding Sources: None

6. Annual Pipe Rehabilitation and Drainage Projects
   - ID: STRM13
   - Year: FY19
   - Budget: $65,000
   - Description: An annual program that provides funding for the design and construction of various pipe rehabilitation, drainage, and treatment projects that improve the structural integrity and conveyance capacity of the City's stormwater infrastructure network. Unplanned funds allow Staff to respond to infrastructure needs that arise from reoccurring system inspection and partner with other Public Works' projects, such as local SID street reconstructions when approved.
   - Alternatives Considered: Staff assessed the potential of Stormwater Operations Personnel completing all pipe rehabilitation and drainage projects; however, this approach would significantly reduce resources applied towards critical reoccurring infrastructure maintenance.
   - Advantages of Approval: The allocation of unplanned funds allows Staff to be proactive in the repair and replacement of stormwater infrastructure that has or is likely to fail, increasing system efficiency and reducing City liability.
   - Additional Operating Cost in the Future: Stormwater Operations Personnel will complete maintenance of projects as required.
   - Additional Funding Sources: None
7. Annual Inlet Replacement Program
   - ID: New
   - Year: FY19
   - Budget: $100,000
   - Description: An annual program that provides funding for the replacement of under sized and degraded stormwater inlets throughout the downtown core in coordination with the Street and Engineering Divisions' ADA pedestrian ramp installation program.
   - Alternatives Considered: Staff assessed the potential of Stormwater Operations Personnel completing inlet replacements; however, this approach would significantly reduce resources applied towards critical reoccurring infrastructure maintenance.

- Advantages of Approval: Upgrading inlets to the City's current standard will reduce localized flooding and improve stormwater treatment through increased sump depth.
- Additional Operating Cost in the Future: Stormwater Operations Personnel will complete maintenance annually, including the removal of collected debris using existing inlet vacuuming equipment. Once collected, Staff will temporarily store and dry debris at the City's Stormwater Waste Management Facility before hauling to the landfill for final disposal.
- Additional Funding Sources: None

8. Mechanical Separation Units - Downtown Stormwater Treatment Phase 3
   - ID: STRM34
   - Year: FY20
   - Budget: $300,000
   - Description: This project includes the installation of three (3) stormwater mechanical separation units near the following intersections: N. Rouse and E. Peach, N. Tracy and W. Main, and Langhor and Westridge. Staff proposes to target these locations because the roads, parking lots, yards, driveways, and drainage systems contained within their urban watersheds have a direct connection to Bozeman and Matthew Bird Creeks, meaning no removal of stormwater pollutants currently occurs.
   - Alternatives Considered: Staff has not identified any alternative stormwater treatment approaches with comparable maintenance requirements, construction footprints, and/or pollutant removal efficiencies, especially considering the large size of the drainage basins targeted.
   - Advantages of Approval: The three (3) units will treat stormwater flowing from 258 urban acres, and collect over 16 tons of sediment, litter, oil, and metals annually. Pollutant removal will improve public safety, help restore Bozeman and Matthew Bird Creeks' aquatic habitat, decrease infrastructure degradation, and provide the City a measurable step towards municipal stormwater discharge permit compliance.
   - Additional Operating Cost in the Future: Stormwater Operations Personnel will complete maintenance semi-annually, including the removal of collected debris using existing vacuuming equipment. Once collected, Staff will temporarily store and dry debris at the City's Stormwater Waste Management Facility before hauling to the landfill for final disposal.
   - Additional Funding Sources: None
9. Boulevard Infiltration Structures – Downtown Stormwater Treatment Phase 3
   - ID: STRM49
   - Year: FY20
   - Budget: $50,000
   - Description: This project includes the installation of two (2) stormwater boulevard infiltration structures near the intersection of N. 11th and W. Alderson. Staff proposes to target this location

because the roads, parking lots, yards, driveways, and drainage systems contained within its urban watershed have a direct connection to Mandeville Creek, meaning no removal of stormwater pollutants currently occurs.

- Alternatives Considered: Staff has not identified any alternative stormwater treatment approaches with comparable maintenance requirements, construction footprints, and/or pollutant removal efficiencies, especially considering the small size of the drainage basin targeted.
- Advantages of Approval: The two (2) structures will divert, capture, and infiltrate stormwater flowing from eight (8) urban acres and collect over two (2) tons of sediment, litter, oil, and metals annually. Pollutant removal will improve public safety, help restore Mandeville Creek's aquatic habitat, decrease infrastructure degradation, and provide the City a measurable step towards municipal stormwater discharge permit compliance.
- Additional Operating Cost in the Future: Stormwater Operations Personnel will complete maintenance semi-annually, including the removal of collected debris using existing vacuuming equipment. Once collected, Staff will temporarily store and dry debris at the City's Stormwater Waste Management Facility before hauling to the landfill for final disposal.
- Additional Funding Sources: None

10. Mechanical Separation Units - Downtown Stormwater Treatment Phase 4
    - ID: STRM31
    - Year: FY21
    - Budget: $300,000
    - Description: This project includes the installation of three (3) stormwater mechanical separation units near the following intersections: N. Rouse and E. Tamarack, S. Black and E. Cleveland, and S. Bozeman and E. Cleveland. Staff proposes to target these locations because the roads, parking lots, yards, driveways, and drainage systems contained within their urban watersheds have a direct connection to Bozeman and Matthew Bird Creeks, meaning no removal of stormwater pollutants currently occurs.
    - Alternatives Considered: Staff has not identified any alternative stormwater treatment approaches with comparable maintenance requirements, construction footprints, and/or pollutant removal efficiencies, especially considering the large size of the drainage basins targeted.
    - Advantages of Approval: The three (3) units will treat stormwater flowing from 278 urban acres and collect over 17 tons of sediment, litter, oil, and metals annually. Pollutant removal will improve public safety, help restore Bozeman and Matthew Bird Creeks' aquatic habitat, decrease infrastructure degradation, and provide the City a measurable step towards municipal stormwater discharge permit compliance.
    - Additional Operating Cost in the Future: Stormwater Operations Personnel will complete maintenance semi-annually, including the removal of collected debris using existing vacuuming

equipment. Once collected, Staff will temporarily store and dry debris at the City's Stormwater Waste Management Facility before hauling to the landfill for final disposal.

- Additional Funding Sources: None

11. Boulevard Infiltration Structures – Downtown Stormwater Treatment Phase 4
    - ID: New
    - Year: FY21
    - Budget: $50,000
    - Description: This project includes the installation of two stormwater boulevard infiltration structures near the intersection of S. Black and E. Garfield. Staff proposes to target this location because the roads, parking lots, yards, driveways, and drainage systems contained within its urban watershed have a direct connection to Matthew Bird Creek, meaning no removal of stormwater pollutants currently occurs.
    - Alternatives Considered: Staff has not identified any alternative stormwater treatment approaches with comparable maintenance requirements, construction footprints, and/or pollutant removal efficiencies, especially considering the small size of the drainage basin targeted.
    - Advantages of Approval: The two (2) structures will divert, capture, and infiltrate stormwater flowing from 14 urban acres and collect over two (2) tons of sediment, litter, oil, and metals annually. Pollutant removal will improve public safety, help restore aquatic habitat, decrease infrastructure degradation, and provide the City a measurable step towards municipal stormwater discharge permit compliance.
    - Additional Operating Cost in the Future: Stormwater Operations Personnel will complete maintenance semi-annually, including the removal of collected debris using existing vacuuming equipment. Once collected, Staff will temporarily store and dry debris at the City's Stormwater Waste Management Facility before hauling to the landfill for final disposal.
    - Additional Funding Sources: None
12. Mechanical Separation Units - Downtown Stormwater Treatment Phase 5
    - ID: STRM38
    - Year: FY22
    - Budget: $300,000
    - Description: This project includes the installation of three (3) stormwater mechanical separation units near the following intersections: N. 4th and W. Peach, N. 11th and W. Koch, and N. 9th and W. Villard. Staff proposes to target these locations because the roads, parking lots, yards, driveways, and drainage systems contained within their urban watersheds have a direct connection to Mandeville Creek, meaning no removal of stormwater pollutants currently occurs.
    - Alternatives Considered: Staff has not identified any alternative stormwater treatment approaches with comparable maintenance requirements, construction footprints, and/or

pollutant removal efficiencies, especially considering the large size of the drainage basins targeted.

- Advantages of Approval: The three (3) units will treat stormwater flowing from 255 urban acres and collect over 15 tons of sediment, litter, oil, and metals annually. Pollutant removal will improve public safety, help restore aquatic habitat, decrease infrastructure degradation, and provide the City a measurable step towards municipal stormwater discharge permit compliance.
- Additional Operating Cost in the Future: Stormwater Operations Personnel will complete maintenance semi-annually, including the removal of collected debris using existing vacuuming equipment. Once collected, Staff will temporarily store and dry debris at the City's Stormwater Waste Management Facility before hauling to the landfill for final disposal.
- Additional Funding Sources: None

13. Boulevard Infiltration Structures – Downtown Stormwater Treatment Phase 5
    - ID: New
    - Year: FY22
    - Budget: $50,000
    - Description: This project includes the installation of two stormwater boulevard infiltration structures near the intersection of N. Montana and E. Beall. Staff proposes to target this location because the roads, parking lots, yards, driveways, and drainage systems contained within its urban watershed have a direct connection to Bozeman Creek, meaning no removal of stormwater pollutants currently occurs.
    - Alternatives Considered: Staff has not identified any alternative stormwater treatment approaches with comparable maintenance requirements, construction footprints, and/or pollutant removal efficiencies, especially considering the small size of the drainage basin targeted.
    - Advantages of Approval: The two (2) structures will divert, capture, and infiltrate stormwater flowing from eight (8) urban acres and collect over two (2) tons of sediment, litter, oil, and metals annually. Pollutant removal will improve public safety, help restore aquatic habitat, decrease infrastructure degradation, and provide the City a measurable step towards municipal stormwater discharge permit compliance.
    - Additional Operating Cost in the Future: Stormwater Operations Personnel will complete maintenance semi-annually, including the removal of collected debris using existing vacuuming equipment. Once collected, Staff will temporarily store and dry debris at the City's Stormwater Waste Management Facility before hauling to the landfill for final disposal.
    - Additional Funding Sources: None
14. Mechanical Separation Units - Downtown Stormwater Treatment Phase 6
    - ID: New
    - Year: FY23

- Budget: $300,000
- Description: This project includes the installation of three (3) stormwater mechanical separation units near the following intersections: S. 17th and W. Babcock, Blackmore and Terrace, and S. Tracy and E. Kagy. Staff proposes to target these locations because the roads, parking lots, yards, driveways, and drainage systems contained within their urban watersheds have a direct connection to Mandeville and Matthew Bird Creeks, meaning no removal of stormwater pollutants currently occurs.
- Alternatives Considered: Staff has not identified any alternative stormwater treatment approaches with comparable maintenance requirements, construction footprints, and/or pollutant removal efficiencies, especially considering the large size of the drainage basins targeted.
- Advantages of Approval: The three (3) units will treat stormwater flowing from 100 urban acres and collect over 6 tons of sediment, litter, oil, and metals annually. Pollutant removal will improve public safety, help restore aquatic habitat, decrease infrastructure degradation, and provide the City a measurable step towards municipal stormwater discharge permit compliance.
- Additional Operating Cost in the Future: Stormwater Operations Personnel will complete maintenance semi-annually, including the removal of collected debris using existing vacuuming equipment. Once collected, Staff will temporarily store and dry debris at the City's Stormwater Waste Management Facility before hauling to the landfill for final disposal.
- Additional Funding Sources: None

15. Boulevard Infiltration Structures – Downtown Stormwater Treatment Phase 6
    - ID: New
    - Year: FY23
    - Budget: $50,000
    - Description: This project includes the installation of two stormwater boulevard infiltration structures near the intersection of N. Broadway and E. Mendenhall. Staff proposes to target this location because the roads, parking lots, yards, driveways, and drainage systems contained within its urban watershed have a direct connection to Bozeman Creek, meaning no removal of stormwater pollutants currently occurs.
    - Alternatives Considered: Staff has not identified any alternative stormwater treatment approaches with comparable maintenance requirements, construction footprints, and/or pollutant removal efficiencies, especially considering the small size of the drainage basin targeted.
    - Advantages of Approval: The two (2) structures will divert, capture, and infiltrate stormwater flowing from four (4) urban acres and collect over one (1) ton of sediment, litter, oil, and metals annually. Pollutant removal will improve public safety, help restore aquatic habitat, decrease infrastructure degradation, and provide the City a measurable step towards municipal stormwater discharge permit compliance.

