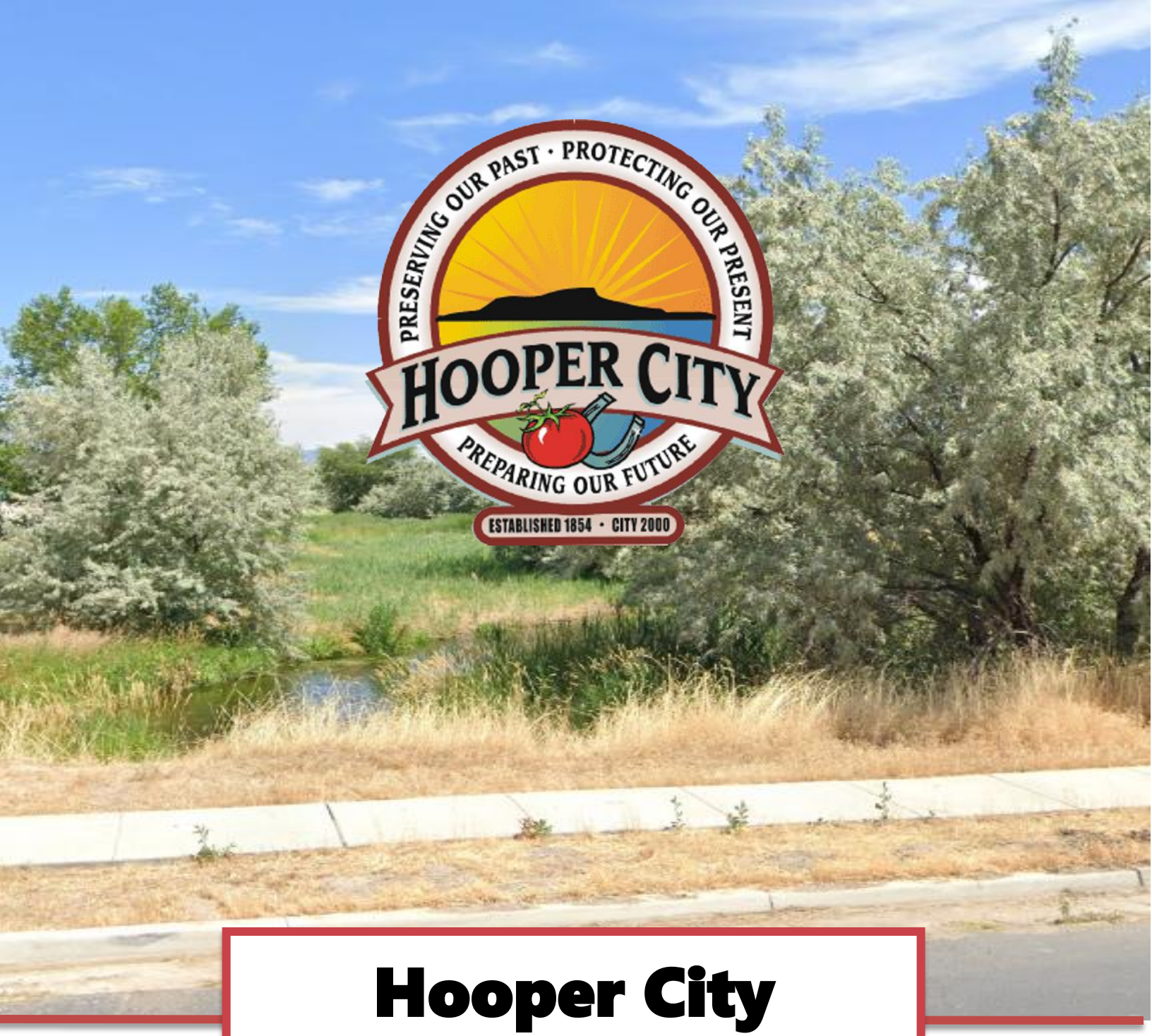


Hooper City

Stormwater Management Plan

Updated July 2026
Permit Effective Date: May 12, 2026 – May 11, 2031
Major Revisions Completed by J-U-B Engineers

Revision Log

Date	Comments	Approved
11/2010	Updated to address new permit requirements	
6/2016	Updated to address new permit requirements	
12/2021	Update to address new permit and LID requirements	
12/2024	Update to address new members of the City storm water advisory committee.	
1/2025	Update to conform with State Audit	
7/2026	Major Update for New MS4 Permit	

INTRODUCTION

Polluted storm water runoff is often transported to municipal separate storm sewer systems (MS4s) and ultimately discharged into local rivers and streams without treatment. EPA's Storm Water Phase II Rule establishes an MS4 storm water management program that is intended to improve the Nation's waterways by reducing the quantity of pollutants that are introduced into storm sewer systems during storm events. Common pollutants include oil and grease from roadways, roadway salts and deicing materials, pesticides and fertilizers from lawns, sediment from construction sites, and carelessly discarded trash, such as cigarette butts, paper wrappers, and plastic bottles. When deposited into nearby waterways through MS4 discharges, these pollutants can impair the waterways, thereby discouraging use of the resource, contaminating drinking water supplies, and interfering with the habitat for fish, other aquatic organisms, and wildlife.

In 1990, EPA promulgated rules establishing Phase I of the National Pollutant Discharge Elimination System (NPDES) storm water program. The Phase I program for MS4s requires operators of "medium" and "large" MS4s, that is, those that generally serve populations of 100,000 or greater, to implement a storm water management program to control polluted discharges from these MS4s. The Storm Water Phase II Rule extends coverage of the NPDES storm water program to certain "small" MS4s but takes a slightly different approach to how the storm water management program is developed and implemented.

In the State of Utah, the EPA has granted primacy to the State of Utah to oversee and manage the storm water program. The State has adopted the Utah Pollutant Discharge Elimination System (UPDES) for that purpose. Hooper City has prepared this Storm Water Management Program (SWMP) to meet the requirements of the UPDES Storm Water Discharge Permit for Small MS4s.

Storm Water Management Program

This document contains a description of the community-specific Storm Water Management Program for Hooper City. The Storm Water Management Program is intended to reduce the discharge of pollutants to the maximum extent practicable (MEP), protect water quality, satisfy Utah Clean Water Act requirements, and adapt to changing conditions and needs. The Program includes the following:

- An organizational chart depicting various departments and personnel within the city and their stormwater-related responsibilities
- Best Management Practices (BMPs) for each of the six minimum control measures:
  1. Public Education and Outreach
  2. Public Participation/Involvement
  3. Illicit Discharge Detection and Elimination
  4. Construction Site Runoff Control
  5. Post-Construction Runoff Control
  6. Pollution Prevention / Good Housekeeping

- Measurable goals for each minimum control measure (i.e., narrative or numeric standards used to gauge program effectiveness)
- Estimated months and years in which actions to implement each measure will be undertaken, including interim milestones and frequency
- The person or persons responsible for implementing or coordinating the storm water program
- List of priority areas and facilities in Hooper City

This document also contains the following information and documentation in its appendices:

- Appendix A – Supplemental Guide to Storm Water Management for Contractors and Developers
- Appendix B – Low Impact Development Handbook
- Appendix C – Standard Operating Procedures
- Appendix D – General program documentation, including inspection forms, enforcement logs, training logs, annual reports, maintenance records, observation reports, and other supporting documentation
- Appendix E – Copies of the most current city ordinances applicable to stormwater
- Appendix F –BMP Fact Sheets
  Appendix G – Program Agreements

Permit Application and Notice of Intent

In 2003, Hooper City applied for and was granted a permit to discharge stormwater to waters of the United States. Hooper is renewing its coverage under the phase II small MS4 permit with the tracking number: UTR090046.

Permit Requirements

On May 12, 2026, the State of Utah issued a revised General Permit for Discharges from Small Municipal Separate Storm Sewer Systems. With the revisions came new requirements and more clarity on existing requirements. A complete list of permit changes can be found on the Utah DWQ website on the UPDES permit page a link has been included here: MS4 Permit (Municipal Separate Storm Sewer System) - Utah Department of Environmental Quality

The chosen measurable goals, submitted in the Notice of Intent as a permit application, become the required storm water management program; however, the NPDES permitting authority can require changes in the mix of chosen BMPs and measurable goals if all or some of them are found to be inconsistent with the provisions of the Phase II Final Rule. Likewise, the permittee can change its mix of BMPs if it determines that the program is not as effective as it could be.

Reports

The permit requires the City to conduct an annual review of the SWMP, document and report program activities, and make any necessary updates. All changes are recorded in the revision log

on page 2. A standard operating procedure (SOP) and an annual review checklist have been developed to guide this process. Annual reports are submitted through NeTMS4 for review by the Utah DEQ. The annual review includes:

- The status of compliance with permit conditions, including an assessment of the appropriateness of the selected BMPs and progress toward achieving the selected measurable goals for each minimum measure
- Results of any information collected and analyzed, including monitoring data if any
- A summary of the storm water activities planned for the next reporting cycle
- A change in any identified BMP or measurable goals for any minimum measure; and
- Notice of relying on another governmental entity to satisfy some of the permit obligations (if applicable).
- Summary of fiscal analysis outlining program costs, allocated money, and expenditures needed.

Record Keeping

Records required by the State must be kept for at least 5 years and made accessible to the public at reasonable times during regular business hours. Records need not be submitted to the State unless the Permittee is requested to do so. Inspection, enforcement, and spill records are kept in an ArcGIS database. Training and education material documentation is kept in a local file server.

Deadlines

The following deadlines are recognized as part of the program:

Date	Description
November, 2026	NOI submission for continuation of permit coverage
May, 2031	Permit Expires

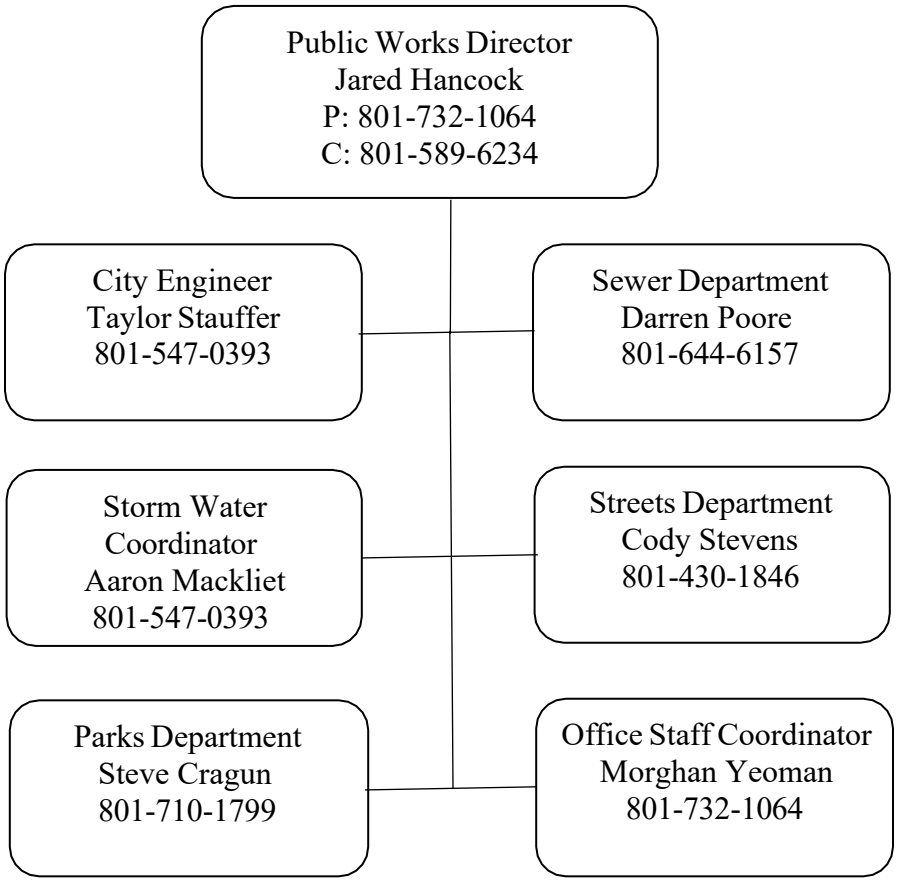
Penalties

The Clean Water Act provides that any person who violates a Permit condition implementing provisions of the Act is subject to a civil penalty not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates Permit conditions or the Act is subject to a fine not exceeding $25,000 per day of violation. Any person convicted under UCA 19-5-115(2) a second time shall be punished by a fine not exceeding $50,000 per day.