- Additional Operating Cost in the Future: Stormwater Operations Personnel will complete maintenance semi-annually, including the removal of collected debris using existing vacuuming equipment. Once collected, Staff will temporarily store and dry debris at the City's Stormwater Waste Management Facility before hauling to the landfill for final disposal.
- Additional Funding Sources: None

16. Stormwater Facility Plan Update
    - ID: New
    - Year: FY20
    - Budget: $150,000
    - Description: This project includes hiring a contractor to update the City of Bozeman's Stormwater Facility Plan, which was last revised in 2007. The City has made significant stormwater programmatic, operational, and administrative changes over the past ten years in response to evolving environmental regulations, growth, and aging infrastructure. An updated Stormwater Facility Plan will assist Staff in identifying high-priority infrastructure deficiencies, future needs, and determine the City's regulatory standing with MS4 General Permit regulations.
    - Alternatives Considered: Staff will continue implementing recommendations provided in the 2007 Stormwater Facility Plan.
    - Advantages of Approval: A Stormwater Facility Plan will provide Staff a framework, action plan, and third party professional oversight that will assist the City in achieving its programmatic goals, which include complying with environmental regulations, improving waterway health, protecting public safety, and managing infrastructure.
    - Additional Operating Cost in the Future: None
    - Additional Funding Sources: None

2.5 Completed Capital Projects

The MS4 has completed the following projects to date:

1. 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
    - Cost: $15,000
    - Discharge Location: Bozeman Creek
    - Date of Completion: Summer 2017
    - Co-Benefits: Progress towards WLA
2. 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
- Cost: $100,000
- Discharge Location: Bozeman Creek
- Date of Completion: Fall 2017
- Co-Benefits: Progress towards WLA

3. Pipe Replacements (S. Black and S. Bozeman)

   - Purpose: Flood control
   - Type: 15" SDR
   - Expected Treatment Efficiency: n/a
   - Treatment Area: 600'
   - Cost: $60,000
   - Discharge Location: Bozeman Creek
   - Date of Completion: Fall 2017
   - Co-Benefits: n/a

4. Mechanical Separation Unit Installation – N. Rouse and E. Griffin

   - Purpose: Reduce sediment load to Bozeman Creek
   - Type: Contech CDS (*6' Diameter*)
   - Expected Treatment Efficiency: 80% TSS Reduction
   - Treatment Area: ≈ 14 Acres
   - Cost: $100,000 (MDT Project)
   - Discharge Location: Bozeman Creek
   - Date of Completion: Fall 2017
   - Co-Benefits: Progress towards WLA

5. Mechanical Separation Unit Installation - N. Rouse and Bridger Center

   - Purpose: Reduce sediment load to Bozeman Creek
   - Type: Contech CDS (*5' Diameter*)
   - Expected Treatment Efficiency: 80% TSS Reduction
   - Treatment Area: ≈12 Acres
   - Cost: $75,000 (MDT Project)
   - Discharge Location: Bozeman Creek
   - Date of Completion: Fall 2017
   - Co-Benefits: Progress towards WLA

6. Mechanical Separation Unit Installation – S. Rouse and E. Olive

   - Purpose: Reduce sediment load to Bozeman Creek
   - Type: Contech CDS (*5' Diameter*)
   - Expected Treatment Efficiency: 80% TSS Reduction
   - Treatment Area: ≈9 Acres
   - Cost: $50,000
   - Discharge Location: Bozeman Creek
   - Date of Completion: Fall 2017
   - Co-Benefits: Progress towards WLA

7. Mechanical Separation Unit Installation – Perkins and E. Peach

- Purpose: Reduce sediment load to Bozeman Creek
- Type: Contech CDS (4*' Diameter*)
- Expected Treatment Efficiency: 80% TSS Reduction
- Treatment Area: ≈ 22 Acres
- Cost: $25,000
- Discharge Location: Bozeman Creek
- Date of Completion: Fall 2017
- Co-Benefits: Progress towards WLA

8. 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
   - Cost: $400,000
   - Discharge Location: Lined wastewater pond
   - Date of Completion: Fall 2017
   - Co-Benefits: Facilitates pollutant reduction totals

9. Midtown Streetscape Project

   - Purpose: Flood control, water quality improvement, economic benefit
   - Type: Basalite permeable pavers and Stratavault soil cells
   - Expected Treatment Efficiency: 100% TSS Reduction
   - Treatment Area: ≈ 600 square feet
   - Cost: Unknown, Economic Development Project
   - Discharge Location: Conveyance Ditch
   - Date of Completion: Winter 2017
   - Co-Benefits: Aesthetic value

10. Mechanical Separation Unit Installation - S. Rouse and E. Lincoln

    - Purpose: Reduce sediment load to Bozeman Creek
    - Type: Contech CDS (*5' Diameter*)
    - Expected Treatment Efficiency: 80% TSS Reduction
    - Treatment Area: ≈32 Acres
    - Cost: $50,000
    - Discharge Location: Bozeman Creek
    - Date of Completion: Fall 2016
    - Co-Benefits: Progress towards WLA

11. Mechanical Separation Unit Installation - N. 11th and W. Lamme

    - Purpose: Reduce sediment load to Mandeville Creek
    - Type: Contech CDS (*4' Diameter*)
    - Expected Treatment Efficiency: 80% TSS Reduction
    - Treatment Area: ≈7 Acres
    - Cost: $25,000
    - Discharge Location: Mandeville Creek
    - Date of Completion: Fall 2016
    - Co-Benefits: Located adjacent to High School and includes educational signage

12. 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: 80% TSS Reduction for Mechanical Separation Unit and 100% for Underground Infiltration Basin
    - Treatment Area: ≈2 Acres
    - Cost: $360,000
    - Discharge Location: Bozeman Creek
    - Date of Completion: Fall 2016
    - Co-Benefits: Progress towards WLA

13. Mechanical Separation Unit Installation – N. Wallace and E. Tamarack

    - Purpose: Reduce sediment load to Bozeman Creek
    - Type: Contech CDS (8*' Diameter*)
    - Expected Treatment Efficiency: 80% TSS
    - Treatment Area: ≈100 Acres
    - Cost: $75,000
    - Discharge Location: Bozeman Creek
    - Date of Completion: November 2016
    - Co-Benefits: Progress towards WLA

14. 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
    - Treatment Area: ≈9 Acres
    - Cost: $20,000
    - Discharge Location: Mandeville Creek
    - Date of Completion: Summer 2016
    - Co-Benefits: Joint water conservation and stormwater LID pilot project

15. Underground Infiltration Basin – Plum and Avocado

    - Purpose: Reduce localized flooding; reduce sediment load to East Gallatin;
    - Type: ADS StormTech
    - Expected Treatment Efficiency: 100% TSS
    - Treatment Area: ≈14 Acres
    - Cost: $50,000
    - Discharge Location: Subsurface
    - Date of Completion: Fall 2016
    - Co-Benefits: Resolved localized flooding issue

16. Backwater Slough – Story Mill Park

    - Purpose: Reduce sediment load in Bozeman Creek
    - Type: Constructed wetland
    - Expected Treatment Efficiency: 100% TSS
    - Treatment Area: Entire Bozeman Creek Watershed

- Cost: $100,000
- Discharge Location: Bozeman Creek
- Date of Completion: Summer 2015
- Co-Benefits: Nutrient uptake, flood mitigation, and wetland restoration

17. 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
    - Cost: Unknown
    - Discharge Location: Bozeman Creek
    - Date of Completion: Spring 2017
    - Co-Benefits: Education, fish habitat, stream bank stabilization, and flood control

18. Meander the Mandeville Construction Phase 1 – 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
    - Cost: Unknown
    - Discharge Location: Mandeville Creek
    - Date of Completion: 2016
    - Co-Benefits: Education, fish habitat, stream bank stabilization, and flood control

19. 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
    - Cost: $75,000
    - Discharge Location: Mandeville Creek
    - Date of Completion: 2016

20. 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: 80% TSS removal
    - Treatment Area: 3 Acres
    - Cost: $70,000
    - Discharge Location: Mandeville Creek
    - Date of Completion: Fall 2015

21. 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
- Cost: n/a
- Discharge Location: Subsurface
- Date of Completion: 2016

22. Gravity Main Install – 15th and Babcock

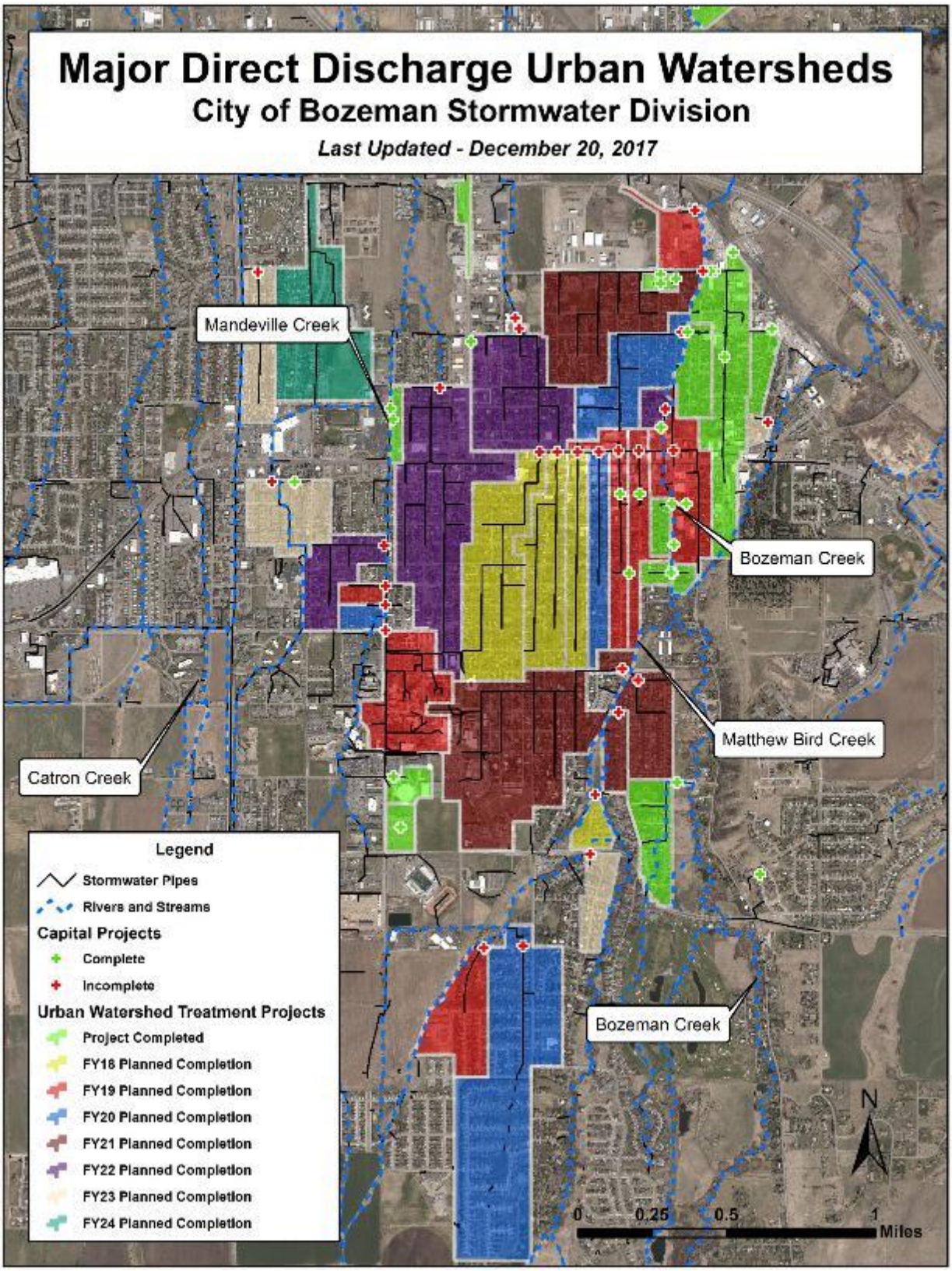
    - Purpose: Eliminate localized flooding issue
    - Type: Construction of underground stormwater main
    - Expected Treatment Efficiency: None
    - Treatment Area: None
    - Cost: ≈30,000
    - Discharge Location: Mandeville Creek
    - Date of Completion: Fall 2015

23. Wallace Street 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
    - Cost: ≈$200,000
    - Discharge Location: Bozeman Creek
    - Date of Completion: 2016

24. 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
    - Cost: ≈$200,000
    - Discharge Location: Bozeman Creek
    - Date of Completion: 2015



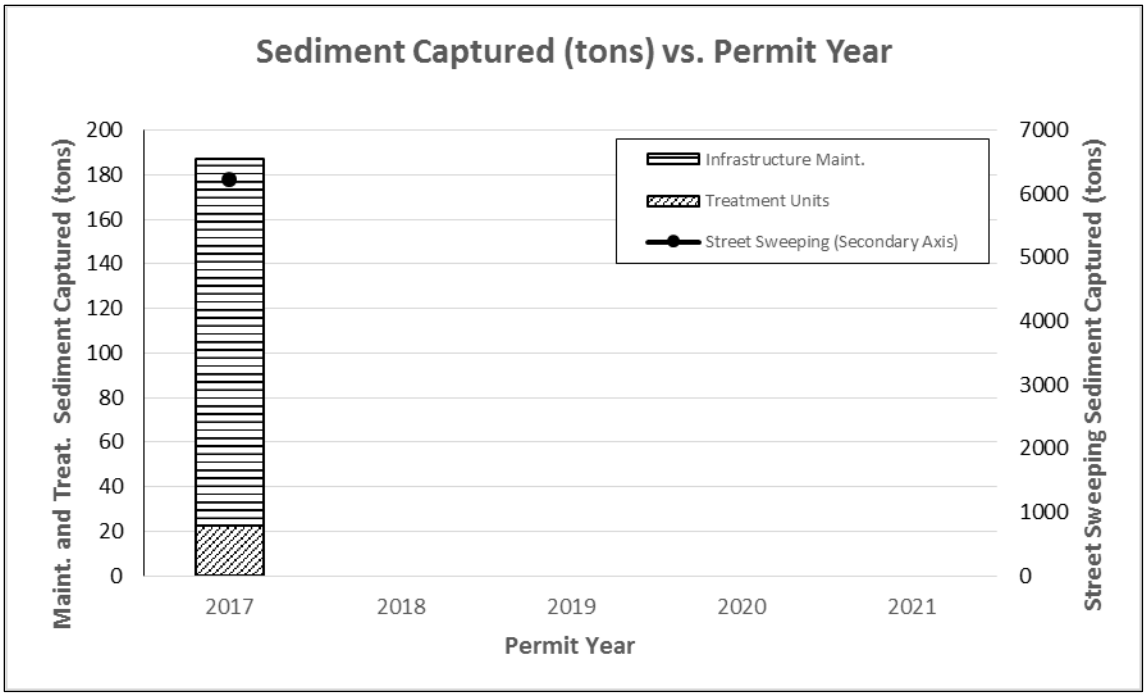
Map 2.3.1: Planned stormwater treatment projects

2.6 Pollutant Reduction Totals

The MS4 tracks pollutant reduction totals using a variety of methods and data tracking mechanisms, including:

1. Total Suspended Solids (Sediment)

- Treatment Unit Maintenance: The MS4 calculates tonnage totals by measuring the depth of sediment within each unit before cleaning. The MS4 subtracts a top of sediment depth measurement from a total depth measurement. The MS4 then calculates a volume of sediment (cubic feet) using dimension information for each unit. Finally, the MS4 converts the volume to tons by using an assumed sand weight ratio of .056 Tons = 1 Cubic Foot of Sand.
    - 2017: 22.6 Tons
        - Bozeman Creek Watershed: 16.3 Tons
        - Mandeville Creek Watershed: 5.0 Tons
        - East Gallatin: 1.3 Tons
        - Citywide (Excluding Above): 0 Tons
- Infrastructure Maintenance: The MS4 calculates tonnage totals by conservatively estimating the depth of sediment 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. Then, the MS4 multiplies the volume by the total assets maintained for that calendar year. Finally, the MS4 converts the volume to tons by using an assumed sand weight ratio of .056 Tons = 1 Cubic Foot of Sand.
    - 2017: 164.7 Tons
        - City Citywide: 117.7 Tons
        - MSU Campus: 46.9 Tons
- Street Sweeping: The MS4 calculates tonnage totals for reoccurring, spring, and fall Street sweeping operations. Streets Division personnel track cubic yard totals for each of the activities, which is then stored in Cityworks and reported on. 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. The MS4 converts yards to tons using an assumed weight ratio of .18 Tons = 1 Cubic Yard of Leaves for fall street sweeping.
    - 2017: 6,232 Tons
        - City Citywide: 6,108 Tons
        - MSU Campus: 124 Tons



Graph 2.6.1: Sediment capture totals

2.7 Performance Measures

The MS4 utilizes performance measures to determine the effectiveness of implemented programs, best management practices, and infrastructure projects. The MS4 updates the following performance measures annually:

1. Inlets Cleaned: Stormwater inlets serve two primary purposes: (1) mitigate flood risk by collecting runoff from the MS4's streets, parking lots, alleyways, and other hard surfaces, reducing flooding, and (2) treat stormwater by capturing sediment, trash, and other pollutants in their nine-inch sumps. The MS4 maintains inlets year-round and documents operation totals, such as the number cleaned, labor hours accumulated, budget spent, and weight of material removed.