HOOPER CITY CHARACTERISTICS

General Information

Hooper City has a very limited public works staff. The Mayor is ultimately responsible for the storm drain system. The following organizational chart shows responsible individuals and provides their contact information.



Public Works Director

- Liaison with administration and City Council
- General coordination of the Storm Water Pollution Prevention (SWPP) program
- Responsible for the Pollution Prevention and Good Housekeeping Program
  - Keep SOPs up to date

Storm Water Coordinator

- Oversees Storm Water Program and works with Department Heads
- Responsible for Construction Program
    - Review SWPPPs
    - Coordinate permitting
    - Attend preconstruction conferences to review SWPPP requirements and expectations
    - Site inspections
- Responsible for IDDE Program
    - Dry weather screening
    - Respond to complaints or calls
    - Annual High Priority Area inspection
    - Coordinating with the Health Department
    - Track Illicit Discharge activities and reporting
    - Publicize hotline reporting
    - Educate on Household Hazardous Waste – provide information for City website
- Responsible for Public Education and Outreach Program
    - Attend Golden Spike Storm Water Coalition meetings
    - Assist with annual Water Fair
    - Provide educational information for target audiences
    - Conduct Employee Training
    - Educational information for Quarterly Newsletters
- Responsible for Long-term Runoff Control Program
    - Work with City Engineer to include long-term BMPs on new development
    - Maintain inventory of long-term BMPs in the city
    - Oversite inspections of privately owned Long-term BMP
    - Work with the City Engineer on maintenance agreements.
    - Annual inspection of City-Owned/Operated long-term BMPs
- Responsible for Public Involvement Program
    - Providing information for City Website postings
    - Keep a current version of the SWMP on the website
    - Review any public comments on the SWMP and respond appropriately
- Assist with the Pollution Prevention and Good Housekeeping Program
    - Tracking Storm Water Program Activities
    - Conduct monthly inspections of High Priority City-Owned Facilities
    - Semi-Annual Comprehensive Inspections of High Priority City-Owned Facilities

    - Annual sampling of storm water discharges at High Priority City-Owned Facilities
    - Work with Public Works Director in keeping SOPs up to date
    - Maintain inventory of City-Owned Facilities
    - Review flood management/control facilities for water quality
- Review and Update SWMP Annually
- Annual Report
- Coordinate any Storm Water Program issues with office staff

City Engineer

- Design reviews to include long-term BMPs
- Keep storm water system mapping updated
- Help educate contractors and developers
- Provide engineering support

Parks Department Head

- Maintain parks department work activities and areas
- Pesticide, Herbicide, and Fertilizer (PHF) program
- Training parks dept. personnel
- Chemical and fertilizer storage in work area
- Parks department equipment operation
- Equipment maintenance for parks dept. equipment
- Mowing, grounds maintenance program

Streets Department Head

- Streets dept. maintenance work activities and areas
- Streets dept. equipment operation
- Equipment maintenance for street dept.
- Training streets dept. personnel
- Chemicals storage in work area
- Snow plowing program
- Street sweeping program
    - As needed
- Storm Drain box program
    - As needed
- Salt and materials storage stockpile areas
    - Stored indoors

Office Staff Coordinator

- Coordinates permitting efforts
- Responds to public input – phone calls, emails and people stopping by
- Reports complaints to Storm Water Coordinator
- Updates city website

Existing Conditions in Hooper City

Population:	9,800 (2026 approximation)
Size:	86.6 sq. miles total 11.8 sq. miles east of the Great Salt Lake
Geographic Description:	8 miles southwest of Ogden. Located in the southwest corner of Weber County with elevations varying between 4215 to 4240 ft.
Receiving Waters:	Most of Hooper drains into either the Hooper Slough or the Howard Slough, both of which drain into the Great Salt Lake. There are small areas on the north side of town that drain into the extreme lower reaches of the Weber River. This section of the river is impaired. The defined impairments are for Benthic Invertebrate assessment. This information was taken from the following link: Water Quality Assessment Map - Utah Department of Environmental Quality
Annual Precipitation:	17.21 inches per year (as measured at the Ogden Sugar Factory, Antelope Island reports 15.48 inches per year)
Type of Community:	A small rural city with moderate rates of residential growth that are expected to continue for many years.
Latitude:	41°10′ N
Longitude:	112°08′ W
Urbanized Area:	11.8 square miles excluding the Great Salt Lake and Fremont Island
Percentage of Drainage to be Permitted:	The intent is to permit the entire portion of Hooper that is east of the Great Salt Lake. The lake itself and Fremont Island are to be excluded from the permit

The Hooper City storm water system consists of curbs and gutters, storm drain pipes, catch basins, manholes, culverts, swales, and canals. Storm water facilities convey runoff through the storm drain infrastructure and discharge to natural drainage features, including the Howard Slough, the Hooper Slough, and the lower fork of the Weber River as it enters the Great Salt Lake wetlands. The sloughs and river wind their way westward where they ultimately discharge to the Great Salt Lake. System controls within the storm water system are limited in some areas. Many streets use curb and gutter with storm drain infrastructure to collect storm water runoff, with some areas utilizing swales for conveyance.

The city's sanitary sewer system primarily consists of a public sewer collection system. Some individual septic tanks and drain fields remain within the city. The city installed, owns, and operates a vacuum sewer collection tank system, and new development is required to connect to the public sanitary sewer system where sewer service is available in accordance with city requirements.

History

Hooper is a relatively young city in the State of Utah. Hooper was incorporated on November 30, 2000 and has a population of approximately 8,646 people. Much of what is now the city has traditionally been devoted to agricultural land uses including the raising of animals and the cultivation of alfalfa, grain, corn and onions. The balance of the land area is largely developed with single-family dwellings on large lots (one acre or greater).

After incorporating, a decision was made to operate the City without a mill levy (property tax). Because of the rural nature of the community there is little existing infrastructure and correspondingly little revenue to work with. The current city staff consists of one Mayor who works part time for the City and two clerks who also work part time for the City, a Public Works Director, a Sewer System Director, a Streets Superintendent, and a few other full and part time Public Works Employees. The staff works closely together to handle issues as they arise.
The City currently contracts with Weber County to do maintenance on its streets. Culinary water is supplied by the Hooper Water Improvement District (HWID). In 2007 Hooper City began operating the first phases of its sanitary sewer collection system.

There are still numerous septic tanks and associated drain fields. The storm drain system consists of many miles of open ditch with culverts at road crossings and driveways. A handful of the newer subdivisions have installed curb and gutter with catch basins and piping to drain to the nearest open ditch.

Local Water Quality Concerns

The surface water quality within the city of Hooper has historically been very poor. In January 2001, Parsons Engineering Science, Inc completed a study for the Weber- Morgan Board of Health, entitled *Shallow Groundwater Management Study for West Weber County*. The results of this study indicate that the shallow groundwater in this part of Weber County is high in nitrates. As a result of this study the Board of Health adopted a policy allowing no net increase in the number of septic systems within the county. It is thought that one of the main culprits leading to the high nitrates is

the septic systems that have been installed in areas with a high-water table. With the limited budget available for Hooper City, the initial focus was on trying to minimize the influence of the sewage system on the water quality within the city. As the city has slowly been progressing toward a city-wide sewer system more attention has been given to other aspects of the city's plan. Hooper is also at the bottom end of the watershed. The only thing downstream of Hooper is the Great Salt Lake. By the time water gets to Hooper through existing drainage channels, the water has been degraded.

Because of the rural agricultural nature of the city other secondary target pollutants include phosphorus and total suspended solids. Hooper's SWMP has been geared toward small city applications, targeting the pollutants mentioned.

The lower section of the Weber River is considered to be impaired water. The listed impairment is Benthic Invertebrate Assessment. The northern portion of Hooper flows into the lower Weber River. The Weber River was previously impaired for ammonia, and Hooper city pursued policies to limit septic tanks to target ammonia reduction in the river. Hooper City will continue to pursue this policy into the future

Stormwater Advisory Committee

A steering committee was formed in the summer of 2002 for the purpose of developing the initial SWMP. Since the initial permitting an Advisory Committee reviews and oversees the stormwater program. The Advisory Committee includes:

- Sheri Bingham, Mayor
- Jared Hancock, Public Works Director Taylor Stauffer, City Engineer (consultant)
- Aaron Mackliet, Storm Water Coordinator, Consultant

Input and recommendations from this committee were used to update this Storm Water Management Program (SWMP). Their countless hours devoted to this task are greatly appreciated and are reflected in this program.

Ongoing Documentation Process

Much of the documentation is or will be included in Appendix D. Inspections and enforcement procedures will be stored in an ArcGIS database. As part of this update, the existing BMPs and measurable goals have been reviewed and assessed for their effectiveness and contribution in helping us achieve our desired results. We have completed evaluation worksheets to document our review and our assessment of our current program. These evaluation sheets are found in Appendix D. This evaluation combined with new permit requirements provided the foundation for this update. We have tried to build off of the positive things that have been accomplished and renewed our commitment to improve in areas where our program has been lacking. We feel the revised program is more focused.

Our plan is to document our activities and to keep better track of what is happening within our

community. We will continue to use the forms, logs, evaluation forms and backup information from the last major update.

PUBLIC EDUCATION AND OUTREACH (Section 4.2.1)

Permit Requirements

Permittees shall implement a public education and outreach program that promotes behavior changes to reduce water quality impacts from stormwater runoff and illicit discharges. The program shall focus on pollutants identified as primary contributors to impairment in Pineview, including nutrients, sediment, and contaminants associated with septic systems, construction site runoff, pet and animal waste, illicit discharges, groundwater impacts, and overall watershed stewardship.

The program will address these topics through targeted outreach to specific audiences, including:

- General Public
- Institutions, industrial, and commercial facilities
- Engineers, construction contractors, developers, development review staff, and land use planners.

with defined messages for each group. Permittees shall establish methods to evaluate program effectiveness, ensuring they are tied to defined goals and demonstrate changes in knowledge and behavior. The program shall include documentation of outreach efforts and provide justification for selected BMPs. Minimum performance measures shall be based on community land uses and target audiences.

1. (4.2.1.1) Permittees shall target specific pollutant sources impacting the designated uses of a receiving water based on land use. This targeting includes.
    a. Provide information describing potential impacts from storm water discharges
    b. Methods for avoiding, minimizing, reducing, and/or eliminating the adverse impacts of stormwater discharges.
    c. Actions individuals can take to improve water quality.
2. (4.2.1.2) At a minimum permittees shall annually provide and document outreach to the **general public**. (4.2.1.2.1) With the following topics considered:
    a. Maintenance of septic systems
    b. Effects of outdoor activities such as lawn care
    c. Effects of automotive work
    d. Proper disposal of swimming pool water
    e. Proper management of pet waste
    f. Any other relevant topics
3. (4.2.1.3) At a minimum permittees shall annually provide and document outreach to the **Institutions, industrial, and commercial facilities**. (4.2.1.3.1) With the following topics considered:
    a. Proper Lawn maintenance
    b. benefits of onsite infiltration of stormwater
    c. building and equipment maintenance
    d. Proper use of salt or other de-icing materials
    e. Proper storage of materials

f. Proper management of waste materials
g. Proper management of parking lot surfaces
h. Any other relevant topics

4. (4.2.1.4) At a minimum permittees shall annually provide and document outreach to the **Engineers, construction contractors, developers, development review staff, and land use planners**. With the following topics covered:
    a. Development of storm water pollution prevention plans
    b. BMP use to reduce impacts from storm water runoff

Summary of Existing Efforts

To-date, Hooper City has completed the following activities relative to our public education and outreach program:

- Prepared and distributed information on the proper methods for disconnecting septic tanks and drain fields for residents who have connected to the sanitary sewer system.
- Encouraged and invited contractor and developer training provided by the Golden Spike Storm Water Coalition.
- Include stormwater education in city newsletters
- Participate in the public outreach program for the Golden Spike Coalition Including:
    - Brochures and printed materials
    - A public information video
    - Annual Water Fair
    - Annual Contractor Training

Currently the city is looking at several items that, if implemented, could and will be utilized to help further the cause of public education and outreach.

Plan and Implementation Measures

To help meet the goals and objectives of this SWMP Hooper City has chosen to adopt the following BMPs. Each BMP is cross referenced alphabetically by code in Appendix B to a fact sheet that describes the BMP, its applicability, its limitations, and its effectiveness. The BMPs listed are the ones that the City has committed to utilize. Documentation of the selection/evaluation process for these BMPs can be found in Appendix D.

BMP	Code
Using Media	UM
Public Education/Participation	PEP
Classroom Education on Storm Water	CESW
Educational Materials	EM
Employee Training	ET

Goals

To more fully realize the benefits of the BMPs the city has set the following goals. The goals set along with the existing efforts fulfill the requirements of the Final Storm Water Phase II Rule for Education and Outreach.

The following table includes the goals for MCM 1.

MCM 1- Public Education and Outreach

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
1	All	General Public	4.2.1.2 Provide and document education outreach given to the general public.	Support Storm water fair through County Coalition annually	Annually in the Spring	PEP and UM	Water Fair is held Annually	Water Fair Attendance Record
1	All	Institutions and Commercial	4.2.1.3. Provide and document information given to institutions, industrial, and commercial facilities on an annual basis of the Permittee's prohibition against and the water quality impacts associated with illicit discharges and improper disposal of waste.	Include Information on the city website, newsletter, or mailers with information for institutions and commercial areas	Annually	PEP and EM	Education Material is posted or mailed annually	Log Educational material recipients and delivery dates
1	All	Engineers, Construction Contractors, Developers	4.2.1.4. & 4.2.1.6 Provide and document information given to engineers, construction contractors, developers, development review staff, and land use planners concerning the development of storm water pollution prevention plans (SWPPPs) and BMPs for reducing adverse impacts from storm water runoff from development sites.	Create an information packet on SWPPP preparation, BMP selection, and filing an NOT	Ongoing	PEP and EM	Developers are promptly given direction on permit requirements	Log Educational material recipients and delivery dates

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MCM 1- Public Education and Outreach

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
1	All	Engineers, Construction Contractors, Developers	4.2.1.4. & 4.2.1.6 Provide and document information given to engineers, construction contractors, developers, development review staff, and land use planners concerning the development of storm water pollution prevention plans (SWPPPs) and BMPs for reducing adverse impacts from storm water runoff from development sites.	Participate in Annual Contractor Training annually	Annually	PEP and EM	Attend and participate in training	Attendance Log
1	All	MS4 Staff	4.2.1.5 Provide and document information and training given to employees of Permittee owned or operated facilities concerning the Permittee's prohibition against and the water quality impacts associated with illicit discharges and improper disposal of waste.	All city employees trained annually and withing 60-days of hire	Annually and as needed	PEP and EM	All employees have been trained on the prohibition of illicit discharge	Annual training log and new hire training records
1	All	All Audiences	4.2.1.7 Evaluate the effectiveness of the public education program by a defined method.	Conduct a survey targeting desired education outcomes	Dec-30	PEP and EM	Survey is conducted during the 5-year permit cycle	Survey question and answer summary
1	All	All Audiences	4.2.1.8 Document why certain BMPs were chosen for public education program (over others)	Attend storm water coalition meetings	Monthly	PEP and EM	City is participating in storm water coalition	Meeting minutes and attendance

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MCM 1- Public Education and Outreach

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
1	Nitrogen & Phosphorus	General Public	3.3.1.3 Distribute educational materials to sources that are likely to produce nitrogen and phosphorus	Provide Education on Proper application of fertilizer	Annually	PEP and EM	Education material is distributed annually	Log Educational material recipients and delivery dates

PUBLIC PARTICIPATION / INVOLVEMENT (4.2.2)

Permit Requirements

Develop a program that complies with State and local public notice requirements and provides at least two public involvement opportunities each year. Include a range of participation activities and engage relevant stakeholder groups such as businesses, industry representatives, environmental organizations, homeowners' associations, and educational institutions.

1. (4.2.2) permittees at a minimum shall provide opportunities for public involvement twice year.
1. (4.2.2.1) Permittees shall adopt a program to create opportunities for the public to provide input during the decision-making process of the SWMP and adoption of ordinances and regulatory mechanisms.
2. (4.2.2.2) Permittees shall make the SWMP available for public review and input prior to submission to the division.
3. (4.2.2.3) Permittees shall post the current SWMP on their website

Summary of Existing Efforts

Advisory Committee

The City has a Storm Water Advisory Committee. This committee is described on page 7 of this document.

Recycling Program

Hooper City has a Recycling Program.

Green Waste Collection

Hooper City residents are encouraged to take advantage of Weber County's Green Waste Recycling Program.

Service Groups

There are local youth and community volunteer groups that have participated in street cleanup and litter reduction.

Plan and Implementation Measures

To help meet the goals and objectives of this SWMP Hooper City has chosen to adopt the following BMPs for use within our city as applicable. Each BMP is cross referenced alphabetically by code to a fact sheet that describes the BMP, its applicability, its limitations, and its effectiveness in the indicated appendix.

BMP	Code	Appendix
Public Education/ Participation	PEP	B

Goals

To more fully realize the benefits of the BMPs the city has set the following goals. The goals set along with the existing efforts fulfill the requirements of the Final Storm Water Phase II Rule for Public Involvement and Participation.

The following table summarizes the goals for MCM 2.

MCM 2 - Public Involvement/Participation

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
2	All	General Public	4.2.2.1 - Adoption of a program or policy to create opportunities for public input during decision making process	Follow City standard notification requirements for public meetings regarding the SWMP	Annually	PEP	Public is notified for annual review report of the SWMP	City Council meeting minutes of annual review meeting
2	All	General Public	4.2.2.2 Have SWMP available for public comment before submission to the state	Hold public hearing when SWMP is through internal review	Jul-26	PEP	SWMP document is available for public comment before official update	Public hearing meeting minutes and copy of public notice
2	All	General Public	4.2.2.3 Have SWMP document available for the public to view at all times	Post SWMP on Stormwater page on website	Ongoing	PEP	Most up to date SWMP is posted on website	Active website
2		General Public	4.2.2 Give citizens a minimum of two opportunities for hands on participation	Hold public hearing for SWMP update. Support city recycling program	Annually	PEP	Citizens are given opportunities to participate in stormwater program	Recycling program resources on website, and copy of public notice

ILLICIT DISCHARGE DETECTION AND ELIMINATION (IDDE) (4.2.3)

Permit Requirements

The permit requirements for Illicit Discharge Detection and Elimination on Storm Water Impacts can be found in Section 4.2.3 of the permit. The permit outlines in general the following requirements.

1. (4.2.3.1) Maintain a current storm drain map.
2. (4.2.3.2) Regulatory mechanism prohibiting illicit discharges. (4.2.3.2.1) Regulatory mechanism shall provide legal authority to detect, investigate, eliminate, and enforce illicit discharges.
3. (4.2.3.3) Creation of an IDDE plan that includes:
    a. (4.2.3.3.1) Identification of priority areas
    b. (4.2.3.3.2) Inspections of priority areas using and inspection form.
    c. (4.2.3.3.3) Dry weather screening of all outfalls once during the permit period
    d. (4.2.3.3.4) notification to the director of any discharger that the permitee suspects requires an additional permit.
    e. (4.2.3.3.5) Promote or provide services for Household hazardous waste disposal.
    f. (4.2.3.3.5) IDDE hotline that is publicly listed for reporting of spills with a record of all calls received.
4. (4.2.3.4) Creation of SOPS for:
    a. (4.2.3.4.1) Tracing illicit discharges
    b. (4.2.3.4.2) Characterizing illicit discharges.
    c. (4.2.3.4.3) Ceasing illicit discharges.
    d. (4.2.3.4.4) Spill and improper disposal response
    e. (4.2.3.4.5) Program evaluation
5. (4.2.3.5) Records of illicit discharges shall be kept for a period of five years.
6. (4.2.3.6) Train all staff, contractors, and other personnel who may encounter, report, or observe illicit discharges, with training tailored to their specific job responsibilities. With the following requirements:
    a. (4.2.3.6.1) training is done annually, and new hires are trained within 60 days of hire.
    b. (4.2.3.6.2) Topics include.
        i. Identification and reporting
        ii. Investigation termination, clean-up, and enforcement
        iii. Documentation requirements
    c. (4.2.3.6.3) Training records are retained for director review.

List of High Priority Areas

High-priority areas for Hooper City were identified using the criteria outlined in the High-Priority Area Determination SOP (Appendix C). The factors considered in the selection process are detailed in that procedure. These areas are shown in greater detail on the Stormwater Map, which is available upon request. The identified high-priority areas are listed below:

1. Old Park Area
2. 5500 Commercial/Industrial area

Summary of Existing Efforts

Ordinances

Hooper City has an ordinance designed to specifically prohibit illicit discharges to the storm sewer system.

Illicit Spills

Currently, reports of spills are handled by the city as well as escalating enforcement and coordination of clean up.

Converting from Septic Tanks to a Sewer Collection System

In 2007, the City implemented the initial phases of a community-wide sewage collection system. The system covers approximately 50% of the total land area within the city.
The areas included in the service were high priority areas, determined by population density and potential for pollution. As part of the new sewer collection system, the City has adopted a policy requiring new development to expand the collection system if the development is within 300 feet times the number of lots of the existing sewer. A copy of this policy can be found at City Hall.

Mapping

The city has a comprehensive storm drain map showing the storm drain system and its points of discharge. A copy of this map is included in Appendix G.

Education

Hooper City participates in the Golden Spike Coalition education programs. Various efforts are applicable to different target audiences. Printed materials are also available to city staff to distribute as needed. City newsletters advertise the illicit discharge hotline as well as info on what an illicit discharge is and why it's important to report them.

Training

Hooper City trains all city staff annually on what an illicit discharge is, how to report it, and what documentation is required. City staff that are likely to encounter an illicit discharge are trained on tracing, characterization, documentation, enforcement, and clean up procedures.

Plan and Implementation Measures

To help meet the goals and objectives of this SWMP Hooper City has chosen to adopt the following BMPs for use within our city as applicable. Each BMP is cross referenced alphabetically by code to a fact sheet that describes the BMP, its applicability, its limitations, and its effectiveness in the indicated appendix.