    - Performance Measure: Clean 20% of inlets annually
    - Calculation Type: Total assets (includes duplicate effort)
    - Data Source: Infrastructure Maintenance Performance Measure

        - *2017: 23.5% (675 maintained inlets/2,877 total inlets)*

            - *City: 19.6% (521 maintained inlets/2,652 total inlets)*
            - *MSU: 68.4% (154 maintained inlets/225 total inlets)*

2. Pipes Cleaned: Stormwater pipes serve two primary 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. The MS4 maintains stormwater pipes year-round, documenting operation totals, such as the length of pipe cleaned, labor hours accumulated, budget spent, and weight of material removed.

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

- *2017: 18.0% (17.0 maintained miles/94.3 total miles)*
  - *City: 21.6% (16.7 maintained miles/77.4 total miles)*
  - *MSU: 1.8% (.3 maintained miles/16.9 total miles)*

3. Manholes Cleaned: Stormwater manholes serve two primary purposes: (1) allow for maintenance access to underground infrastructure, and (2) treat stormwater by capturing sediment, trash, and other pollutants in their sumps, requiring reoccurring maintenance to remain effective. The MS4 maintains manholes year-round, documenting operation totals, such as the number of manholes cleaned, labor hours accumulated, budget spent, and weight of material removed.

   - Performance Measure: Clean 20% of manholes annually
   - Calculation Type: Total assets (includes duplicate effort)
   - Data Source: Infrastructure Maintenance Performance Measure
     - *2017: 30.3% (376 maintained manholes/1,240 total manholes)*
       - *City: 23.8% (255 maintained manholes/1,073 total manholes)*
       - *MSU: 72.5% (121 maintained manholes/167 total manholes)*

4. Infrastructure Repairs: Infrastructure repairs or "spot repairs" serve two primary purposes: (1) fix known pipe failures and restrictions to ensure the adequate flow of stormwater, and (2) repairs open sections of pipe where scouring of subgrade soils occur, mitigating the chance of a road failure and sediment load contribution. The MS4 completes infrastructure repairs year-round, documenting operation totals, such as the number of repairs, labor hours accumulated, and budget spent.

   - Performance Measure: Indicator measure
   - Calculation Type: Total repairs
   - Data Source: Performance Measures Spreadsheet
     - *2017: 22 Repairs*
       - *City: 17 Repairs*
       - *MSU: 5 Repairs*

5. Stormwater Mains Inspected: Stormwater main inspections serves two primary purposes: (1) allows staff to identify structural, and maintenance needs for underground infrastructure, and (2) ensure no cross connection or illegal pipe connections exist. The MS4 inspects pipes year-round, documenting operation totals, such as labor hours accumulated and budget spent.

   - Performance Measure: Inspect 20% of stormwater mains annually
   - Calculation Type: Total assets (mains and laterals, includes duplicate effort)
   - Data Source: Infrastructure Maintenance Performance Measure
     - *2017: 10.4% (9.8 inspected miles/94.3 total miles)*
       - *City: 12.0% (9.31 inspected miles/77.4 total miles)*
       - *MSU: 3.0% (.5 inspected miles/16.9 total miles)*

6. Sediment Prevented from Discharging into Waterways: Sediment is the MS4's primary pollutant of concern. Significant efforts are completed and tracked annually to reduce the amount entering local waterways. The MS4 plans to maintain existing and implement new improvements, increasing totals annually.

   - Performance Measure: 81 tons per year (Lower Gallatin TMDL WLA)

- Calculation Type: Total tons (excludes street sweeping and spring and fall cleanups)
- Data Source: Treatment Unit Totals Document
    - *2017: 187 Tons*

7. Urban Acres Treated: Over 1,500 acres of the MS4 contains aged conveyance infrastructure that discharges stormwater directly into waterways without treatment or flood control. A primary component of the MS4's Stormwater Program is to retrofit or install enhancement improvements that bring these areas up to current water quality and, when applicable, quantity standards. Example projects include the installation of mechanical separation units, regional pond facilities, and green infrastructure.

    - Performance Measure: Indicator measure
    - Calculation Type: Acres/total acres
    - Data Source: Treatment Unit Totals Document
        - *2017: 81/192 Acres*

8. Construction Site Inspections: The MS4 tracks the totals and types of compliance inspections completed annually. Three separate construction site permits types exist and are subject to review: Less than One (1) Acre, Greater than One (1) Acre, and Single-Family Residential.

    - Performance Measure: Inspect 20% per year
    - Calculation Type: Percentage of total inspections, does not include multiple visits or occupancy inspections
    - Data Source: Less and Over One (1) Acre count from Construction Folder, SFR calculated using meter activations in GIS
        - *2017: 4.2% (19 inspections/450 projects)*
            - *City: 2.4% (14 inspections/445 projects)*
            - *MSU: 100% (5 inspections/5 projects)*

9. Illicit Discharges Resolved: Illicit discharge events can threaten public safety and environmental health and pose difficulties to MS4 infrastructure operations and maintenance. The MS4 responds to a variety of illicit discharge events, ranging from minimal to severe on an annual basis.

    - Performance Measure: Indicator measure
    - Calculation Type: Total events
    - Data Source: Performance Measures Spreadsheet
        - *2017: 5 Events*
            - *City: 3 Events*
            - *MSU: 2 Events*

10. Impervious Area Added to Utility Billing Database: The MS4 utilizes ERUs as its mechanism to generate impervious area based stormwater utility rates. A single ERU totals 2,700 square feet of impervious area or the equivalent of the total area of a rooftop and driveway found on a typical single-family residential lot. The MS4 updates ERUs as the MS4 adds new impervious area through residential, multi-family, and commercial building construction and new roads. ERUs function as growth and workload indicators for the time it takes to maintain the totals.

    - Performance Measure: Indicator measure
    - Calculation Type: Total acres

- Data Source: GIS calculation for multi-family and commercial, assumed 1 ERU for SFR properties with a total based on the construction performance measure (excludes public right-of-way)
    - *2017: 91.3 Acres (multi-family and commercial = 60.8 acres, residential = 30.5 acres)*

11. Stormwater Basin Inspections: HOAs are responsible for the maintenance of stormwater basins within their subdivisions via Maintenance Agreements created during the development process. Historically, HOA maintenance of basins has been severely lacking, resulting in the degradation of the majority of the MS4's HOA ponds. Degraded ponds can result in negative water quality impacts and flooding. The MS4 has initiated a new process as of 2016 to educate, inspect, and report on the condition of stormwater basins to improve their management.
    - Performance Measure: Inspect 20% per year
    - Calculation Type: Percentage of total
    - Data Source: GIS calculation
        - *2017: 8.7% (38 stormwater basins/439 total stormwater basins)*
            - *City: 2.0% (8 stormwater basins inspected/409 total stormwater basins)*
            - *MSU: 100% (30 stormwater basins inspected/30 total stormwater basins)*

3.0 Public Education and Involvement

Image 3.0.1: Construction field academy

Image 3.0.2: Dog waste station with educational signage

3.1 Strategy

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

1. Passive Engagement (Education): Involves creating and distributing educational messages targeting pollutant-generating activities. Strategies include:
    - Audio and visual
    - Website
    - Utility bill inserts
    - Internet and radio advertisements
    - Brochures
    - Magazine articles
    - Educational signage
    - Vehicle wraps
2. Active Engagement (Involvement): Includes holding customized interpersonal interactions with various audiences targeting pollutant-generating activities. Strategies include:
    - Presentations
    - Meetings
    - Trainings
    - Tours
    - Events

3.2 Key Audiences

The MS4 targets the following audiences because majorities within each group complete activities that do not conform to best practice procedures, such as proper erosion control, fertilizer application, and stormwater basin maintenance.

1. Residents
    - Pollutant(s): E.coli, nutrients, and sediment
    - Activity: Yard maintenance and dog waste collection
    - Rationale: Large cumulative impact, opportunity for source reduction, and foundation for cultural shift
    - Outreach Strategy: Passive Engagement and Active Engagement
2. Home Owner Associations (HOAs) and Property Management Companies
    - Pollutant(s): Nutrients, sediment, and flood control (downstream erosion)
    - Activity: Stormwater basin maintenance
    - Rationale: Responsible for majority of post-construction features, lack of education regarding maintenance methods
    - Outreach Strategy: Passive and Active Engagement
3. Construction Industry
    - Target Pollutant(s): Sediment, floatables, oil and grease, and concrete waste
    - Targeted Activity: Construction
    - Rationale: Lack of education regarding erosion, sediment, and pollutant control, high growth rate, large industry, entrenched business practices

- Outreach Strategy: Passive and Active Engagement

3.3 Ongoing Initiatives

The MS4 completes initiatives to engage, educate, and change the behavior of its key target audiences. Also, the MS4 evaluates and collects feedback from its audiences, using it to improve existing practices and identify future opportunities. Ongoing initiatives include:

1. Educational Stormwater Video: Seven-minute video directed and produced by Jon Catton in the fall (made public on November 13) of 2017. The video 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
    - Targeted Pollutant(s): E.coli, nutrients, and sediment
    - Strategy: Passive Engagement
    - Treatment Area: Citywide
    - Performance: Total views, watch time, and average view duration tracked annually using YouTube Analytics.
        - 2017: 179 views, 722 minutes watch time, and 4:02 average view duration
2. Dog-Waste Collection Campaign: Campaign devoted to educating residents about the importance of dog waste collection and disposal. Outreach includes one (1) utility bill insert sent to ratepayers annually and maintenance of strategic signage placed in high dog use areas.
    - Key Audience: Residents
    - Targeted Pollutant(s): E.coli
    - Strategy: Passive Engagement
    - Treatment Area: Citywide
    - Performance: Tonnage tracked annually by calculating the total amount of dog waste collected by the Parks Division at all city-owned stations. One bag (containing numerous individual bags) weighs 10 lbs. on average, which Staff multiplies by the number of bags collected in a given year and divides by 2,000 lbs. to arrive at tons.
        - 2017: 19.5 tons
3. Contractor Training: Training designed to educate contractors on proper selection and use of Best Management Practices. The MS4 holds trainings regularly, including six (6) or more different classes tailored to various education levels, construction activities, and inspection procedures. Further, the MS4 maintains a Construction Program that includes permits, processes, and materials tailored to this group further described in Section 5.0.
    - Key Audience: Contractors
    - Targeted Pollutant(s): Sediment, floatables, oil and grease, and concrete waste
    - Strategy: Active and Passive Engagement
    - Treatment Area: Citywide
    - Performance: Attendance tracked annually.
        - 2017: 268 Attendees
4. HOAs and Property Management Company Training: Tailored outreach, educating HOA Boards and management representatives on the proper function and maintenance of stormwater basins. The City participates in site tours, board meetings, and annual assemblies upon request,

or in situations when Staff identifies an issue. The MS4 maintains a Post-Construction Program that includes processes and materials tailored to this group further described in Section 6.0.

- Key Audience: Home Owner Associations and Property Management Companies
- Targeted Pollutant(s): Nutrients, sediment, flood control (downstream erosion)
- Strategy: Active and Passive Engagement
- Treatment Area: Citywide
- Performance:
  - 2017: 0 annual meeting(s), 0 board meeting(s), 1 site tour(s)

5. Vehicle Decal Wraps: Educational signage installed on the MS4's Vactor truck and street sweeper demonstrating the connection between the urban terrestrial landscape and waterways. Both vehicles drive hundreds of miles annually, subjecting thousands of residents to their messages. The MS4 maintains, repairs, and replaces wraps as necessary.

   - Key Audience: Residents
   - Targeted Pollutant(s): E.coli, nutrients, and sediment
   - Strategy: Passive Engagement
   - Treatment Area: Citywide
   - Performance:
     - 2017: No tracking mechanism

6. Website: Publically accessible site that includes a variety of information, spanning from what stormwater is, how to report a pollution event, rate model information, post-construction design standards, and more. Address: www.bozeman.net/government/stormwater. The MS4's new web management system went live July of 2017, and Staff updates content on a regular basis.

   - Key Audience: Residents, Home Owner Associations, and Contractors
   - Targeted Pollutant(s): E.coli, nutrients, and sediment
   - Strategy: Passive Engagement
   - Treatment Area: Citywide
   - Performance: Total unique page views tracked by Google Analytics annually
     - 2017: 677 views

7. Project WET Stormwater Curriculum: Class exercises administered by 4th, 5th, and 6th-grade teachers in local schools educating students on stormwater-related issues. Project WET is a non-profit organization that provides action-oriented water education programs for students and teachers worldwide. Project WET utilizes customized, and location-specific lesson plans and activities to teach young learners. The MS4 is working with Project WET to integrate the developed lessons into the Bozeman Public Schools Next Generation Science Standards. The program has trained hundreds of students to date, yielding an average pre and post-assessment score increase of 120%. Address: http://www.projectwet.org/bozeman

   - Key Audience: Residents
   - Targeted Pollutant(s): E.coli, sediment, nutrients, and trash
   - Strategy: Passive Engagement
   - Treatment Area: Entire MS4
   - Performance: Total student participants
     - 2017: 492 students

8. General Outreach: Presentations, trade show booths, conferences, community events, and advertisement developed by Staff and applied in various settings focused on providing general stormwater information to the public.