BMP	Code	Appendix
Community Hotline	CH	B,C
Employee Training	ET	B,C
Hazardous Waste Management	HWM	B,C
Illegal Dumping Control	IDC	B,C
Identify Illicit Connections	IIC	B,C
Illegal Solids Dumping Controls	ISDC	B,C
Leaking Sanitary Sewer Control	LSSC	B,C
Non-Storm Water Discharge to Drains	NSWD	B,C
Ordinance Development	OD	B,C
Public Education/ Participation	PEP	B,C
Used Oil Recycling	UOR	B,C

Goals

To more fully realize the benefits of the BMPs the city has set the following goals. The goals set along with the existing efforts fulfill the requirements of the Final Storm Water Phase II Rule for Illicit Discharge Detection and Elimination.

The following table includes the goals for MCM 3.

MCM 3 - Illicit Discharge Detection and Elimination

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
3	All	Public Works	4.2.3.1 – Maintain a current storm water map that includes: •Outfall locations with names and location of all State waters that receive discharge from these outfalls •Storm drain pipe and other structures	Map is updated as new infrastructure is built	Ongoing	NSWD	Have an active updated map available to city staff	Map showing complete storm drain system
3	All	General Public	4.2.3.2 - Effectively prohibit, through ordinance or other regulatory mechanism, non-SW discharges. The IDDE program must have adequate legal authority to detect, investigate, eliminate and enforce against non-SW discharges.	Enforce existing illicit discharge ordinance	Ongoing	OD	Ordinances allow for prohibition of non-storm water discharges and remove roadblocks to detect, investigate, eliminate and enforce spills	Ordinance reference in Appendix E
3	All	General Public	4.2.3.3.1 Written systematic procedures for locating and listing the following priority areas likely to have illicit discharges (if applicable to the jurisdiction)	Use developed procedure to update high priority areas	Annually	IDC	Policy in place, SWMP includes list of high priority areas	list of high priority areas in SWMP
3	All	General Public	4.2.3.3.2 Field inspections of areas which are considered a priority shall be achieved by inspecting each priorityarea annually	Conduct field inspections of high priority areas	Annually	IDC	Inspection reports are completed each year	Annual Inspection reports

MCM 3 - Illicit Discharge Detection and Elimination

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
3	All	General Public	4.2.3.3.3 - Dry weather screening for the purpose of verifying outfall locations and detecting illicit discharges	Complete 20% of dry weather screening annually	Annually	IIC	Dry weather screening is 100% complete when city renews permit	Dry Weather screening inspection reports
3	All	General Public	4.2.3.3.4 - Report suspected unpermitted discharges (dewatering or industrial) to the State	Develop policy for reporting suspected activity	Ongoing	NSWD	Add Reporting to the state suspected discharges to IDDE SOPs	Copy of emails to DEQ about suspected discharges
3	Household Hazardous Waste	General Public	4.2.3.3.5 - Promote or provide services for collection of household hazardous waste	Include household hazardous waste disposal information on website	Ongoing	HWM	Citizens know where to dispose of Household hazardous waste	Website with information on where to dispose of HHW
3	All	General Public	4.2.3.3.6 - Publicly list and publicize a hotline or other telephone number for public reporting of spills and other illicit discharges	Put the hotline phone number on city website	Ongoing	CH	Citizens know who to call to report a spill	Address and Phone number listed on website

MCM 3 - Illicit Discharge Detection and Elimination

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
3	All	City Staff	4.2.3.4.1 - Develop and implement standard operating procedures for tracing the source of illicit discharge, and create an inspection form	Develop Spill response SOPs	Ongoing	IDC	SOPs and inspection templates have been created	Copy of SOPS, and spill reports
3	All	City Staff	4.2.3.4.2 – Implement SOPs for characterizing the nature of any illicit discharges found or reported to the Permittee	Create SOPs for illicit discharge and create inspection report	Ongoing	IDC	SOPs have been created, and inspection report tracks all the required information	Applicable SOPs, and documentation of calls received, and inspections performed for IDDE program
3	All	City Staff	4.2.3.4.3– Implement SOPs for ceasing the illicit discharge. All IDDE investigations must be thoroughly documented and may be requested at any time by the Division.	SOPs developed for ceasing illicit discharge	Ongoing	IDC	SOPs have been created, and documentation procedures are followed	Spill reports have: Inspection report, Incoming call log (if applicable), enforcement actions, and other agency reports

MCM 3 - Illicit Discharge Detection and Elimination

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
3	All	City Staff	4.2.3.4.4 - Develop a written spill and improper disposal SOP including a flow chart for internal use	Create flow charge and SOP	Ongoing	IDC	Flow chart and SOP are created and trained on	SOP and Flowchart
3	All	General Public	4.2.3.4.5 - Adopt and implement procedures for program evaluation and assessment. Include a database for mapping, tracking of the spills or illicit discharges identified and inspections conducted	Create database to map and track spills	Ongoing	IDC	All spills are effectively tracked	Database with spill and inspection history
3	All	City Staff	4.2.3.6 - Receive minimum annual training in the IDDE program. Immediate training for new hires along with follow-up training as needed to address to changes. A summary of such training shall be included in the annual report.	Provide annual and new hire training of the IDDE program	Annually/60 - days of hire	ET	Staff is aware of and knows their responsibility in the IDDE program	Annual Training and new hire training Documents

CONSTRUCTION SITE RUNOFF CONTROL (4.2.4)

Permit Requirements

The permit requirements for Construction Site Runoff Control on Storm Water Impacts can be found in Section 4.2.4 of the permit. The permit outlines in general the following requirements

1. (4.2.4.1) -Permittees shall revise as necessary and enforce an ordinance that requires compliance with the most current UPDES construction permits. Ordinance must include sanctions to ensure compliance.
2. (4.2.4.1.1) Permittees shall require construction operators to prepare and implement a SWPPP compliant with applicable UPDES permits.
3. (4.2.4.1.2) Permittees shall require applicable construction sites to receive coverage under a UPDES permit.
4. (4.2.4.1.3) Permittees shall include a provision for access by a qualified person to inspect construction sites.
5. (4.2.4.2) Permittees shall develop an written enforcement strategy that includes:
    a. (4.2.4.2.1) Construction oversite enforcement SOP.
    b. (4.2.4.2.2) Documentation of all enforcement actions.]
6. (4.2.4.3) Permittees shall develop and implement a pre-construction SWPPP review checklist.
7. Prior to construction a permittee shall;
    a. (4.2.4.3.1) Conduct a pre-construction SWPPP meeting.
    b. (4.2.4.3.2) Develop procedures for receiving and considering comment submitted by the public for proposed projects.
    c. (4.2.4.3.3) Determine whether a site is a high priority construction site.
8. (4.2.4.4) Permittees shall implement an inspection program to ensure compliance with applicable UPDES storm water permits.
9. The program shall include:
    a. (4.2.4.4.1) Construction oversite Inspection SOP
    b. (4.2.4.4.2) Monthly inspections of all new qualifying sites until (4.2.4.4.2.1) adequate compliance history is established unless site is considered high priority which shall be inspected monthly.
    c. (4.2.4.4.4) The other following inspections shall be completed.
        i. Inspection prior to land disturbance
        ii. Annual inspection following active construction.
        iii. Inspection following construction activity.
        iv. Inspections to investigate verified complaints.
    d. (4.2.4.4.4) Permittee shall utilize electronic site inspections. Unless there is a valid documented reason for completing on on-site oversite inspection.
    e. (4.2.4.4.6) Permittee shall take all necessary follow-up actions to ensure compliance.

10. (4.2.4.5) Permittees shall provide training to all staff and contractors whose primary responsibility are related to implementing the construction storm water program as follows:
    a. (4.2.4.5.1) Annually and within 60 days of hire
    b. (4.2.4.5.2) Topics shall include:
        i. Permitting
        ii. Plan review
        iii. Construction site inspections
        iv. Enforcement of construction projects
    c. (4.2.4.5.3) Training records are retained.
11. (4.2.4.6) Records of al qualifying construction sites are kept for a minimum of five years.

Summary of Existing Efforts

City Ordinances

The City currently has an ordinance that requires a storm water construction activity permit for construction activities. The application for this permit requires a completed Notice of Intent filed with the State Department of Environmental Quality and an approved Storm Water Pollution Prevention Plan (SWPPP).

Site Plan Review Process

The City currently has a procedure requiring the submittal of construction drawings prior to approving a new development. This process does not specifically require water quality impacts to be considered.

Inspectors

The City has qualified inspectors making monthly inspections at all construction sites. Adequate compliance will now be assessed and less frequent inspections will occur on qualifying sites.

Training

The City makes sure all staff associated with the construction of projects is trained annually.

Standard Drawings and Specifications

The city has a set of standard drawings and specifications for subdivision site development.

Plan and Implementation Measures

To help meet the goals and objectives of this SWMP Hooper City has chosen to adopt the following BMPs for use within our city as applicable. Unlike some of the other minimum control measures, this is one where the majority of the BMPs listed will be utilized by contractors. Because of this, two lists of BMPs have been prepared; ones to be implemented by the City, the other is simply a list of BMPs that the city will consider approving on construction sites. Specific BMPs will vary for each site depending on the individual circumstances at each site. Each BMP is cross referenced alphabetically by code to a fact sheet that describes the BMP, its applicability,

its limitations, and its effectiveness in the indicated appendix.

City Implemented BMPs

BMP	Code	Appendix
Certification and Inspector Training	CCIT	A,B
Erosion Control Plan	ECP	A,B
Landscape and Irrigation Plan	LIP	A,B
Ordinance Development	OD	A,B
Zoning	ZO	A,B

Goals

To more fully realize the benefit of the BMP the city has set the following goals. The goals set along with the existing efforts fulfill the requirements of the Final Storm Water Phase II Rule for Construction Site Runoff Control.

The following table includes the goals for MCM 4.

MCM 4 - Construction Site Runoff Control

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
4	Sediment, Construction Site Debris, Hydrocarbons	Contractors and Developers	4.2.4.1.1 - The ordinance or other regulatory mechanism shall, at a minimum, require construction operators to prepare a Storm Water Pollution Prevention Plan (SWPPP) and apply sediment and erosion control BMPs as necessary to protect water quality	Require a SWPPP for every site that requires a CPP or CGP	Ongoing		All CGP and CPP construction sites have an approved SWPPP	Signed SWPPP approval checklist for each site
4	Sediment, Construction Site Debris, Hydrocarbons	Contractors and Developers	4.2.4.1.2 - Permittees shall require construction operators to obtain coverage under current UPDES permit and terminate coverage through CDX	Ordinance requiring qualifying construction sites to have UPDES permit	Ongoing		All qualifying construction sites have UPDES permit coverage	Code reference in Appendix E, and up to date netCGP database
4	Sediment, Construction Site Debris, Hydrocarbons	Contractors and Developers	4.2.4.1.3 - The ordinance shall include a provision for access by qualified personnel to inspect construction storm water BMPs	Ordinance gives access to qualified personnel	Ongoing		Qualified personnel has access to construction sites	Code reference in Appendix E

MCM 4 - Construction Site Runoff Control

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
4	Sediment, Construction Site Debris, Hydrocarbons	Contractors and Developers	4.2.4.2 - Develop a written enforcement strategy and implement the enforcement provisions of the ordinance or other regulatory mechanism which shall include:• SOPs• Documentation and tracking of all enforcement actions	Enforce ordinances that include escalating enforcement	Ongoing		Enforcement actions are tracked and closed out	All inspection reports and enforcement actions documented on arcGIS and outlook
4	Sediment, Construction Site Debris, Hydrocarbons	Contractors and Developers	4.2.4.2.1 - Standard Operating Procedures that include specific processes and sanctions to minimize the occurrence of violations and obtain compliance from violators.	Follow state law on enforcement and inspection enforcement actions	Ongoing		Local laws and SOPs agree with State regulation	Codified Ordinances and completed SOPs
4	Sediment, Construction Site Debris, Hydrocarbons	Contractors and Developers	4.2.4.2.2 - Documentation and tracking of all enforcement actions	Use arcGIS to document inspections and enforcement	Ongoing		All Inspection and enforcement events are documented	History of inspection and enforcement actions