    - Key Audience: Residents
    - Targeted Pollutant(s): E.coli, sediment, and nutrients
    - Strategy: Active Engagement
    - Treatment Area: Entire MS4
    - Performance: Total events

        - 2017: 15 *(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)*

3.4 Future Initiatives

The MS4 seeks educational partnership opportunities with local non-profits, internships, and town/gown (University) opportunities whenever feasible, and if the evaluation (SWMP Sec. 8.0) of the MS4's efforts yield results necessitating further improvement. The ongoing initiatives detailed above are the MS4's primary objectives. Additionally, the MS4 may pursue the following as resources and collaborative opportunities arise:

1. Adopt a Curb/Storm Inlet Campaign: Development of an adoption program pairing residents with a local street inlet adjacent to their property. The MS4 would provide bags, and ask residents to collect debris on a reoccurring basis throughout the spring, fall, and summer. The MS4 would then pick up the bags at a determined interval, weigh, and dispose of as necessary.
2. Outreach Effectiveness Study: Collaborative effort with a professor to measure the effectiveness of various outreach initiatives occurring within a selected residential watershed. The MS4 would compare collected data with a control watershed of similar character.
3. Community Education Video Series: Development of a multifaceted video library that would bring to life many of the concepts presented in the MS4's static educational materials, such as how to properly fertilize, pick up dog waste, install rain barrels, etc.

4.0 Illicit Discharge Detection and Elimination

Image 4.0.1: Bentonite slurry spill

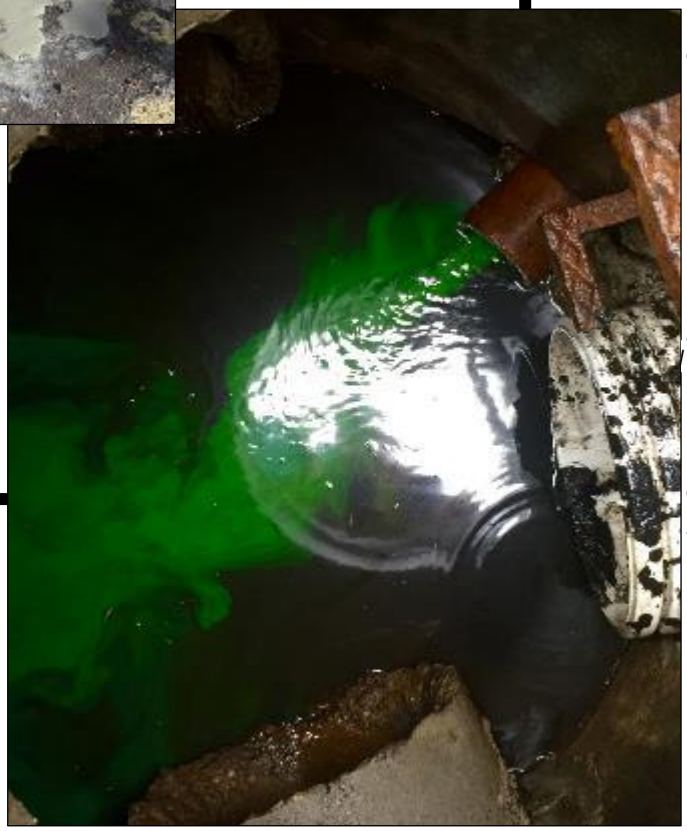


Image 4.0.2: Illicit connection confirmation through dye test

4.1 Response Action Plan

Strategy: The MS4 responds to and resolves illicit discharge events, which vary in scope, public health threat, and environmental risk. The MS4 uses professional judgment and the following protocol to assess event priority, formulate a response, and, if necessary, pursue enforcement in cases where a party completes a repeat, blatant, or knowing violation of Bozeman Municipal Code Section 40.04.200.

Protocol: The MS4 subjects all suspected illicit discharge to the following:

1. Assign event coordinator
2. Investigate complaint to determine pollutant type and severity (*pictures, site visit, phone correspondence*)
3. Implement one of the following responses:
   - Tier 1 Event
     - Threat Level: Minimal impact to public safety and environment
     - Team: MS4 staff
     - Timeline: Initiate response within 5-days
     - Resolution: MS4 operations staff and/or contracted restoration firm
     - Pollutant Disposal: Public - Disposal Facility, private - varies
     - Reporting: Internal report
     - Examples: Leaking vehicles, dripping grease dumpster, and minor construction site violations
   - Tier 2 Event
     - Threat Level: Moderate impact to public safety and environment
     - Team: MS4 Staff
     - Timeline: Initiate response within 24-hours
     - Resolution: MS4 operations staff and/or contracted restoration firm
     - Pollutant Disposal: Public - Disposal Facility, private - varies
     - Reporting: Internal report
     - Examples: Carpet cleaning process water discharge, sanitary overflow, camper waste disposal, homeless camp cleanup, floor drain and illicit sanitary connections, non-hazardous chemical spills, and moderate to severe construction violations
   - Tier 3 Event
     - Threat Level: Immediate threat to human health and environment
     - Team: MS4 operations staff and emergency services
     - Timeline: Immediate response
     - Resolution: Fire, MS4 operations, and/or restoration firm
     - Pollutant Disposal: Public - Disposal Facility, private - varies
     - Reporting: Internal report and DEQ Notification
     - Example: Hazardous chemical spills
4. Eliminate discharge by whatever means necessary
5. Notify appropriate agencies
6. Prepare and file event report
7. Assess penalty(s) to responsible party(s) (*based on: staff time accrued and remediation costs)*

High Priority Determination: The MS4 considers all illicit discharge events to be high-priority if the assigned Event Coordinator deems them a Tier 1, 2, or 3 Event, no matter their location within City limits.

Annual Total:

1. 2017 Events (Identified by or reported to the MS4)
   - Significant Events:
     - Tier 1 Event: Ellis Apartments - Leaking vehicle
       - Pollutant: Oil
       - Local Control: Bozeman Municipal Code *(report available upon request)*
       - Resolved: Yes, owner cleaned up oil
     - Tier 1 Event: Crystal Bar - Illicit roof drain
       - Pollutant: Wash water
       - Local Control: Bozeman Municipal Code *(report available upon request)*
       - Resolved: Yes, owner disconnected sink from roof drain
     - Tier 2 Event: Lindley Park - Homeless camp clean up
       - Pollutant: Trash, human waste, and drug paraphernalia
       - Local Control: Bozeman Municipal Code *(report available upon request)*
       - Resolved: Yes, restoration firm cleaned up debris
     - Tier 1 Event: NAC Construction Site Fueling Spill
       - Pollutant: Diesel Fuel (<25 gallons)
       - Local Control: MSU Safety and Risk Management *(report available upon request)*
       - Resolved: Yes, MSU Facility Services
     - Tier 1 Event: Stadium Tractor Hydraulic Oil Spill
       - Pollutant: Hydraulic Oil (<25 gallons)
       - Local Control: MSU Safety and Risk Management *(report available upon request)*
       - Resolved: Yes, MSU Facility Services
   - Non-Significant Events:
     - Emergency Main Break Dewatering
       - Pollutant: Sediment
       - Local Control: Treatment system design and purchase in progress
     - Operations Planned Dig Dewatering
       - Pollutant: Sediment
       - Local Control: Treatment system design and purchase in progress
     - Fire Hydrant Flushing
       - Pollutant: Residual chlorine
       - Local Control: Dechlorinating procedure managed by the Water and Sewer Division
     - Crawl Space Sump Pump Discharges
       - Pollutant: n/a

- Local Control: Slab on grade requirement when building in high groundwater areas

Illicit Discharge Events Resolved					
	2017	**2018**	**2019**	**2020**	**2021**
Tier 1 Events	4				
Tier 2 Events	1				
Tier 3 Events	0				
Total	5				

Chart 4.1.1: Illicit discharge events

4.2 Outfall Reconnaissance Inventory (ORI)

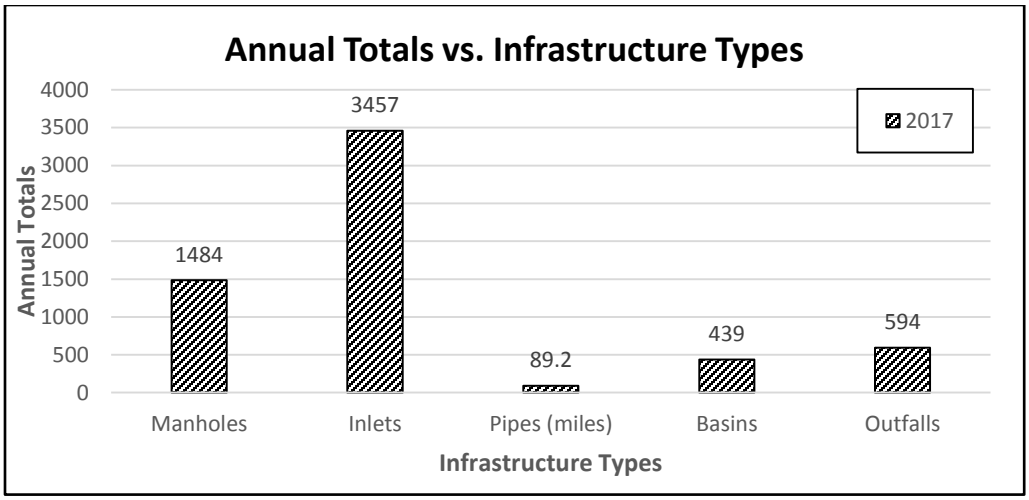
The MS4 General Permit requires the MS4 to prioritize and inspect outfalls detailed in SWMP Sec. 1.5 during the Permit Term to ensure no illicit discharges exist. The MS4 completed the following:

1. 2017 ORI Inspection Total
    - Inspected: 0 (0%)
    - Total: 594
    - High-Priority Inspected: TBD
    - High-Priority Total: TBD

4.3 Infrastructure Map

The MS4 collects and updates stormwater infrastructure spatial data annually using GPS and GIS technology. The Montana DEQ and public can access the stormwater system map by visiting the following link: https://gisweb.bozeman.net/Html5Viewer/?viewer=infrastructure

1. 2017 Infrastructure Totals *(includes public, private, and MSU assets)*
    - Manholes: 1,484
    - Inlets: 3,457
    - Underground Pipes (laterals and mains): 89.2 miles
    - Stormwater Basins: 439
    - Outfalls: 594



Graph 4.3.1: Infrastructure totals

5.0 Construction Site Management

Image 5.0.1: Compliant single-family residential property

Image 5.0.2: Inlet sump clogged with construction debris

5.1 Strategy

The MS4 adheres to the following strategy:

1. Make Positive Contact: Ensure initial interactions with contractors are positive, allowing for the clear articulation of program goals, expectations, procedures, and regulations.
2. Provide Educational Opportunities: Offer educational opportunities focused on providing construction industry personnel with the tools and thought processes necessary for compliance.
3. Complete Permit Reviews: Hold pre-submittal meetings, conduct stormwater permit adequacy reviews, and, if necessary, hold stormwater permit preparers accountable through denial and resubmittal before allowing contractors to obtain building permits.
4. Confirm Compliance through Inspections: Conduct compliance inspections to ensure contractors implement and maintain stormwater permits. Utilize enforcement proceedings as necessary.

5.2 Ongoing Initiatives

The MS4 requires contractors to comply with regulations detailed in the Bozeman Municipal Code and the City of Bozeman Best Management Practice (BMP) Manual for Construction Sites. The MS4 implements a program grounded in the following protocol to invoke industry compliance:

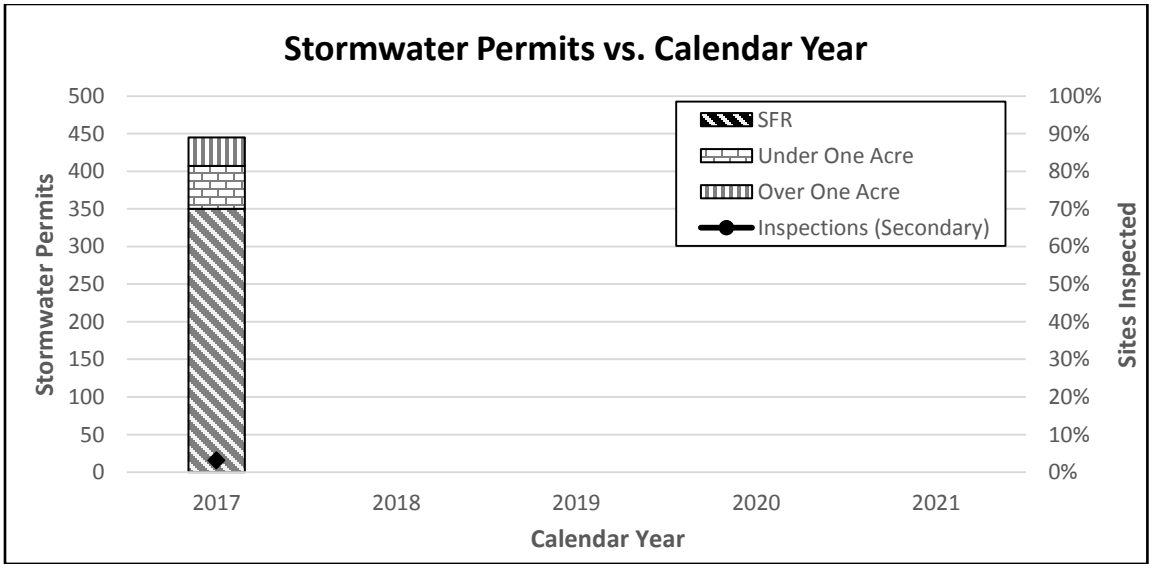
1. Training *(optional)*: Classes held regularly for construction industry professionals, including Introduction to Stormwater Management, Construction Site BMP Field Academy, Stormwater Pollution Prevention Plan (SWPPP) Administrator, SWPPP Administrator Re-Certification, SWPPP Preparer, Construction Dewatering, and Compliance Evaluation Inspector.
2. Permit Pre-submittal Meeting *(optional)*: Initial meeting where parties discuss minimum expectations, project details, and specific concerns.
3. Permit Review: Adequacy reviews for all permits, tracking steps using Cityworks PLL permit management software. Stage repeats until the applicant submits an adequate permit.
4. Inspection: Inspections based on the following prioritization:
    - Priority Site: Goal is to inspect one per week or 20% of total per year.
        - Complaint Driven *(internal or external); or*
        - Field Observation; or
        - Compliance History
    - High-Priority Site: Goal is to inspect per frequency outlined in the MS4 Permit.
        - Greater than One (1) Acre; and
        - Direct Discharge to Bozeman Creek
5. Notice of Violations and Inspection Report: Documents Bozeman Municipal Code violations, required corrective actions, schedule to remedy, and potential penalties if not resolved, including one or more of the following:
    - Cease and Desist Order and Notice to Clean: The MS4 issues if the contractor does not implement corrective actions within required timeframes. The MS4 hires a third party contractor to clean the right-of-way road surface and underground infrastructure with the cost borne by the violator.
    - Civil Action: The MS4 issues when contractors are guilty of repeat or knowing violations.

- Criminal Charges: The MS4 issues when contractors are guilty of egregious repeat or knowing violations.

6. Notice of Penalty: Same as Notice of Violations, but also includes a description of assessed penalties. The MS4 repeats protocols three, four, and five as necessary until the contractor resolves corrective actions.

2017 Totals:

- Construction Projects: 445 (*City*)
  - Single-Family Residential: 350
  - Less than One (1) Acre: 57
  - Greater than One (1) Acre: 38
- Plan Reviews: 445 (*City*)
  - Single-Family Residential: 350
  - Less than One (1) Acre: 57
  - Greater than One (1) Acre: 38
- Site Inspections: 14 or 3.1% (*City*)
  - Single-Family Residential: 8
  - Less than One (1) Acre: 0
  - Greater than One (1) Acre: 11
- Training Classes: 11
  - Attendees: 268



Graph 5.2.1: Stormwater permits

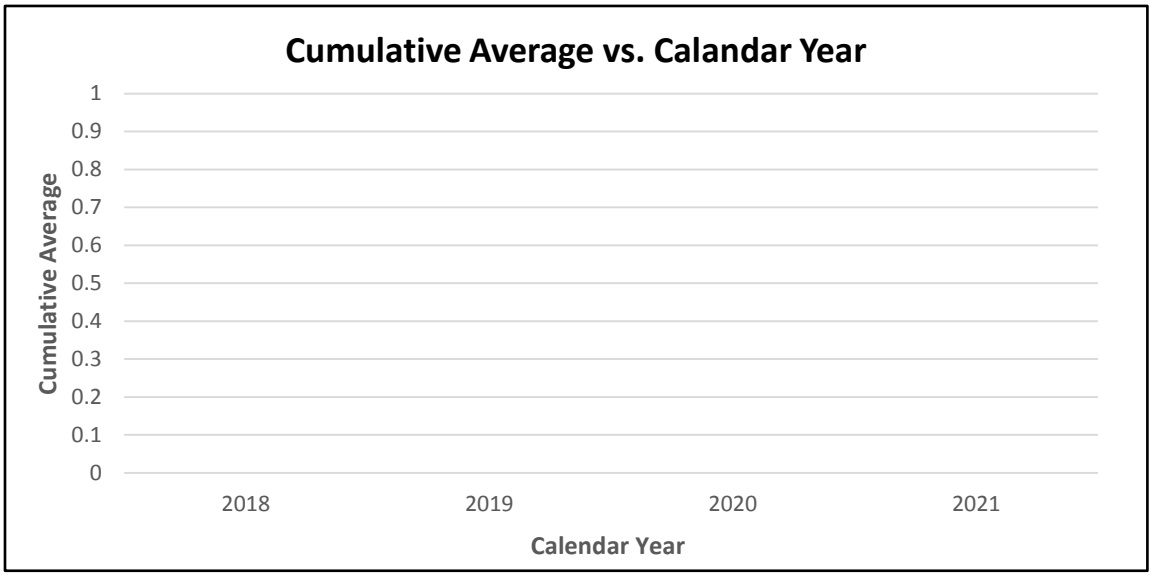
5.3 Performance

The MS4 conducts program performance evaluation through an annual broad-based condition analysis of active construction sites after spring snowmelt. The MS4 randomly selects 50 active construction sites, completes a drive-by inspection for each, and records one of the following observations:

1. Good Condition (2 points): Sites that exhibit adequate BMP implementation and are compliant with regulations
2. Moderate Condition (1 point): Sites that exhibit inadequate BMP implementation, and are slightly compliant with regulations
3. Poor Condition (0 points): Sites that exhibit no BMP implementation, and are not compliant with regulations

The MS4 compiles the collected data and updates the following:

1. 2017 Total:
    - Good Condition Sites (total sites x 2 points): n/a
    - Moderate Condition Sites (total sites x 1 point): n/a
    - Poor Condition Sites (total sites x 0 points): n/a
    - Cumulative Average (total points/total sites): n/a
    - Trend *(increasing or decreasing)*: n/a



Graph 5.3.1: Construction program performance

The MS4 analyzes the data by comparing annual averages and uses the results to evaluate, communicate, and determine the need for future initiatives and stricter policy to improve construction industry compliance.

5.4 Future Initiatives

The MS4's Construction Program continues to improve, requiring the implementation of the following initiatives:

1. Inspection Percentage: The MS4 inspected 4.2% of active construction sites in 2017, 15.8% percent below its goal of 20%. Factors influencing this low rate include an extraordinary growth rate, entrenched industry, and limited staff. However, the MS4 will see a significant improvement in the percentage in 2018, primarily due to a new Stormwater Program Technician position hired late in 2017.

2. New Single-Family Residential Permit: Single-family construction represents the majority of projects occurring within the City. Also, homebuilders' current adherence to Bozeman Municipal Code and its contained regulations is low, resulting in hundreds of non-compliant sites annually. The MS4 will implement a new single-family residential permit in 2018 for homebuilders with the goal of further raising awareness.
3. Occupancy and Infrastructure Refusal: The MS4's enforcement protocol is efficient at (1) mitigating pollution coming from a non-compliant construction site, and (2) penalizing responsible parties for their lack of attention to pollution controls. However, the MS4's enforcement protocol is not valid at ensuring the responsible party pays the debts accrued by the City for these efforts.

   Current Bozeman Municipal Code allows the MS4 to lien debts against property but has found that the timing of this process is challenging. To resolve, the MS4 plans to work with their attorneys to tie the occupancy process to enforcement action. The MS4 is confident that withholding occupancy will increase the construction industry's compliance with MS4 standards.
4. Explore the use of flocculants.

5.5 Documents

The MS4 utilizes the following documents *(available upon request):*

1. General Documents:
   - Bozeman Municipal Code: Article 4
   - City of Bozeman Best Management Practice (BMP) Manual for Construction Sites v.6
2. Single-Family Construction:
   - Single-Family Residential Drainage Certification
   - Construction Stormwater Site Inspection Form: Sites Less than One (1) Acre
3. Projects Less than One Acre:
   - Construction Stormwater Permit: Sites Less than One (1) Acre
   - Construction Stormwater Permit Review Checklist: Sites Less than One (1) Acre
   - Construction Stormwater Site Inspection Form: Sites Less than One (1) Acre
   - Request for Final Occupancy (RFO) Form
4. Projects Greater than One Acre:
   - MDEQ Construction General Permit
   - MDEQ Construction General Permit Notice of Intent (NOI)
   - MDEQ Construction Stormwater Pollution Prevention Plan (SWPPP)
   - Construction Stormwater Permit Review Checklist: Sites Greater than One (1) Acre
   - Construction Stormwater Site Inspection Form: Sites Greater than One (1) Acre
   - Request for Final Occupancy (RFO) Form

6.0 Post Construction

Image 6.0.1: Overgrown stormwater basin

Image 6.0.1: Dredged stormwater basin

6.1 Ongoing Initiatives

The MS4 requires new and redevelopment projects exceeding one (1) acre to infiltrate the first ½ inch of stormwater runoff and meet the MS4's 10-year storm volume control requirement, maintaining pre-development runoff patterns and pollutant loading post project build out. Developers use an array of strategies to meet MS4 standards, including traditional and LID-based stormwater control measures, such as stormwater basins, permeable pavers, and bioretention systems.

The MS4 regulates and documents compliance with development requirements through its site plan application and review process, which the Engineering and Community Development Divisions manage. The longstanding process, professional staff responsible, and required documentation ensure developers construct projects by MS4 regulations.

1. 2017 Totals:
    - Development Project Reviews: 262

Also, the MS4 educates Home Owner Associations (HOA), private property owners, and Property Management Companies, jointly known as parties, on how to complete maintenance on a reoccurring basis, including the following protocol:

1. Inventory and Condition: As of 2018, the majority of parties do not understand that they own stormwater assets, requiring annual inspection and maintenance. The MS4 works to educate parties on the inventory and condition of their systems through a variety of reports, walking tours, and presentations.
2. Plan and Funding: The MS4 recommends that parties plan and forecast workloads for a minimum of fifteen years, allowing for an adequate budget. Further, the MS4 suggests that parties develop a stable funding mechanism through either a special assessment or increase in HOA fees, allowing a stable framework to achieve set goals. In some cases, parties are not qualified to develop these plans, especially considering the complexity and cost of civil projects. In those situations, the MS4 suggests hiring a professional consultant well versed in civil and environmental design.
3. Complete Maintenance: Typically, parties utilize three primary maintenance activities, including:
    - Vegetation clearing or vacuuming (1-2 years)
    - Minor debris removal and stabilization (2-5 years)
    - Dredging and reshaping (5-10 years)

    Maintenance and rehabilitation costs grow exponentially over time if not responsibly achieved. As such, the MS4 works hard to educate parties on the snowball effect that can result and the need to manage their assets proactively.

As of early 2018, the MS4 does not have an enforcement strategy developed and plans to continue an education based approach for the near future with the broad goals of determining:

1. An effective strategy and support structure, allowing HOAs and private owners to succeed in managing their assets.
2. If the MS4s has unrealistic expectations, requiring a new strategy where MS4 takes a larger role, including assuming maintenance responsibility, implementing a SID policy, or establishing an enforcement protocol.

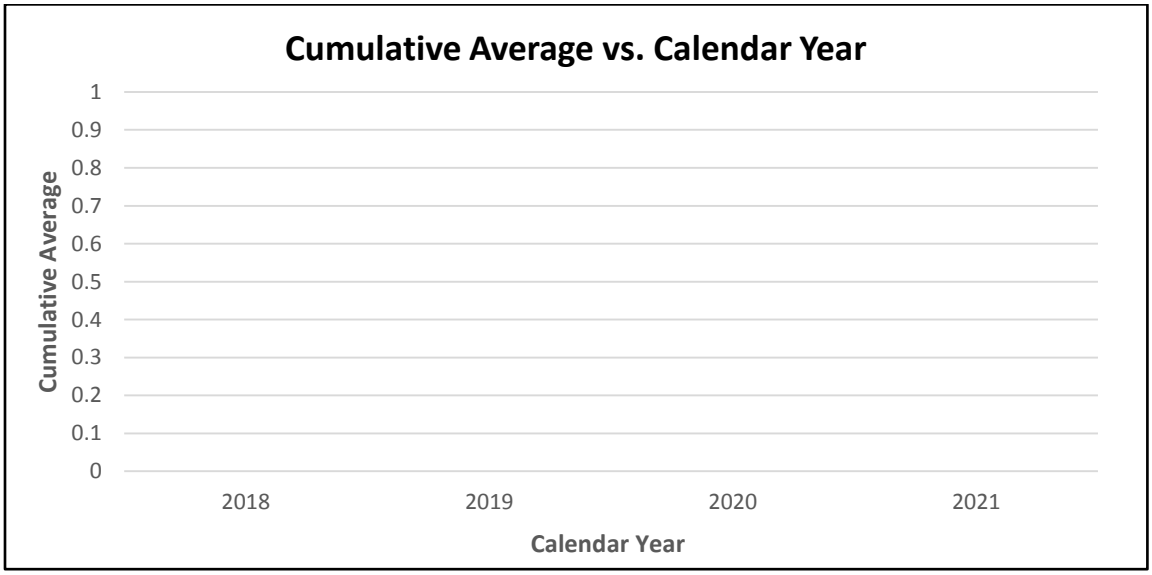
6.2 Performance

The MS4 conducts program performance evaluation through an annual broad-based condition analysis of stormwater post-construction measures features during the first week in September. The MS4 randomly selects 50 measures, completes a drive-by inspection for each, and records one of the following observations:

1. Good Condition (2 points): Sites that exhibit adequate maintenance history, and are functioning as designed
2. Moderate Condition (1 point): Sites that exhibit inadequate maintenance history, and are moderately functioning as designed
3. Poor Condition (0 points): Sites that exhibit no maintenance history, and are not functioning as designed

The MS4 compiles the collected data and updates the following:

1. 2017 Total:
    - Good Condition Sites (total sites x 2 points): n/a
    - Moderate Condition Sites (total sites x 1 point): n/a
    - Poor Condition Sites (total sites x 0 points): n/a
    - Cumulative Average (total points / total sites): n/a
    - Trend *(increasing or decreasing)*: n/a



Graph 6.2.1: Post-construction program performance

The MS4 analyzes the data by comparing annual averages and uses the results to evaluate, communicate, and determine the need for future initiatives and stricter policy to improve stormwater basin condition.

6.3 Future Initiatives

The MS4's Post-Construction Program continues to improve and evolve, requiring the implementation of the following initiatives:

1. New Drainage Design Standards: The MS4 developed current standards in 2004. In 2008, the MS4 completed a Facility Plan, which evaluated requirements, identified shortfalls, and provided recommendations for improvement. The MS4 has not implemented the changes proposed in 2008 and is working to bring standards in line with the Facility Plan's recommendations, requiring significant political, internal, and external conversations. Most notable changes include:
    - Increasing design storm from 10-year to 25, 50, or 100-year
    - Requiring detention downtown for redevelopment projects that do not exceed one acre
    - Aligning language to work jointly with the content of the Montana Post-Construction Stormwater BMP Guidance Manual
    - Redeveloping rainfall curves to represent modern rainfall intensity and distribution

    The MS4 plans to solicit proposals during the summer of 2018, with the goal of proposing the new standard to the City Commission and, if found agreeable, implementing late fall.