MCM 4 - Construction Site Runoff Control

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
4	Sediment, Construction Site Debris, Hydrocarbons	Contractors and Developers	4.2.4.3.1 - Conduct a pre-construction SWPPP meeting	Hold Pre-con meetings with water quality on the agenda	Ongoing		All pre-con meetings have water quality issues discussed following	Agendas for each site showing water quality was discussed
4	Sediment, Construction Site Debris, Hydrocarbons	General Public	4.2.4.3.2 Develop Procedures for receiving and considering information and comments submitted by the public on proposed projects	Follow public notice procedures for new developments	Ongoing		New developments have opportunities for public comment	City Council meeting minutes with new developments on the agenda
4	Sediment, Construction Site Debris, Hydrocarbons	Contractors and Developers	4.2.4.3.3 - Identify priority construction sites	Create high priority criteria to include in pre construction SWPPP review	Jul-26		All CGP and CPP sites are evaluated for being high priority or not	SWPPP preconstruction review checklist shows high priority was evaluated

MCM 4 - Construction Site Runoff Control

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
4	Sediment, Construction Site Debris, Hydrocarbons	Contractors and Developers	4.2.4.4 Inspections of all new construction sites until adequately compliant and then annually.	Construction sites are inspected until they are compliant then annually	Ongoing		Inspection of construction sites is being completed and documented and SOPs for process followed	arcGIS database showing inspection history
4	Sediment, Construction Site Debris, Hydrocarbons	Contractors and Developers	4.2.4.4.3 - Conduct monthly inspections on high priority construction sites	High priority sites are inspected at a higher frequency	Monthly		High priority sites are inspected monthly	Inspection history of high priority sites on arcGIS database
4	Sediment, Construction Site Debris, Hydrocarbons	Contractors and Developers	4.2.4.4.4 - all phases of construction shall be inspected by the permitee	inspections will be completed 1) Before land disturbance 2) annually 3) NOT inspections 4) Complaint inspections	Ongoing		Construction Sites are inspected during all phases of construction	arcGIS database showing inspection history
4	Sediment, Construction Site Debris, Hydrocarbons	Contractors and Developers	4.2.4.4.5 - Permitee will utilize electronic site inspections	Operators will be informed of City's electronic site inspection policy	Ongoing		All operators are aware and following electronic site inspection procedure	arcGIS database showing inspection history or file server with opt-out forms

MCM 4 - Construction Site Runoff Control

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
4	Sediment, Construction Site Debris, Hydrocarbons	Contractors and Developers	4.2.4.4.6 Based on site inspection findings, the Permittee must take all necessary follow-up actions (i.e., re- inspection, enforcement) to ensure compliance in accordance with the Permittee's enforcement strategy. These follow-up and enforcement actions must be tracked and documented.	Track all follow-up and enforcement actions	Ongoing		All follow-up and enforcement actions are documented	follow-up inspections in arcGIS database, Enforcement actions in outlook
4	Sediment, Construction Site Debris, Hydrocarbons	MS4 staff	4.2.4.5 - Provide training to city staff and 3rd party designers	Inspectors are trained prior to inspecting sites	Ongoing		All city inspectors are qualified to inspect construction sites	list of qualifications for each stormwater inspector

LONG TERM STORM WATER MANAGEMENT (4.2.5)

Permit Requirements

The permit requirements for Long-Term Storm Water Management in New Development and Redevelopment can be found in Section 4.2.5 of the permit. The permit outlines in general the following requirements:

1. (4.2.5.1) Permittees new development/redevelopment program shall have requirements or standards to ensure that any storm water controls or management practices will prevent or minimize impacts to water quality.
2. (4.2.5.1.1) Permittee's new development/redevelopment program shall include non-structural BMPs.
3. (4.2.5.1.2) Permittees shall develop and define a specific hydrologic method for calculating runoff volumes and flow rates for consistent sizing of stormwater controls.
4. (4.2.5.1.3) Permittee's new development/redevelopment program shall include a process which requires evaluation of a LID approach.
5. (4.2.5.1.4) Permittee's new development/redevelopment program shall include a process to evaluate a site's feasibility to implement LID controls.
6. (4.2.5.2) Permittees shall develop and adopt a regulatory mechanism that requires long-term-post-construction storm water controls for qualifying construction sites. Regulatory mechanism must include the following:
    a. Storm water control selection, design, installation, operation, and maintenance standards.
    b. (4.2.5.2.1) enforcement provisions which include sanctions to minimize occurrences of violations
    c. (4.2.5.2.2) access to inspect post-construction-storm-water-controls
    d. (4.2.5.2.3) Maintenance agreements for post-construction-stormwater-controls which are privately owned with provisions for inspections and enforcement.
    e. (4.2.5.2.4) Documentation on how the requirements of the ordinance will protect water quality and reduce discharge of pollutants. Documentation shall include.
        i. How long-term controls were selected.
        ii. Pollutant removal performance expected from selected controls.
        iii. Technical basis that supports the performance claims for selected controls.
7. (4.2.5.3) Permittee shall have a plan review process that:
    a. Has an adopted SOP for site plan review to evaluate potential water quality impacts.
    b. Reviews post-construction plans for all qualifying new development and redevelopment sites to ensure they include long-term storm water management measures
8. (4.2.5.4) Permittee shall adopt and implement SOPs for site inspection and enforcement of post-construction stormwater control measures with the following requirements:

a. (4.2.5.4.1) permanent structural storm water controls are inspected once during construction and once after completion by a qualified person to ensure they were constructed as designed.
b. (4.2.5.4.2) Inspections of permanent structural controls is done at a minimum every other year, and maintenance is done according to those inspection reports. For controls that are privately owned they must be inspected at a minimum every five years.
c. (4.2.5.5) Permittees shall maintain a current inventory of all post-construction structural storm water controls.

9. (4.2.5.6) Permittees shall provide training to all staff and MS4 contractors as follows:
   a. (4.2.5.6.1) Annually and within 60 day of hire/contract date
   b. (4.2.5.6.2) Topics shall include:
      i. Fundamentals of long-term stormwater management
      ii. Plan review
      iii. Inspections
      iv. Enforcement
      v. LID and green infrastructure practices
      vi. Specific requirements for post-construction control
   c. (4.2.5.6.3) Permittees shall keep and maintain training records

Summary of Existing Efforts

Ordinances

The City is updating its ordinance to require onsite retention as per the UPDES permit requirements.

Low Impact Development Practices

Historically, Hooper City has been known as a rural farming community. There is a strong desire to maintain that identity. As such, the City has discouraged development on small lot sizes. There are State statutes that require “affordable housing”. These statutes have required that the City allow for a certain percentage of smaller lot sizes. Outside of these requirements the City has tried to limit a majority of individual building lot sizes to 0.5 acres or more. Larger lot sizes decrease the percentage of the lot that is impermeable, allowing for more infiltration and on-site retention of storm water.

The city has adopted LID practices that are compatible with the character of the city and may not be some of the more popular practices implemented in more urban areas.

The City has implemented a new LID Handbook to assist the development community in evaluating LID alternatives and selecting and sizing appropriate BMPs.

LID feasibility in Hooper is going to be limited. The average water table in Hooper is probably no more than 2 to 3 feet below the existing ground surface. Historically, conventional septic tank and drain fields have not been very successful. Detention basins typically are limited in depth because ground water fills them if they are too deep. The City's LID Handbook details standards that need to be met for infiltration to be feasible. This new manual will be the foundation of the new LID program.

Post Construction BMPs

When LID practices are not feasible, development will be required to install BMPs that will filter or otherwise help clean the storm water before discharging it. Each of these new facilities is inspected annually, with the City conducting oversite inspections at least once every five years.

Landscaping Plans

Developers are required to outline a landscaping plan of the proposed development to the City as part of the development review process.

Plan and Implementation Measures

To help meet the goals and objectives of this SWMP Hooper City has chosen to adopt the following BMPs for use within our city as applicable. Each BMP is cross referenced alphabetically by code to a fact sheet that describes the BMP, its applicability, its limitations, and its effectiveness in the indicated appendix.

Development Site Possible Post Construction BMPs

BMP	Code	Appendix
BMP Inspection and Maintenance	BMPIM	A,B
Educational Materials	EM	A,B
Infrastructure Planning	IPL	A,B
Landscape and Irrigation Plan	LIP	A,B
Land Use Planning / Management	LUPM	A,B
Zoning	ZO	A,B
Grassed Swales	GS	A,B
Open Space Design	OSD	A,B
Ordinance Development	OD	A,B
Biofilters	BF	
Conservation Easements	CE	

Minimizing Directly Connected Impervious Areas	DCIA	
Filter Strips	FS	
Floatable Skimmers	FS	
Infiltration	IN	
Seeding and Planting	SP	

Goals

To more fully realize the benefit of the BMP the City has set the following goals. The goals set along with the existing efforts fulfill the requirements of the Final Storm Water Phase II Rule for Post Construction Runoff Control.

The following table includes the goals for MCM 5.

MCM 5 - Post Construction Runoff Control

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
5	All	Developers	4.2.5.1 Permittees new development and redevelopment program will have requirements or standards to ensure storm water controls will prevent or minimize impacts to water quality.	Include in review process a water quality review	Ongoing	OD	New LTSWM address water quality in development and redevelopment projects	Forms filled out by developer
5	all	Developers	4.2.5.1.1 - Permitee shall consider non-structural BMPs in development and redevelopment program	LID handbook provided to developers that has non-structural controls listed	Ongoing		Contractors have resource to consider non-structural BMPs in their design	Packet sent out to contractors
5	all	Developers	4.2.5.1.2 - Permitees shall define a model to calculate runoff volumes and flow-rates to ensure consistent sizing	Include in review process a runoff volume review	Ongoing		New LTSWM address runoff volume in new development and re-developments sites	Forms filled out by developer
5	all	Developers/MS4 staff	4.2.5.1.3/4.2.5.1.4 - Permitee shall include a process to evaluate LID approach for all projects and documentation on whether LID is feasible or not	Require Developers to evaluate LID approaches to each project. City will have parameters for feasibility	Ongoing		New projects are considering LID approaches to their project	Forms filled out by developer and LID review in review checklist

MCM 5 - Post Construction Runoff Control

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
5	all	LTSWM facility Owners	4.2.5.2-Permitee will have a regulatory mechanism that requires post-construction stormwater controls at new-development and redevelopment sites that protect water quality. Ordinance will include enforcement authority, access, and maintenance agreements	Ordinance passed that includes water quality	Nov-26	OD	Ordinances in place to protect water quality	Code refrence in Appendix E
5	all	LTSWM facility Owners	4.2.5.2.3 Require private property owner/operators or qualified third parties to conduct maintenance and provide annual certification that adequate maintenance has bee performed on long term water quality facilities	Require a maintenance agreement on all privately owned LTSWM facility	Annually		All privately LTSWM facilities have a maintenance agreement in place	Maintenance agreement on all privately owned LTSWM facilities
5	all	MS4 Staff	4.2.5.4.1 - Permanent structural BMPs shall be inspected at least once during installation by qualified personnel.	Inspect all LTSWM facilities once during construction and once during NOT inspection	Ongoing		All LTSWM facilities are inspected during construction and during NOT inspection	Inspection forms filled out for each LTSWM facility