2. HOA Policy Questions: Two significant policy-level issues exist that require City Commission guidance, including:

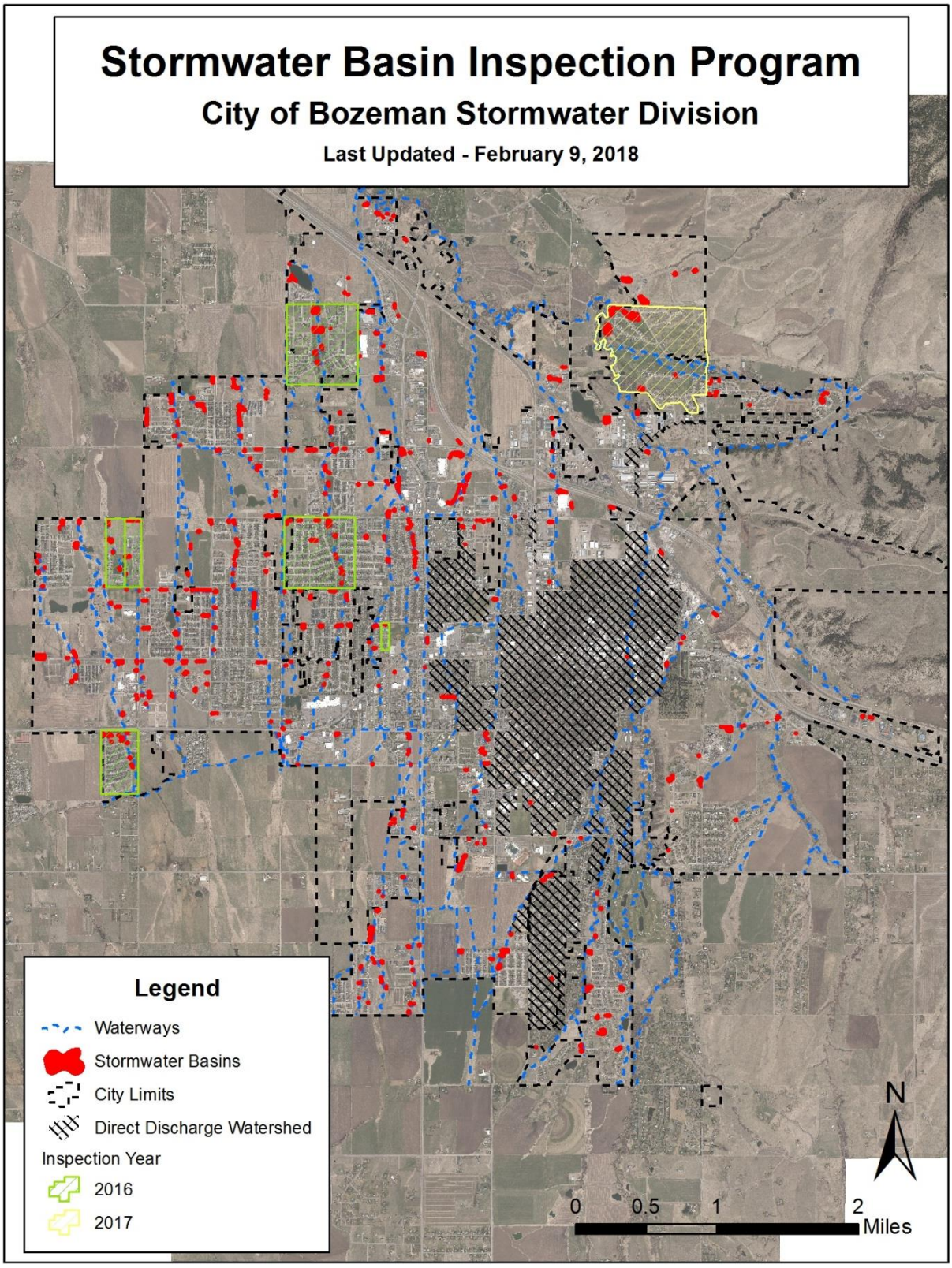
    - Subdivisions that have defunct HOAs and thus lack the money to maintain stormwater basins. *Possible solution: The MS4 would hire and oversee maintenance of the features. Once complete, the MS4 would develop a special improvement district surrounding the contributing properties and bill the selected for the costs accrued. This approach would require a significant increase in the MS4's staffing level.*

    - HOAs that decide to not maintain their post-construction features after repeated requests by the City. *Possible solution: The MS4 would take control of all HOA-owned features and maintain as needed. The approach would require a significant increase in the MS4's utility and staffing levels.*

6.4 Documents

The MS4 utilizes the following documents *(available upon request):*

1. Stormwater Basin Maintenance:
    - Stormwater Basin Maintenance Guide
    - Stormwater Basin Inspection Form
2. Post-Construction Design
    - City Engineering Division Design Standards and Specifications Policy
    - Montana Post-Construction Stormwater BMP Design Guidance Manual
    - Development Review Documents (Plan Review Checklist): Planning Division Staff Report, Engineering Review Letter, and DRC Memo



Map 6.4.1: Stormwater basin inspection frequency

7.0 Good Housekeeping

Image 7.0.1: Street sweeping debris pile

Image 7.0.2: Sediment management facility

7.1 Ongoing Initiatives

The MS4 has dedicated stormwater operation and maintenance employees who complete over 6,000 hours of work annually. Further, the MS4's Streets, GIS, and Solid Waste Divisions provide resources towards work activities that have a direct benefit for water quality. Specific activities include:

1. Pipe repair, replacement, inspection, and maintenance
2. Inlet repair, replacement, inspection, and maintenance
3. Manhole repair, adjustment, inspection, and maintenance
4. Spring leaf and debris pickup
5. Fall leaf and debris pickup
6. Waterway Cleanup
7. Infrastructure mapping
8. City solid waste cleanup
9. Street sweeping

The MS4 owns various facilities, where staff works to mitigate pollutant sources, including:

1. High-Priority:
    - East Gallatin Storage Area
        - Use: Storage area for sediment, millings, street sweepings, and other materials used during the daily operation of numerous MS4 divisions
        - Control Measures: None
        - Pollutants of Concern: Sediment, oils and greases, and floatables
        - Responsible Party: Public Works and Parks Directors
    - University Shops Facility
        - Use: Staging, storage, and office property that supports numerous MSU divisions
        - Control Measures: None
        - Pollutants of Concern: Sediment, fuels, oils and greases, and metals
        - Responsible Party: MSU Environmental Services Manager
    - City Shops Complex
        - Use: Staging, storage, and office property that supports numerous City divisions
        - Control Measures: Underground storage and mechanical separation
        - Pollutants of Concern: Sediment, fuels, oils and greases, and metals
        - Responsible Party: Public Works Director
2. Low-Priority:
    - Bozeman Sediment Management Facility
        - Use: Stormwater debris collection and drying
        - Control Measures: Fully contained, no connection to state surface waters
        - Pollutants of Concern: None
        - Responsible Party: Public works Director
    - Water Reclamation Facility
        - Use: Treatment plant that is regulated under the MDEQ's Stormwater Industrial Permit
        - Control Measures: Numerous stormwater basins and dry wells
        - Pollutants of Concern: Oil and grease and fuels

- Responsible Party: Public Works Director

- Water Treatment Plant
  - Use: Potable water treatment plant
  - Control Measures: Numerous stormwater basins
  - Pollutants of Concern: None
  - Responsible Party: Public Works Director
- Parks
  - Use: Numerous parks exist citywide with varying sizes and amenities
  - Control Measures: Varied
  - Pollutants of Concern: TSS, total nitrogen, phosphorous, and E.coli
  - Responsible Party: Parks Director
- Vehicle Maintenance Facility
  - Use: Facility that supports the storage and maintenance of equipment for all municipal operations
  - Control Measures: Stormwater basin
  - Pollutants of Concern: Sediment, oils and greases, and metals
  - Responsible Party: Public Works Director
- Closed Landfill
  - Use: Facility that is no longer supporting the disposal of solid waste, but does house the Solid Waste Division and is permitted under the MDEQ's Stormwater Industrial Permit
  - Control Measures: Numerous stormwater basins, swales, and berms
  - Pollutants of Concern: Sediment, oils and greases, and metals
  - Responsible Party: Public Works Director
- Snow Storage Area
  - Use: Location that houses snow throughout winter
  - Control Measures: Vegetated buffer and grading
  - Pollutants of Concern: Sediment, oils and greases, floatables, and metals
  - Responsible Party: Public Works Director

The MS4 completes an array of maintenance and operation activities annually to facilitate community health and safety. The MS4 identifies and develops solutions for the following activities:

1. High-Priority:
   - Sanitary sewer breaks and overflows
     - Contaminant: Pathogens and floatables
     - Responsible Party: Public Works Director
2. Low-Priority:
   - Diesel wash-down of asphalt paving equipment
     - Contaminant: Fuels
     - Responsible Party: Public Works Director
   - Water main breaks

- Contaminant: TSS
- Responsible Party: Public Works Director

- Concrete Washout
  - Contaminant: pH
  - Responsible Party: Public Works Director
- Curb-cut slurry capture, collection, and disposal
  - Contaminant: pH
  - Responsible Party: Public Works Director
- Roadway traction sand, salt, and chemical application rates and techniques
  - Contaminant: pH and TSS,
  - Responsible Party: Public Works Director
- Facility and vehicle chemical transport, storage, and transfer
  - Contaminant: Varied
  - Responsible Party: Public Works Director
- Solid waste collection and disposal
  - Contaminant: Floatables and oils and greases
  - Responsible Party: Public Works Director
- Fueling and preventative maintenance of vehicles
  - Contaminant: Oils and greases and fuels
  - Responsible Party: Public Works Director
- Equipment and vehicle washing
  - Contaminant: Oils and greases, fuels, TSS, and metals
  - Responsible Party: Public Works and Parks Directors
- Trenching and excavation
  - Contaminant: TSS
  - Responsible Party: Public Works Director
- Fertilizer application rates and locations
  - Contaminant: Total nitrogen and phosphorous
  - Responsible Party: Parks Director

7.2 Training

Professional Staff: The MS4 trains its professional Staff tasked with implementing portions of the Stormwater Management Plan.

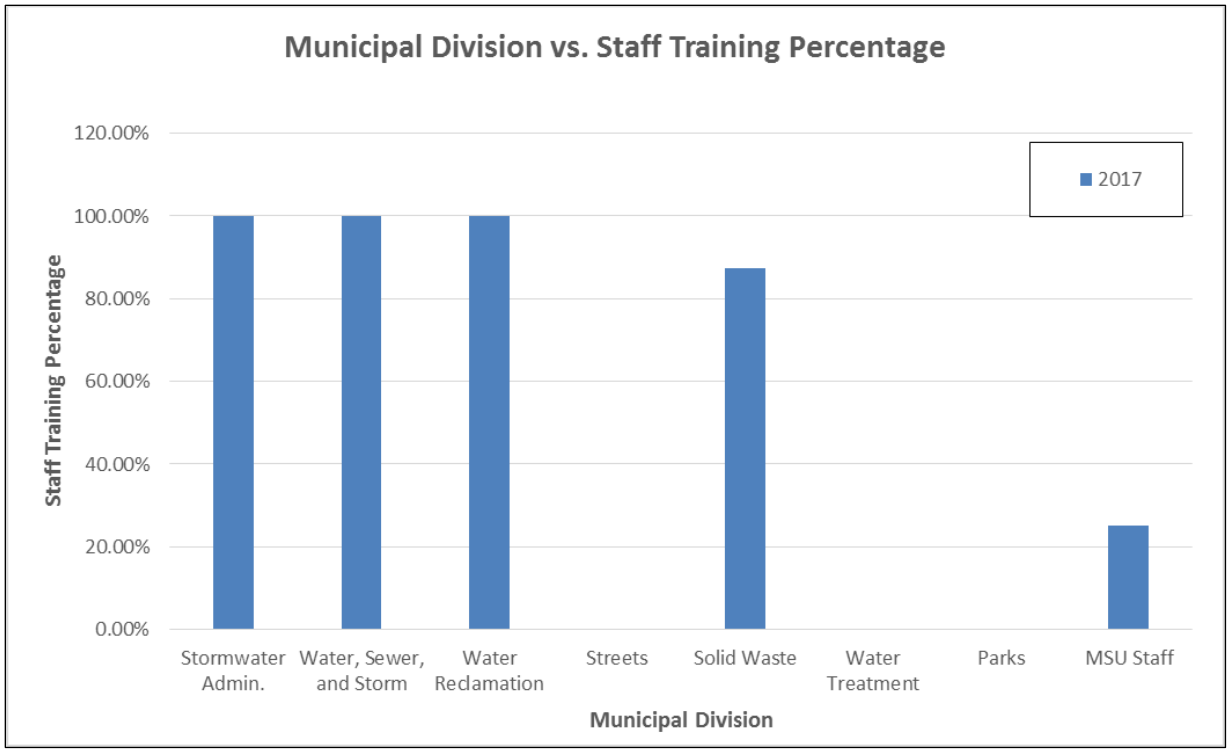
1. Construction Site and Post Construction Feature Compliance Inspection Staff: The MS4 receives external training when available, and all team members hold responsibility in not only knowing how to implement procedures but also how to identify issues and improve workflows.

- 2017: Frank Greenhill and EJ Hook, 301 Compliance Evaluation Inspections Training held by Altitude Training Associates and sponsored by the MDEQ and City of Bozeman on October 17 and 18.

2. Post-Construction Feature Design Review Staff: The City's Engineering Division is responsible for the review and approval of site plans to ensure projects align with approved standards. Shawn Kohtz P.E., and Griffin Nielsen E.I., are the primary reviewers and individually receive 40-hours or more of Civil Engineering training every two years to maintain their Montana licenses, of which a portion is specific to stormwater. The primary SWMP coordinator communicates and works with the engineers on a daily basis to ensure proper function of the MS4.
3. Stormwater Management Team (listed in SWMP Sec. 1.5): Stormwater Staff lead monthly meetings for the Stormwater Team, which include permit requirement discussions, Streets Division updates, Storm/Water/Sewer updates, capital project updates, responsibilities, MSU updates, budget updates, identified issues, solutions, and general discussion regarding the operation of the MS4.
    - 2017: 8 meetings

Internal Operations: The MS4 trains employees with the goal of increasing awareness and reducing stormwater pollutants generated from internal operations. The MS4 utilizes an online-based application (Proprofs) to hold interactive training for field supervisors and employees that includes the following content:

1. Stormwater Division Overview Video (7 minutes) - "Stormwater in Bozeman: The Big Picture"
    - Broad view of Bozeman's stormwater system
    - Information about the importance of mitigating stormwater pollution
    - Team member introduction
2. Facility Operations Training Videos: "Rain Check"
    - Notes and FYIs
    - Quiz questions
    - 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
        - Landscaping



Graph 7.2.1: Staff training totals

7.3 Future Initiatives

The MS4's Good Housekeeping Program continues to improve and evolve, requiring the implementation of the following initiatives:

1. Operation and Maintenance Plan: The MS4 works to collect and utilize data whenever possible to inform programmatic decision. The development of a Plan will further assist MS4 staff in conducting annual operations of its infrastructure, increasing effectiveness, reducing liability, and ensuring performance measures maintain accuracy. Numerous area require consideration, including:
    - High-Priority Areas
    - Individual vs. Actual Maintenance Frequency
    - Geographic Distribution of System
    - Asset Classifications
    - Public vs. Private Ownership
    - Inaccessible Assets

8.0 Sampling and Evaluation

Image 8.0.1: In-stream sampling equipment

Image 8.0.2: Stormwater runoff nutrient analysis

8.1 Introduction

The MS4 conducts sampling, collects data, and evaluates program performance to:

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

The MS4 implements four protocols annually, including:

1. Urban Runoff Monitoring
2. In-Stream Wet Weather Monitoring
3. Sediment Reduction Monitoring
4. Long-Term Monitoring

Area

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

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

Numerous waterways originate within or pass through the MS4, with a northerly flow direction. Peak flows occur in May and June, coinciding with the months of highest precipitation and snowmelt.