MCM 5 - Post Construction Runoff Control

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
5	all	MS4 Staff	4.2.5.4.2 Inspections and any necessary maintenance must be conducted at least every other year or as necessary to maintain functionality of the control by the Permittee, or, if applicable, the propertyowner/operator.	Inspect all LTSWM facilities every other year	Ongoing		LTSWM facilities are inspected and maintained a minimum of every other year	Inspection and maintenance report history
5	all	MS4 staff, contractors and developers	4.2.5.3 Adopt and implement procedures for site plan review which evaluate water quality impacts. The procedures shall apply through the life of the project from conceptual design to project closeout.	Discuss water quality impacts during site plan review	Ongoing		Developers consider water quality in their projects	Comments on plans discussing water quality
5	All	MS4 staff, contractors and developers	4.2.5.3.2 Review post-construction plans for, at a minimum, all new development and redevelopment sites to ensure that the plans include long- term storm water management measures that meet the requirements of this minimum control measure.	Add LTSWM retention requirements to review checklist	Ongoing		Storm water in new development and redevelopment sites is retaining water up to the 80th percentile storm	Review checklists with this requirement

MCM 5 - Post Construction Runoff Control

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
5	All	MS4 staff	4.2.5.4 Permittee shall adopt and implement SOPs for site inspection and enforcement of post-construction stormwater control measures. SOPs will include control verification inspections and maintenance inspections	SOPs developed for inspections and inspections complete	Ongoing		LTSWM facilities are inspected when they are installed as well as every other year	arcGIS stormwater inspections map showing inspection history
5	All	MS4 staff	4.2.5.5 The Permittee must maintain an inventory of all post-construction structural storm water control measures installed and implemented at new development and redevelopment sites. This inventory must include both public and private sector sites that were developed since the Permittee obtained coverage by this permit or the date that post construction requirements came into effect.	Update inventory of LTSWM facilities when other storm infrastructure is mapped	Ongoing		New LTSWM facilities are added to the arcGIS stormwater map	arcGIS stormwater map showing LTSWM facilities
5	All	MS4 staff	4.2.5.6. Permittees shall provide adequate training for all staff involved in post-construction storm water management, planning and review, and inspections and enforcement.	Annual and new hire training is complete for LTSWM	Annually and within 60 days of hire		All relevant personnel are trained	Annual Training and New hire documents
5	All	Plan Review Staff	4.2.5.6. Permittees shall provide adequate training for all staff involved in Low Impact Development and Green infrastructure	Annual and new hire training is complete for LID and Green infrastructure	Annually and within 60 days of hire		All relevant personnel are trained	Annual training and new hire documents

POLLUTION PREVENTION / GOOD HOUSEKEEPING (4.2.6)

Permit Requirements

The permit requirements for Pollution Prevention and Good Housekeeping on Storm Water Impacts can be found in Section 4.2.6 of the permit. The permit outlines in general the following requirements:

1. (4.2.6.1) Permittees shall develop and keep a written Inventory of potential high priority areas that:
    a. (4.2.6.2) Permitees shall list common pollutants from facilities and how they are prevented from entering the storm drain.
    b. (4.2.6.3) Permitees shall keep and maintain a list of high priority facilities.
    c. (4.2.6.3.1) (4.2.6.3.2) Permitees shall develop SWPPPs of high priority facilities that include BMPs to target specific pollutants on site.
2. (4.2.6.4.1) (4.2.6.4.2) (4.2.6.4.3) Permitees shall conduct Monthly, Semi-Annual, and Annual inspections of high priority facilities.
3. (4.2.6.5) Permitees shall develop and maintain SOPs to protect water quality from activities done by permitee. A list of required SOPs can be found in the permit.
4. (4.2.6.6) Permitees shall keep and maintain an inventory of floor drains in permitee operated facilities.
5. (4.2.6.5.6) Permitees shall develop a spill prevention plan in coordination with local fire department.
6. (4.2.6.7) Permitees shall have oversite over O&M contractors to ensure through contract or inspection that they are using appropriate storm water controls and following proper procedures as determined by the permitee.
7. (4.2.6.8) Permitee shall assess New and existing flood management controls for water quality impacts.
8. (4.2.6.9) Permitee shall develop a Retrofit plan to improve water quality in existing storm drain infrastructure.
10. (4.2.6.10) Permittees shall provide training to all staff and MS4 contractors as follows:
    a. (4.2.6.10.1) Annually and within 60 days of hire
    b. (4.2.6.10.2) Consider the following topics at a minimum.
        i. The importance of protecting water quality
        ii. Permit requirement 4.2.6
        iii. Inspection and follow-up procedures
        iv. Ways to prevent or minimize impacts to water quality by how they perform their job.
        v. SWPPPs for high priority sites
        vi. Prohibition of illicit discharges and improper disposal of waste
        vii. Water quality concern reporting for illicit discharge.
11. (4.2.6.10.3) Permitees shall keep and maintain annual and new hire training records.

Summary of Existing Efforts

Existing Maintenance Program

The City currently maintains inlet boxes, pipes, and other MS4 improvements on an as- needed basis.

Inventory of City Owned Facilities

The City maintains a list of all city owned facilities and has identified 'high priority' facilities. The Public Works yard has no discharge to the storm drain collection system and has not been listed as 'high priority'.

High Priority City Owned Facilities

The City Cemetery and Public Works Facility are the highest priority city owned facilities. A detailed assessment of all city facilities can be found in ArcGIS in SW_CityFacilites map which is available upon request. SWPPPs have been prepared for both of these facilities and they are inspected regularly.

Public Works Facility

- Vehicle Maintenance
- Salt Storage
- Stockpile Storage

Cemetery Garages

- Soil Stockpile from grave excavation

SOPs

The City has developed SOPs for many routine activities. They can be found in Appendix D

Employee Training

The City conducts Annual training of staff concerning pollution prevention and good housekeeping SOPs, and provides Training for new hires within 60 days. All SOPs concerning Pollution Prevention will be covered over the course of a permit, with illicit discharge training happening annually

New Flood Management Water Quality Considerations

Any new flood management control structures will be evaluated for their water quality impact and any flood control structures that meet the following criteria will have water quality controls considered. As part of the design process.

- Drains to an impaired water body
- Proximity to a sensitive eco system such as wetlands
- Drains to a water body that is in primary contact with humans
- Watershed of flood control structure is in a high priority area as determined by Hooper Cities high priority map

If one of these criteria is met the appropriate control will be selected and installed based on the pollutant of concern whether that is determined by the receiving water body or pollutants of

concern in the watershed of the flood control structure.

Plan and Implementation Measures

To help meet the goals and objectives of this SWMP Hooper City has chosen to adopt the following BMPs for use within our city as applicable. Each BMP is cross referenced alphabetically by code to a fact sheet that describes the BMP, its applicability, its limitations, and its effectiveness in the indicated appendix.

BMP	Code	Appendix
Catch Basin Cleaning	CBC	A,B
Housekeeping Practices	HP	A,B
Infrastructure Planning	IPL	A,B
Septic System Controls	SSC	A,B
Storm Drain System Cleaning	SDF	A,B
Employee Training	ET	A,B

Goals

To more fully realize the benefit of the BMP the city has set the following goals. The goals set along with the existing efforts fulfill the requirements of the Final Storm Water Phase II Rule for Pollution Prevention/Good Housekeeping.

The following table includes the goals for MCM 6.

MCM 6 - Pollution Prevention Good Housekeeping

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
6	All Pollutants	MS4 staff	4.2.6.1 The Permitee shall develop and keep current a written inventory of all potential "high priority" facilities that are owned or operated by the Permittee	Create Criteria for High priority facilities and evaluate new facilities as they are built	Ongoing		Facilities that meet created criteria are designated as high priority	Map of city facilities with evaluation criteria which includes if it is high priority or not
6	All Pollutants	MS4 Staff	4.2.6.1 The permittee shall update the SWMP to include a list of "high priority" facilities and prepare a SWPPP for each facility.	Create a high priority list when applicable	Ongoing		Facilities are added to a high priority list	List of high priority facilities added to SWMP
6	All Pollutants	MS4 Staff	4.2.6.1 … prepare a Storm Water Pollution Prevention Plan (SWPPP) for each "high priority" facility	Create a SWPPP for any facility evaluated as high priority	Ongoing		Facilities on high priority list have a SWPPP created	SWPPPs attached to high priority site on arcGIS
6	All Pollutants	MS4 Staff	4.2.645.1 Monthly visual inspections: The Permittee must perform weekly visual inspections of "high priority" facilities in accordance with the developed SOPs to minimize the potential for pollutant discharge.	Conduct Monthly inspections	Monthly		Monthly inspections are performed and follow up actions taken	Inspection reports on arcGIS

MCM 6 - Pollution Prevention Good Housekeeping

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
6	All Pollutants	MS4 Staff	4.2.6.4.2 Semi-annual comprehensive inspections: At least once every six months, a comprehensive inspection of "high priority" facilities, including all storm water controls, must be performed	Conduct semi-annual inspections	Semi-annually		Semi-annual inspections are performed, and follow-up actions are taken	Inspection reports on arcGIS
6	All Pollutants	MS4 Staff	4.2.6.4.3 Annual visual observation of storm water discharges: At least once a year, the Permittee must visually observe the quality of the storm water discharges from the "high priority" facilities	Conduct annual inspections	Annually		Annual inspections are performed, and follow-up actions taken	Inspection reports on arcGIS
6	All Pollutants	MS4 Staff	4.2.6.5. Permittees shall develop and implement SOPs to protect water quality at each of the facilities owned or operated by the Permittee and/or activities conducted by the permittee	Develop SOPs for city activities	May-31		SOPs are developed for any city activity that may pollute water ways	SOPs for different activities
6	All Pollutants	MS4 Staff	4.2.6.5.6 The Permittee shall develop a spill prevention plan in coordination with the local fire department	Prepare a spill response plan with fire department	Jul-27		Fire department has received copy of spill response plan	Email sent to fire department of spill response plan

MCM 6 - Pollution Prevention Good Housekeeping

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
6	All Pollutants	MS4 Staff	4.2.6.6 All Permittees must maintain an inventory of all floor drains inside all Permittee-owned or operated buildings.	When buildings are constructed add floor drains to an inventory	Ongoing		Written inventory of floor drains	Spreadsheet of floor drains in the city
6	All Pollutants	MS4 Staff	4.2.6.7 The Permittee shall be responsible for ensuring, through contractually required documentation and/or periodic site visits that contractors performing Operation and Maintenance activities for the Permittee are using appropriate storm water controls	Contracts with third parties will include water quality requirements	Ongoing		Standard Contract has water quality requirements added to it	Standard contracts with each O&M operator
6	All Pollutants	MS4 Staff, Contractors and Developers	4.2.6.8. The Permittee must develop and implement a process to assess the water quality impacts in the design of all new flood management structural controls that are associated with the Permittee or that discharge to the MS4.	Draft a policy/process to assess water quality impacts on all new flood control projects	Ongoing		Water Quality assessment SOP for new flood control projects	SOP for water quality assessment

MCM 6 - Pollution Prevention
Good Housekeeping

MCM	Target		Permit requirement Fulfilled	Measurable Goal	Milestone date	Assoc BMPs	Measure of Success	Documentation
	Pollutant(s)	Audience						
6	All Pollutants	MS4 Staff, Contractors and Developers	4.2.6.8. The Permittee must develop and implement a process to assess the water quality impacts in the design of all new flood management structural controls that are associated with the Permittee or that discharge to the MS4.	Enforce policy	Ongoing		If policy is approved	Approved Policy
6	All Pollutants	MS4 Staff	4.2.6.8.1 Existing flood management structural controls must be assessed to determine whether changes or additions should be made to improve water quality.	If flood controls are mapped that the city operates evaluate them for impact to water quality	May-31		If flood controls are found, they are evaluated for water quality impacts	SOP for water quality assessment
6	All Pollutants	MS4 Staff	4.2.6.9 The Permittee must develop a plan to retrofit existing developed sites that the Permittee owns or operates that are adversely impacting water quality.	Include retrofit plan into storm drain master plan	Jul-29		Retrofit is included in Storm drain master plan	Storm Drain Master Plan with Retrofit plan section
6	All Pollutants	MS4 Staff	4.2.6.10. Permittees shall provide training for all employees who have primary construction, operation, or maintenance job functions that are likely to impact storm water quality.	Annual and new hire training is complete for MCM 6	Annually		All relevant personnel are trained	Annual Training and New hire documents

APPENDIX A – SUPPLEMENTAL GUIDE FOR CONTRACTORS AND DEVELOPERS

Preferred List of Stormwater Best Management Practices (BMP) for Construction Activities in Utah

Prepared to Support Compliance with:

Utah Construction General Permit (CGP)

Utah Common Plan Permit (CPP)

Utah Code § 19-5-108.3 (Amended by SB220)

40 CFR Part 450 – Effluent Limitations Guidelines for Construction and Development

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Construction Storm Water Permit (UPDES) - Utah Department of Environmental Quality

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1. Introduction

Construction activities can significantly impact water quality if not properly managed. Soil disturbance, materials storage, and heavy equipment use all pose risks of sediment and pollutants washing into Utah's rivers and lakes during storm events. Best Management Practices (BMPs) are the front-line tools to control these impacts. This manual provides guidance on selecting, installing, and maintaining effective BMPs on construction sites in Utah. It is written for contractors, municipal inspectors, engineers, Storm Water Pollution Prevention Plan (SWPPP) developers, and anyone with a role in keeping sediment and contaminants out of stormwater. By following this manual, project teams will better protect water quality and comply with stormwater regulations in a practical and effective way.

2. Purpose

This BMP manual is designed to help users meet Utah's stormwater requirements and implement industry best practices on construction sites. The guidance provided in this manual supports compliance with Utah's construction stormwater permits and aligns with the intent of Utah Code § 19-5-108.3 by detailing the proper use of BMPs to prevent pollution. According to Utah Code § 19-5-108.3, each municipal system authority is responsible for determining and publishing its preferred BMPs on a publicly accessible website. This manual serves as a comprehensive resource, explaining how to effectively implement these BMPs to meet regulatory requirements and protect water quality on construction sites with State and Municipal Separate Storm Sewer (MS4) authority oversight. Overall, the manual's goal is to improve water-quality outcomes by helping users choose the right BMPs, install and maintain them correctly, and thus meet the performance criteria expected by regulators.

3. Regulatory Overview

Construction sites that disturb one acre or more (or less than one acre of land but will be part of a common plan of development or sale that will ultimately disturb one or more acre of land) require stormwater discharge permit under the Clean Water Act. In Utah, this takes the form of a state-issued UPDES Construction General Permit (CGP) or the Common Plan Permit (CPP), which is issued under Utah Code Title 19, Chapter 5 with EPA oversight. Federal regulations set baseline effluent limitation guidelines for construction activities in 40 CFR Part 450, which outline required BMP-based controls known as *Construction and Development Effluent Guidelines*.

Regulations mandate that operators at permitted sites implement controls to minimize erosion and sediment runoff, stabilize disturbed soils promptly, manage dewatering and wash water, and prevent exposure of pollutants or debris to stormwater. Federal rules require effective erosion and sediment controls to be designed, installed, and maintained to minimize pollutant discharges. They also require contractors to implement pollution prevention measures for equipment washing and material storage, and prohibit the discharge of concrete washout, fuels, oils, or other toxic substances. All federal requirements are built into Utah's permits and expectations for BMPs on construction sites.

Utah has adopted state-specific provisions to ensure compliance with these federal standards and to streamline enforcement. Utah Code §19-5-108.3 (2025) amended the Utah Water Quality Act to streamline and unify the implementation of construction stormwater controls. This legislation explicitly defines a "best management practice" as any method or measure that complies with *40 C.F.R. Part 450*. In other words, Utah law aligns its BMP definition and expectations directly with the federal effluent guidelines. This preferred list of BMPs for construction sites ensures that contractors have clear guidance on which BMPs are considered effective and acceptable.

Utah's construction storm water permits (CGP/CPP) further implement these rules by requiring owners/operators of construction projects to develop a SWPPP that incorporates appropriate BMPs and meet specific effluent limitations and inspection routines. The CGP/CPP applies from the commencement of earth-disturbance until final stabilization of the site. Permits mandate regular self-inspections, maintenance of BMPs, and record-keeping to demonstrate that selected BMPs are effectively controlling stormwater pollution. As of May 7, 2025, Utah Code §19-5-108.3, requires oversight authorities to complete oversight inspections via Electronic Site Inspection (ESI). The ESI consists of geo-located, time-stamped photos of on-site BMPs which are taken, evaluated, and sent to the authority by the operator as proof of compliance. Together, the federal and state regulations set the framework that this manual supports: establishing why BMPs are needed, which BMPs are recommended, and how those must be implemented and monitored to stay in compliance.

4. Stormwater Pollution Prevention

BMPs are the core tools used in a SWPPP to prevent polluted runoff from leaving a construction site. When implemented properly, BMPs address the main ways construction can impact water quality: erosion control BMPs keep soil in place, sediment control BMPs capture mobilized sediments, and pollution prevention BMPs prevent spills, trash, and chemicals from entering stormwater. Utah's stormwater approach emphasizes proactive, year-round pollution control. BMPs must be installed before storm events, maintained consistently, and remain in place outside the traditional "rainy season," as both rain and snowmelt can generate runoff throughout the year. In many cases, BMPs are most effective when used in combination. For instance, hydromulch alone may not prevent erosion on large slopes, but when paired with wattles or silt fences at the base, overall control improves. By selecting and maintaining a designed series of BMPs, operators can reduce the risk of stormwater violations and help protect Utah's water quality.

5. BMP Selection, Installation, and Compliance

Choosing the right BMPs, and installing them correctly, is crucial for both effective pollution prevention and legal compliance. The Utah construction storm water permits require that BMPs be selected based on site-specific conditions and that they achieve the permit's performance standards. In practice, the operator is responsible for selecting effective, site-specific BMPs for erosion control, sediment control, and pollution prevention, considering the site's unique conditions throughout all phases of construction. A "qualified person," as defined in the permit, should assess the site and help choose BMPs that will work for that terrain, soil type, slope, proximity to waterways, and the planned construction activities. Factors like steep grades, highly

erodible soils, or sensitive nearby waters, will influence which BMPs are appropriate.

Proper installation according to the specifications in this manual (and manufacturer guidelines for proprietary products) is essential. BMPs that are installed poorly or used in the wrong context/setting can fail, leading to polluted runoff leaving the site. BMPs that do not meet their performance criteria can result in notices of violation and potential enforcement actions by the regulatory authority. The enforcement framework is outlined in Utah Code 19-5-108.3. If a site is found out of compliance, the oversight authority will issue a written notice of violation and require the operator to fix the problem within a specified timeframe. Failure to correct issues can lead to escalating responses, including fines. Utah Code (19-5-108.3) allows fines up to $500 per violation (occurrence), for each day that BMP requirements are not met (after 3 written warnings of non-compliance).

Utah Code 19-5-108.3 provides an incentive for proper BMP selection and implementation: an authority generally may not issue a stop-work order solely for a runoff violation if the operator had correctly implemented the jurisdiction's "preferred" BMPs for the site and the problem resulted from an unexpected BMP failure. This underscores the importance of following the recommended BMP standards in this manual, particularly maintenance standards to stay compliant. This manual offers standard details and criteria for each BMP to ensure that when installed as described, they will perform effectively and meet the required standards. Always verify that the BMPs chosen match the site's needs and regulatory expectations; when in doubt, consult with the permitting authority or a qualified stormwater professional.

6. Responsibilities of Site Operators, Designers, and Inspectors

Effective stormwater management during construction is a shared responsibility. Different parties have distinct roles to play in implementing and overseeing BMPs:

- **Site Operators (Contractors/Permittees):** The on-site operator (which can be the general contractor and/or owner) has the primary responsibility for executing the SWPPP. This includes installing all required BMPs, conducting routine site inspections, and maintaining BMPs in good working order throughout the project. Under the Utah CGP/CPP, operators must inspect their stormwater controls at regular intervals and keep records of these inspections.

- **SWPPP Designers/Engineers:** Long before construction begins, the project designer or SWPPP developer is responsible for planning appropriate BMPs. They must understand the project scope and site conditions to propose a suite of BMPs in the SWPPP that will meet regulatory requirements. Designers should use this manual during project planning to select BMPs that are from the State's preferred list and suited to the site. They should ensure the construction drawings or SWPPP documentation clearly show where and how each BMP will be implemented. Good design also means accounting for the sequencing of BMP installation and including provisions for maintenance.

Collaboration between the designer and contractor is encouraged; if site conditions change, the SWPPP should be updated with new BMPs or modifications as needed, using the templates provided for alternative BMPs, if necessary (See Part 11). Ultimately, a well-prepared SWPPP and BMP plan make it easier for the operator to do their job and for inspectors to verify compliance.

- **Oversight Authority:** Local MS4 inspectors and Division of Water Quality inspectors provide oversight to ensure that BMPs are implemented as required. Their responsibility is to conduct oversight inspections of construction sites to assess compliance with the CGP and local stormwater ordinances. Inspectors will compare site conditions against the SWPPP and this BMP manual's standards. If violations are observed (such as missing BMPs, improperly maintained controls, or evidence of polluted runoff), regulatory inspectors are empowered by Utah Code to take enforcement actions. Typically, an inspector will issue a written notice detailing the specific violation and requiring corrective action within a set time frame. Inspectors may follow up to verify that problems are fixed, and if not, additional steps can be taken, including warnings of fines or stop-work orders in severe cases. The ultimate responsibility of inspectors is to ensure protection of water quality and that all parties adhere to permit requirements. They also serve as a resource; many inspectors will provide guidance or references (such as this manual) to help the operator correct violations.

7. Using this Manual Throughout the Project Lifecycle

- **During project design and planning:**
  Use this manual to identify which BMPs will effectively manage stormwater on site. Planners and engineers should reference the recommended practices here when writing the SWPPP and drawing erosion control plans, ensuring that chosen BMPs meet Utah's preferred criteria.

- **Before construction starts:**
  Review the installation guidelines for each BMP you will deploy. For example, if silt fence is the chosen perimeter control, consult the manual for the correct trenching depth, stake spacing, and maintenance triggers. Contractor training can be conducted using the illustrations and instructions in this manual.

- **During active construction**:
  The manual should be on hand to troubleshoot and adapt. Site conditions often change, you might encounter unexpected drainage patterns or soil conditions, and the manual can guide you in modifying BMPs or selecting additional measures (see template for adding alternative BMPs not originally in the plan). After major weather events or as different subcontractors come and go, consult the manual to ensure BMPs remain effective. The manual's alignment with regulatory requirements means it can also be used as a reference during inspections; if a question arises about what a proper installation entails, this document provides a common point of understanding for both operators and inspectors.

- **At project completion**:

  The manual can guide final stabilization steps (like criteria for seeding and mulching) to ensure permit termination requirements are met.

Consistently referring to the manual helps maintain compliance momentum throughout the project lifecycle, rather than treating stormwater control as a one-time task, it becomes an integrated process. By using the manual proactively, project teams can catch and fix issues early (often preventing formal violations) and ensure that the construction site has minimal environmental impact.

8. Erosion Controls

8.1. BMP 1: Erosion Control Blankets

Purpose & Applicability

Erosion control blankets are used to reduce the impact of rainfall, hold soil in place, and absorb moisture near the soil surface. It is designed to protect disturbed areas during the establishment of vegetative cover and may be used alone or in conjunction with mulch.