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 various impairments from natural and anthropogenic sources when preparing the 2013 Lower Gallatin Planning Area TMDL.

Bozeman Creek Impairment Information			
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

Chart 8.1.1: Bozeman Creek Impairment Information

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 that Mandeville Creek contained various impairments from anthropogenic sources when preparing the 2013 Lower Gallatin Planning Area TMDL.

Mandeville Creek Impairment Information			
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

Chart 8.1.2: Mandeville Creek Impairment Information

Regulatory Requirements

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

1. Monitor stormwater discharges based on residential and industrial land-use types
    - See SWMP Sec. 8.2 Urban Runoff Monitoring
2. Assess in-stream water quality impacts of stormwater discharges to Bozeman and Mandeville Creeks (Option 2)
    - See SWMP Sec. 8.3 In-Stream Wet-Weather Monitoring and SWMP Sec. 8.5 Long-Term Trend Monitoring.
3. Conduct TMDL-related monitoring to evaluate the effectiveness of best management practices (BMPs) implemented to reduce pollutant loading from the MS4 to impaired waters (Option 2)
    - See SWMP Sec. 8.4 Sediment Reduction Monitoring
4. Self-evaluate results relative to long-term medians
    - See SWMP Sec. 8.6 Evaluation

8.2 Urban Runoff Monitoring

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.

Methods and Sites

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

1. 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
2. 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
3. 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

4. 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

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:

1. Total Suspended Solids (TSS), mg/L
2. Chemical Oxygen Demand (COD), mg/L
3. Total Phosphorus, mg/L
4. Total Nitrogen, mg/L
5. pH, standard units
6. Copper, mg/L
7. Lead, mg/L
8. Zinc, mg/L
9. Oils and Greases, mg/L

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

$$Q = CiA \qquad \textit{Equation 1}$$

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

Sampling Location Runoff Coefficients (C-Factors)		
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_01	Industrial	0.80

Chart 8.2.1: Sampling location runoff coefficients C-factors

	TSS (mg/L)	Oil and Grease (mg/L)	Total Nitro. (mg/L)	Phosp. (mg/L)	Zinc (mg/L)	Lead (mg/L)	Copper (mg/L)	COD	PH
RES_01: 2017 (1)	203	2	6.2	0.908	0.116	0.0052	0.022	251	6.7
RES_01: 2017 (2)	368	0	12	1.23	0.179	0.0073	0.03	175	6.97
RES_01: 2018 (1)									
RES_01: 2018 (2)									
RES_01: 2019 (1)									
RES_01: 2019 (2)									
RES_01: 2020 (1)									
RES_01: 2020 (2)									
RES_01: 2021 (1)									
RES_01: 2021 (2)									
RES_01 Median	**285.5**	**1**	**9.1**	**1.07**	**0.15**	**0.01**	**0.03**	**213.00**	**6.84**
RES_02: 2017 (1)	-	-	-	-	-	-	-	-	-
RES_02: 2017 (2)	-	-	-	-	-	-	-	-	-
RES_02: 2018 (1)									
RES_02: 2018 (2)									
RES_02: 2019 (1)									
RES_02: 2019 (2)									
RES_02: 2020 (1)									
RES_02: 2020 (2)									
RES_02: 2021 (1)									
RES_02: 2021 (2)									
RES_02 Median	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
IND_01: 2017 (1)	149	4	17.3	1.38	0.578	0.016	0.044	292	7
IND_01: 2017 (2)	1820	0	11.68	1.32	0	3.35 !	0.0867	151	6.92
IND_01: 2018 (1)									
IND_01: 2018 (2)									
IND_01: 2019 (1)									
IND_01: 2019 (2)									
IND_01: 2020 (1)									
IND_01: 2020 (2)									
IND_01: 2021 (1)									
IND_01: 2021 (2)									
IND_01 Median	**984.5**	**2**	**14.49**	**1.35**	**.289**	**0.016**	**0.0654**	**221.5**	**6.96**
IND_02: 2017 (1)	-	-	-	-	-	-	-	-	-
IND_02: 2017 (2)	-	-	-	-	-	-	-	-	-
IND_02: 2018 (1)									
IND_02: 2018 (2)									
IND_02: 2019 (1)									
IND_02: 2019 (2)									
IND_02: 2020 (1)									
IND_02: 2020 (2)									
IND_02: 2021 (1)									
IND_02: 2021 (2)									
IND_02 Median	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Chart 8.2.2: Monitoring Results

! = Indicates suspected analysis error. Not included in median calculations

Evaluation

The MS4 enters monitoring results into a local spreadsheet and stores analysis reports for 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 scores ranging from 0 to 4-points, representing a set increase from EPA benchmarks provided in previous MS4 General Permits.

For 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.

Urban Runoff Monitoring: Scoring Matrix					
	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

Chart 8.2.3: Urban Runoff Monitoring: Scoring Matrix

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

For 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.

Urban Runoff Monitoring: RES_01								
	2018		**2019**		**2020**		**2021**	
	(1)	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**
TSS								
Oil and Grease								
Total Nitrogen								
Phosphorus								
Zinc								
Lead								
Copper								
COD								
PH								
Event Points:								
Annual Points:								

Chart 8.2.4: Urban Runoff Monitoring: RES_01

Urban Runoff Monitoring: IND_01								
	2018		2019		2021		2022	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
TSS								
Oil and Grease								
Total Nitrogen								
Phosphorus								
Zinc								
Lead								
Copper								
COD								
PH								
Event Points:								
Annual Points:								

Chart 8.2.5: Urban Runoff Monitoring: IND_01

Urban Runoff Monitoring: RES_02								
	2018		2019		2021		2022	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
TSS								
Oil and Grease								
Total Nitrogen								
Phosphorus								
Zinc								
Lead								
Copper								
COD								
PH								
Event Points:								
Annual Points:								

Chart 8.2.6: Urban Runoff Monitoring: RES_02

Urban Runoff Monitoring: IND_02								
	2018		2019		2021		2022	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
TSS								
Oil and Grease								
Total Nitrogen								
Phosphorus								
Zinc								
Lead								
Copper								
COD								
PH								
Event Points:								
Annual Points:								

Chart 8.2.7: Urban Runoff Monitoring: IND_02

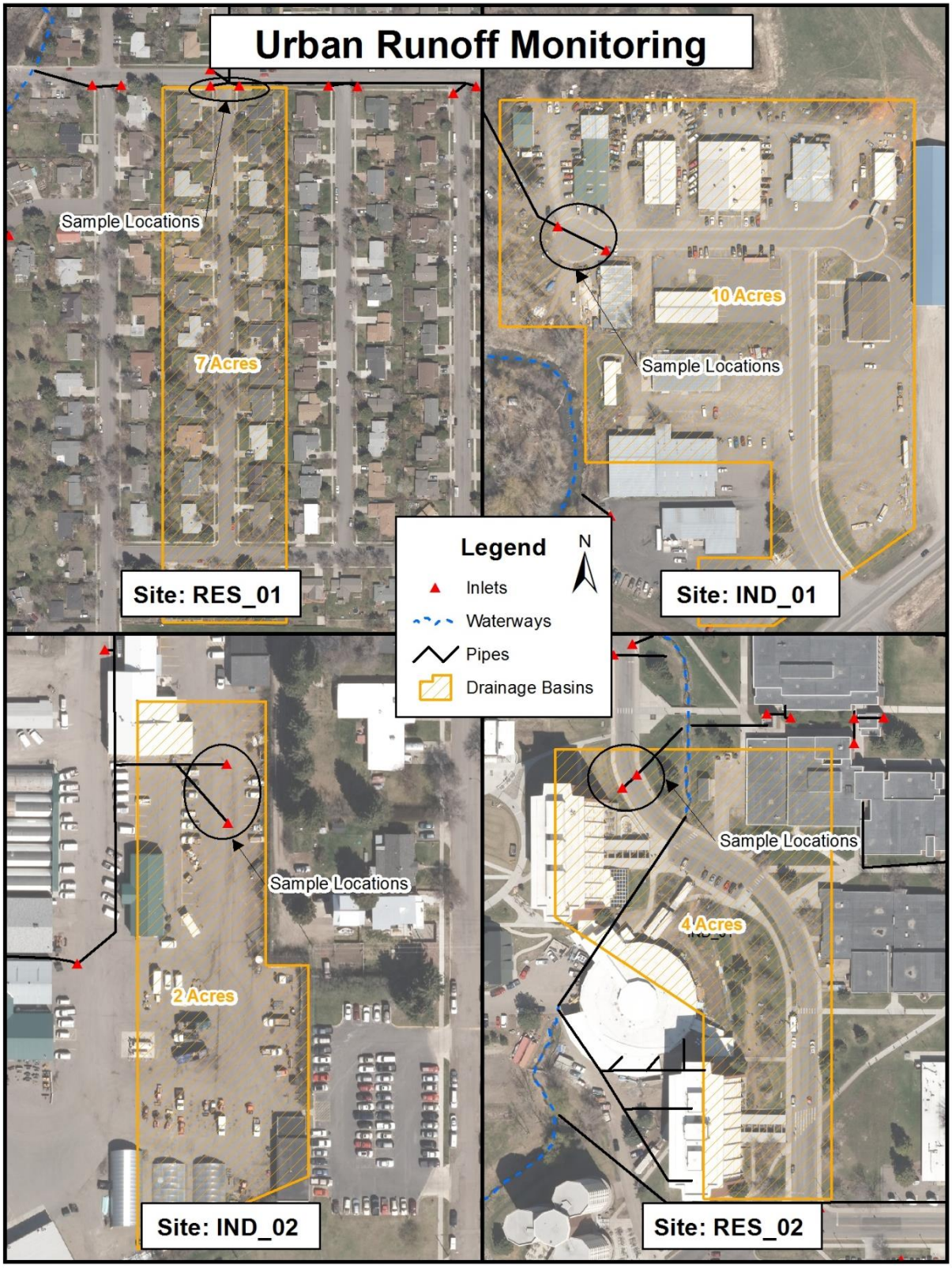
The MS4 sums the individual scores to obtain an Event Point Total.

The MS4 sums both Event Scores to obtain an Annual Point Total.

The MS4 calculates a Final Score by transferring and summing the Annual Points in the Urban Runoff Monitoring: Results chart. The MS4 divides the Total Points by the Possible Points to calculate the Final Score. The MS4 transfers the Final Score to SWMP Sec. 8.6.

Urban Runoff Monitoring: Results				
	2018	**2019**	**2021**	**2022**
RES_01 Annual Points				
IND_01 Annual Points				
RES_02 Annual Points				
IND_02 Annual Points				
Total Points:				
Possible Points:	**288**	**288**	**288**	**288**
Final Score (decimal):				

Chart 8.2.8: Urban Runoff Monitoring: Results



Map 8.2.9: Urban Runoff Monitoring

8.3 In-Stream Wet-Weather Monitoring

The MS4 conducts In-Stream Wet-Weather Monitoring to analyze 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.

Methods and 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:

1. 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
2. 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
3. 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
4. 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

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:

1. Total Suspended Solids (TSS), mg/L

2. Chemical Oxygen Demand (COD), mg/L
3. Total Phosphorus, mg/L
4. Total Nitrogen, mg/L
5. pH, standard units
6. Copper, mg/L
7. Lead, mg/L
8. Zinc, mg/L
9. Oils and Greases, mg/L

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.

	Monitoring Results								
	TSS (mg/L)	**Oil and Grease (mg/L)**	**Total Nitro. (mg/L)**	**Phosp. (mg/L)**	**Zinc (mg/L)**	**Lead (mg/L)**	**Copper (mg/L)**	**COD**	**PH**
UPS_01: 2017 (1)	7	0	0.406	0.0847	0.0054	0.0005	0.0036	11.6	8.18
UPS_01: 2017 (2)	14	0	0	0.022	0	0	0	15	8.1
UPS_01: 2018 (1)									
UPS_01: 2018 (2)									
UPS_01: 2019 (1)									
UPS_01: 2019 (2)									
UPS_01: 2020 (1)									
UPS_01: 2020 (2)									
UPS_01: 2021 (1)									
UPS_01: 2021 (2)									
UPS_01 Median	**10.5**	**0**	**0.203**	**0.0534**	**0.0027**	**0.0002**	**0.0018**	**13.3**	**8.14**
UPS_02: 2017 (1)	-	-	-	-	-	-	-	-	-
UPS_02: 2017 (2)	-	-	-	-	-	-	-	-	-
UPS_02: 2018 (1)									
UPS_02: 2018 (2)									
UPS_02: 2019 (1)									
UPS_02: 2019 (2)									
UPS_02: 2020 (1)									
UPS_02: 2020 (2)									
UPS_02: 2021 (1)									
UPS_02: 2021 (2)									
UPS_02: Median	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
DWS_01: 2017 (1)	10	0	0.547	0.0879	0.007	0.0006	0.0036	15.3	8.2
DWS_01: 2017 (2)	134	0	1.8	0.264	0.03	0.006	0.006	42	8.1
DWS_01: 2018 (1)									
DWS_01: 2018 (2)									
DWS_01: 2019 (1)									
DWS_01: 2019 (2)									
DWS_01: 2020 (1)									
DWS_01: 2020 (2)									
DWS_01: 2021 (1)									
DWS_01: 2021 (2)									

DWS_01: Median	72	0	1.1735	0.1760	0.0185	0.0033	0.0048	28.65	8.15
DWS_02: 2017 (1)	-	-	-	-	-	-	-	-	-
DWS_02: 2017 (2)	-	-	-	-	-	-	-	-	-
DWS_02: 2018 (1)									
DWS_02: 2018 (2)									
DWS_02: 2019 (1)									
DWS_02: 2019 (2)									
DWS_02: 2020 (1)									
DWS_02: 2020 (2)									
DWS_02: 2021 (1)									
DWS_02: 2021 (2)									
DWS_02 Median	-	-	-	-	-	-	-	-	-

Chart 8.3.1: Monitoring Results

Evaluation

The MS4 enters data into a local spreadsheet and stores analysis reports for 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 percent change of pollutants between the upstream and downstream sites.

For 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.

In-Stream Wet-Weather Monitoring: Scoring Matrix					
	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)

Chart 8.3.1: In-Stream Wet-Weather Monitoring Scoring Matrix

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

For 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.

In-Stream Wet-Weather Monitoring: Bozeman Creek UPS_01 and DWS_01								
	2018		2019		2021		2022	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
TSS								
Oil and Grease								
Total Nitrogen								
Phosphorus								
Zinc								
Lead								
Copper								
COD								
PH								
Event Points:								
Annual Points:								

Chart 8.3.2: In-Stream Wet-Weather Monitoring: Bozeman Creek UPS_01 and DWS_01.

In-Stream Wet-Weather Monitoring: Mandeville Creek UPS_02 and DWS_02								
	2018		2019		2021		2022	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
TSS								
Oil and Grease								
Total Nitrogen								
Phosphorus								
Zinc								
Lead								
Copper								
COD								
PH								
Event Points:								
Annual Points:								

Chart 8.3.3: In-Stream Wet-Weather Monitoring: Mandeville Creek UPS_02 and DWS_02.

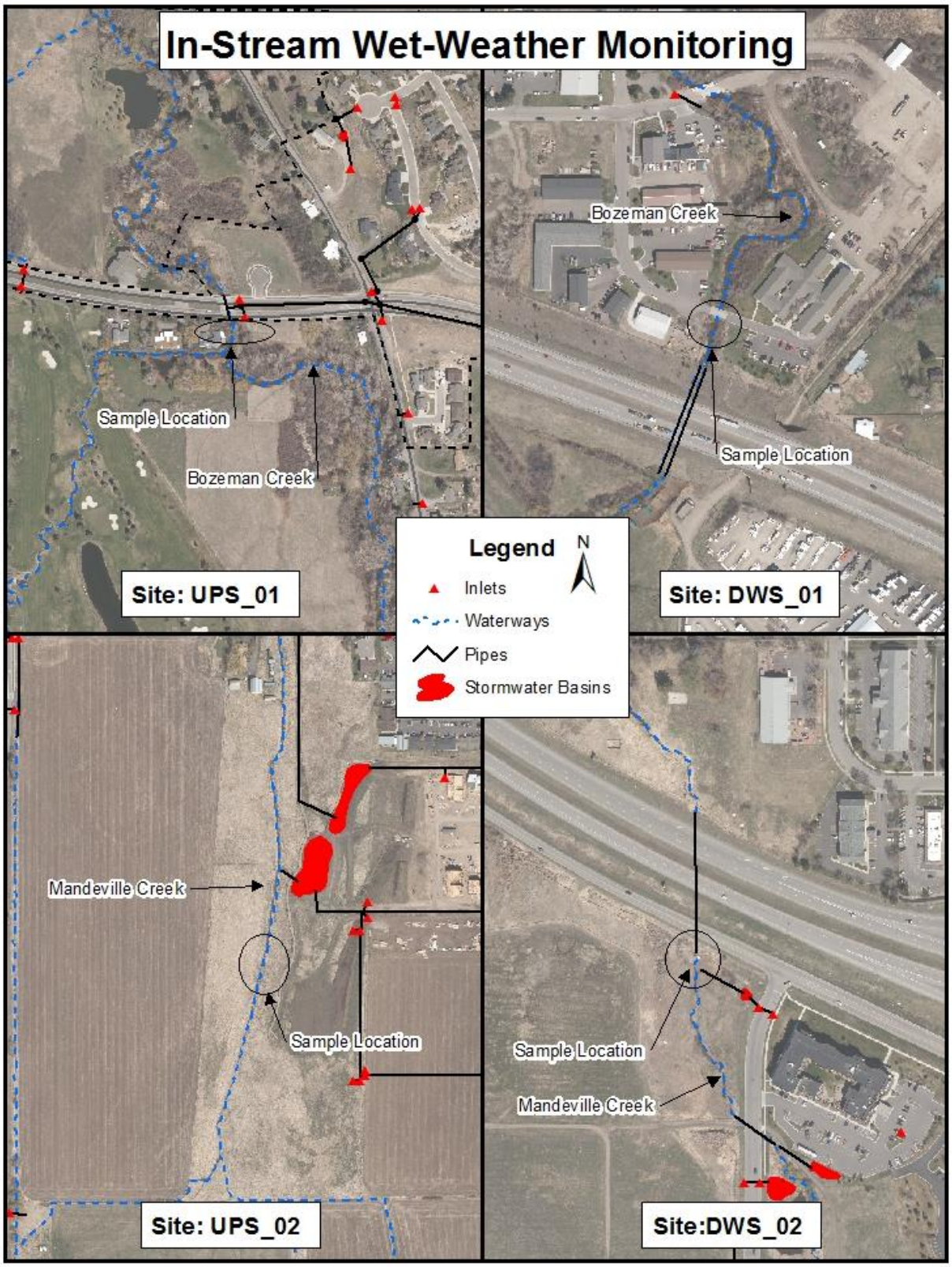
The MS4 sums the individual scores to obtain an Event Point Total.

The MS4 sums both Event Scores to obtain an Annual Point Total.

The MS4 calculates a Final Score by transferring and summing the Annual Points in the In-Stream Wet-Weather Monitoring: Results chart. The MS4 divides the Total Points by the Possible Points. The MS4 transfers the Final Score to SWMP Sec. 8.6.

In-Stream Wet-Weather Monitoring: Results				
	2018	2019	2021	2022
Bozeman Creek Annual Points				
Mandeville Creek Annual Points				
Total Points:				
Possible Points:	144	144	144	144
Final Score (decimal):				

Chart 8.3.4: In-Stream Wet-Weather Monitoring: Results



Map 8.3.4: In-Stream Wet-Weather Monitoring

8.4 Sediment Reduction Monitoring

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 Sec. 2.3 TMDL Action Plan.

Bozeman Creek Sediment Waste Load Reduction				
Sediment Source	**Estimated Load**	**Waste Load Allocation**	**Required Load Reduction**	**Required Load Reduction**
Municipal Storm Sewer	218 tons/year	137 tons/year	37%	81 tons/year **DEQ Imposed**

Chart 8.4.1: 2013 Lower Gallatin Planning Area TMDL - Bozeman Creek Sediment Waste Load Reduction

Mandeville Creek Sediment Waste Load Reduction				
Sediment Source	**Estimated Load**	**Waste Load Allocation**	**Required Load Reduction**	**Load Reduction Goal**
Municipal Storm Sewer	None	None	None	10 tons/year **Self Imposed**

Chart 8.4.2: 2013 Lower Gallatin Planning Area TMDL Mandeville Creek Sediment Waste Load Reduction

Methods and Sites

The MS4 calculates sediment capture twice per year from its BMPs described in SWMP Sec. 2.3 Pollutant Reduction Totals.

Analysis

The MS4 analyzes the following parameter:

1. 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.

Sediment Reduction Monitoring: Scoring Matrix (Bozeman Creek)					
	4-Points	**3-Points**	**2-Points**	**1-Point**	**0-Points**
Sediment Captured (tons)	≥81	60 – 80	40 – 59	20 – 39	0 – 19

Chart 8.4.3: Sediment Reduction Monitoring: Scoring Matrix (Bozeman Creek)

Sediment Reduction Monitoring: Scoring Matrix (Mandeville Creek)					
	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

Chart 8.4.4: Sediment Reduction Monitoring: Scoring Matrix (Mandeville Creek)

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.
For example, the MS4 captured 40 tons of sediment within the Bozeman Creek watershed in 2018. The MS4 assigns and populates the Sediment Reduction Monitoring: Results chart Bozeman Creek Annual Points box with 2-points.

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. The MS4 transfers the Final Score to SWMP Sec. 8.6.

Sediment Reduction Monitoring: Results				
	2018	**2019**	**2021**	**2022**
Bozeman Creek Annual Points	x 1.5			
Mandeville Creek Annual Points	x .5			
Total Points:				
Possible Points:	**8**	**8**	**8**	**8**
Final Score (decimal):				

Chart 8.4.5: Sediment Reduction Monitoring: Results.

8.5 Long-Term Trend Monitoring

Macroinvertebrate community assemblages are predictable, shifting from expected taxa to an increase in sediment-tolerant taxa because of sedimentation. The MS4 conducts a macroinvertebrate biological index sampling effort using the Observed/Expected Model (O/E) to assess macroinvertebrate community structure.

Methods and Sites:

The MS4 monitors benthic macroinvertebrates on Bozeman and Mandeville Creeks at the In-Stream Wet-Weather Monitoring Sites (SWMP Sec. 8.3). The MS4 derives macroinvertebrate biological index monitoring protocols from MDEQ Sample Collection, Sorting, and Taxonomic Identification of Benthic Macroinvertebrate Communities Standard Operating Procedures (*two samples 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:

1. Taxonomic Sorting and Identification
2. Species Abundance
3. Species Diversity

The MS4 enters data into the Utah State University's Western Center for Monitoring and Assessment of Freshwater Ecosystems O/E model to calculate O/E ratios.

	Monitoring Results		
	Observed	**Expected**	**O/E Ratio**
UPS_01: 2017 (1)	-	-	-
UPS_01: 2017 (2)	-	-	-
UPS_01: 2018 (1)			
UPS_01: 2018 (2)			
UPS_01: 2019 (1)			
UPS_01: 2019 (2)			
UPS_01: 2020 (1)			
UPS_01: 2020 (2)			
UPS_01: 2021 (1)			
UPS_01: 2021 (2)			
UPS_01 Median			
UPS_02: 2017 (1)	-	-	-
UPS_02: 2017 (2)	-	-	-
UPS_02: 2018 (1)			
UPS_02: 2018 (2)			
UPS_02: 2019 (1)			
UPS_02: 2019 (2)			
UPS_02: 2020 (1)			
UPS_02: 2020 (2)			
UPS_02: 2021 (1)			
UPS_02: 2021 (2)			
UPS_02: Median			
DWS_01: 2017 (1)	-	-	-

DWS_01: 2017 (2)	-	-	-
DWS_01: 2018 (1)			
DWS_01: 2018 (2)			
DWS_01: 2019 (1)			
DWS_01: 2019 (2)			
DWS_01: 2020 (1)			
DWS_01: 2020 (2)			
DWS_01: 2021 (1)			
DWS_01: 2021 (2)			
DWS_01: Median			
DWS_02: 2017 (1)	-	-	-
DWS_02: 2017 (2)	-	-	-
DWS_02: 2018 (1)			
DWS_02: 2018 (2)			
DWS_02: 2019 (1)			
DWS_02: 2019 (2)			
DWS_02: 2020 (1)			
DWS_02: 2020 (2)			
DWS_02: 2021 (1)			
DWS_02: 2021 (2)			
DWS_02 Median			

Chart 8.5.1: Monitoring Results

Evaluation

The MS4 enters data into a local spreadsheet and stores analysis reports for 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 ranging from 0 to 4-points, which relate to percent change in O/E ratios between the upstream and downstream sites for each creek.

For 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 Sec. 8.3.

For 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.

Long-Term Trend Monitoring: Scoring Matrix					
	4-Points	**3-Points**	**2-Points**	**1-Point**	**0-Points**
O/E Ratio (% △)	>0 – (-20)	-21 – (-40)	-41 – (-60)	-61 – (-80)	-81 – (-100)

Chart 8.5.2: Long-Term Trend Monitoring: Scoring Matrix

The MS4 relates results to the Matrix and then populates the Long-Term Trend Monitoring: Results chart with the corresponding scores.

The MS4 calculates a Final Score by summing the Event Points in the Long-Term Trend Monitoring: Results chart and dividing by the Possible Points. The MS4 transfers the Final Score to SWMP Sec. 8.6.

	Long-Term Trend Monitoring: Results							
	2018		2019		2021		2022	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Bozeman Creek Event Points								
Mand. Creek Event Points								
Total Points:								
Possible Points:	16		16		16		16	
Final Score (decimal):								

Chart 8.5.3: Long-Term Trend Monitoring: Results

8.6 Evaluation

The MS4 calculates a Final Grade to determine the overall effectiveness of its programs and initiatives detailed in SWMP Sec. 1.0 to 7.0.

The MS4 transfers scores from each protocol (8.2 to 8.5) to the Programmatic Evaluation: Final Points chart. The MS4 utilizes a weighted sum calculation to make the four scores comparable to each other.

Programmatic Evaluation: Final Points (2018)				
	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 (%):	

8.6.1: Programmatic Evaluation: Final Points (2018)

Programmatic Evaluation: Final Points (2019)				
	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 (%):	

8.6.2: Programmatic Evaluation: Final Points (2019)

Programmatic Evaluation: Final Points (2020)				
	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 (%):	

8.6.3: Programmatic Evaluation: Final Points (2020)

Programmatic Evaluation: Final Points (2021)				
	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 (%):	

8.6.4: Programmatic Evaluation: Final Points (2021)

The MS4 relates the Final Weighted Total (%) to the following equally distributed ranges (100-percent scale) and their associated Final Grades:

1. Final Grade A: 80% - 100%
2. Final Grade B: 60% - 79%
3. Final Grade C: 40% - 59%
4. Final Grade D: 20% - 39%
5. Final Grade F: 0% - 19%

The MS4 populates the Stormwater Division Report Card with a Final Grade for the corresponding year.

Stormwater Division Report Card			
2018 Final Grade	**2019 Final Grade**	**2020 Final Grade**	**2021 Final Grade**
X	**X**	**X**	**X**

8.6.5: Stormwater Division Report Card

Discussion

The MS4 utilizes its empirical knowledge, performance measures, and monitoring 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 to receiving waters. Maintain administrative programs, level of service goals, development policies, and capital strategies detailed in SWMP Sec. 2.3. Reduce system treatment budget levels.
2. Grade = B: Low stormwater impact to receiving waters. Maintain administrative programs, level of service goals, development policies, system enhancement funding, and capital strategies detailed in Section SWMP Sec. 2.3.
3. Grade = C: Moderate stormwater impact to receiving waters. Maintain operation service goals, system enhancement funding, and capital strategies detailed in Section SWMP Sec. 2.3. Increase administrative programs and development policies.
4. Grade = D: Significant stormwater impact to receiving waters. Increase administrative programs, level of service goals, development policies, system enhancement funding, and capital strategies detailed in Section SWMP Sec. 2.3.
5. Grade = F: Major stormwater impact to receiving waters. Increase administrative programs, level of service goals, development policies, system enhancement funding, and capital strategies detailed in Section SWMP Sec. 2.3.

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 evalaution methodology is effective at tracking program performance. The MS4 expects a positive trend over the Permit Term as Staff implements the content of this SWMP.