- **Appropriate Applications:**
    - Steep slopes (generally steeper than 1:3 vertical to horizontal).
    - Newly vegetated slopes or areas with high erosion potential.
    - Disturbed soils where mulch must be anchored and where plants are slow to develop.
    - Channels with flows exceeding 3 to 7 ft/sec, stockpiles, and slopes adjacent to water bodies.
- **Limitations:**
    - Matting and blankets (e.g., jute, straw, excelsior, glass fiber) have maximum flow rate limitations - consult manufacturer specifications.
    - Blankets and mats are generally more expensive and may not be suitable for excessively rocky sites or areas where final vegetation will be mowed (staples/netting may catch on mowers).
    - Plastic sheeting is vulnerable to vandalism, tearing, photodegradation, and produces 100% runoff; its use should be limited to temporary applications (e.g., covering stockpiles) until seeding and mulching are established.

Installation & Use Procedures

To ensure effective erosion control and facilitate vegetation establishment, follow these steps (See figures 1 and 2):

- **Site Preparation:**
    - After the site has been shaped and graded per approved design, prepare a friable seed bed free of clods, rocks greater than 1.5 inches, and other debris that could inhibit direct contact between the matting and the soil.
- **Planting & Application:**
    - Fertilize and seed according to the approved planting plan.
    - When using jute matting on seeded areas, apply approximately half the seed before laying the mat and the remainder after; matting may also be laid over sprigged areas once grass is planted.
    - For areas where vines or ground covers will be planted, install the matting first and then plant through the mat.
- **Laying and Securing the Matting:**

    - Unroll the matting starting at the upper end of the slope or channel, ensuring a minimum 4-inch overlap.
    - Bury the top edge of the matting in a narrow trench at least 6 inches deep, backfill, and tamp firmly to conform to the cross-section.
    - Secure the matting with staples (minimum 6 inches in length, 1 inch wide, using Number 11-gauge wire or equivalent) placed approximately 12 inches down-slope from the trench.
    - Where matting segments overlap (including at erosion stops), use a double row of staples (staggered pattern) with a minimum 3-foot overlap at ends and a 4-inch overlap at the sides.
- **Final Check:**
    - Verify that the matting is uniformly in contact with the soil.
    - Ensure all lap joints are secure, and all staples are flush with the ground.
    - Confirm that all disturbed areas have been seeded.
- **Recommended Types:**
    - **Jute Mat:** Uniform plain weave of undyed, unbleached jute yarn.
    - **Straw Mat:** Composed of ~70% agricultural straw and 30% coconut fiber, with polypropylene netting overlays.
    - **Excelsior Mat:** Wood excelsior with a reinforcing netting.
    - **Glass Fiber Matting:** Bonded textile glass fibers.
    - **Other Mulch Nettings:** Follow manufacturer recommendations and provide specific specifications in the SWPPP.

Maintenance & Management

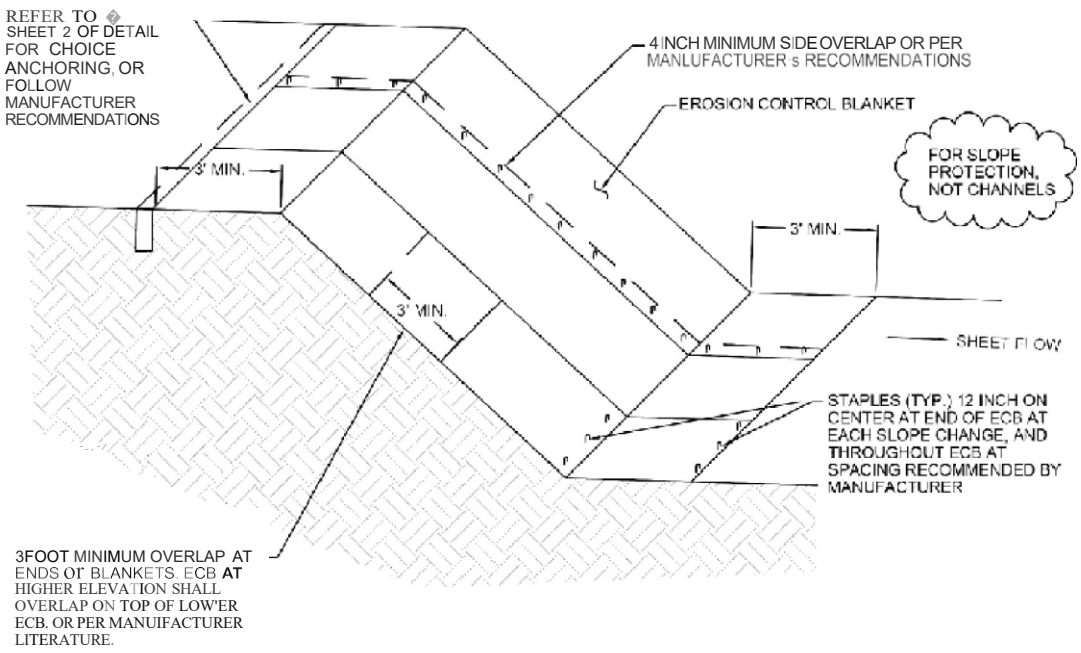
Regular inspection and prompt maintenance are critical to ensure continued performance of the erosion control matting:

- **Inspection Schedule:**
    - Inspect the installed matting during each routine inspection period and after any storm events, to check for erosion, washout, or undermining.
- **Maintenance Actions:**
    - Repair or re-install the matting if it has been damaged or if there are bare spots.
    - Re-anchor loosened nettings, and replace any lost netting or staples as required.
    - Reapply or replace temporary soil stabilization measures if the protected area becomes exposed or exhibits visible erosion.

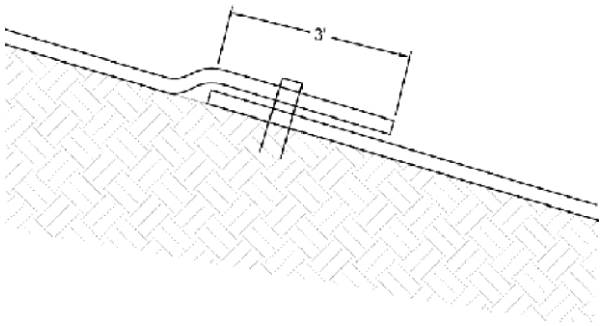
Performance Criteria

This BMP is considered successful when:

- Erosion control matting effectively reduces soil erosion and assists in the establishment of protective vegetative cover.
- The matting remains in full contact with the soil, with secure lap joints and properly anchored edges.
- There is minimal erosion or washout beneath the matting, and the protected area remains stable until vegetation is established.

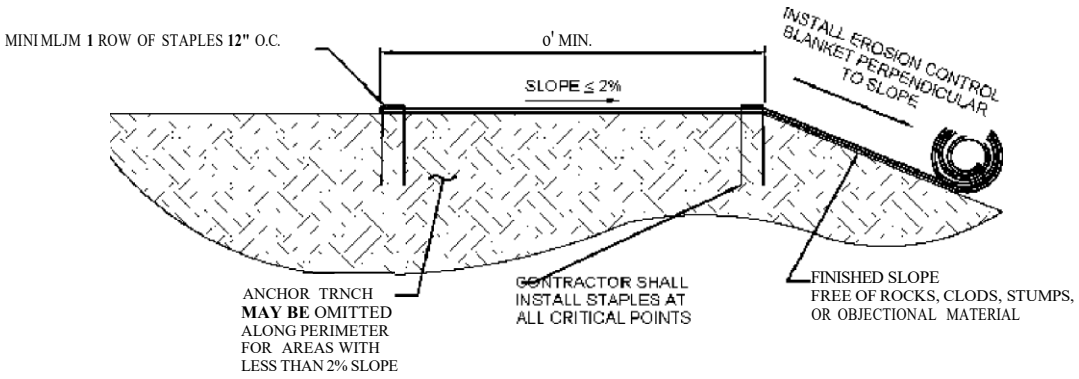


ECB ISOMETRIC PLAN VIEW

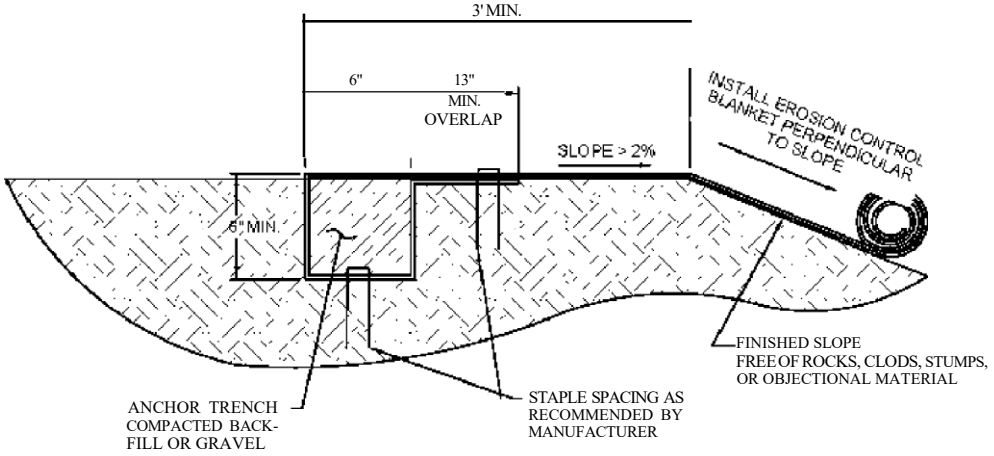


ECB OVERLAP EXAMPLE

Figure 1: Schematic diagram for erosion control blanket installation



TOP OF SLOPE ANCHOR EXAMPLE 1



TOP OF SLOPE ANCHOR TRENCH EXAMPLE 2

Figure 2: Schematic diagram for anchoring erosion control blankets

8.2. BMP 2: Soil Treatments (Roughening)

Purpose & Applicability

This BMP is designed to reduce wind and water erosion by providing temporary stabilization of bare soil through surface treatments, including roughening. It is primarily used for short-term stabilization (less than 30 days) on disturbed sites where dust control and erosion reduction are needed.

- **Applicability:**
  - Use on construction sites where dust is generated and there is potential for air and water pollution from disturbed soils.
  - Applicable to bare soil areas, temporary soil berms, stockpiles, earth-moving activities, and demolition sites.
  - Particularly effective for soils in groups 1 through 4 and 4L; if the soil type is unknown, consult the NRCS Web Soil Survey.

Installation & Use Procedures

To achieve effective erosion and dust control, implement the following procedures:

- **General Design Criteria:**
  - Minimize the area of disturbed soil by limiting clearing and grading to areas required for the immediate construction phase. For larger sites, phase work to keep disturbed areas below 10 acres at any time.
  - Select the surface treatment based on the length of time stabilization is needed.
- **Water Treatments for Dust Control:**
  - Apply water 15–20 minutes before work begins and reapply as needed during the day to moisten the top two inches of soil without generating runoff.
  - For areas with frequent grading, consider installing portable piping and sprinklers to achieve adequate soil moisture.
- **Palliative Treatments (Soil Binders):**
  - Use palliatives (e.g., polyacrylamide, guar-based compounds, or polyvinyl acetates) to bond soil particles and create a cohesive crust.
  - Develop a site-specific palliative mix in consultation with the supplier; avoid "off the shelf" mixes.
  - Apply palliatives only after minimizing soil compaction; loosen compacted surfaces if necessary.
  - Do not apply palliatives during rainy conditions or when the soil is excessively moist; pre-wet excessively dry soils to prevent premature curing.
  - Follow precise dilution and application rates based on soil type, climate, and anticipated traffic.
- **Vegetation Treatments:**
  - For areas undisturbed for one year or longer, establish vegetation as a cost-effective permanent stabilization measure.
  - Refer to established vegetation criteria (see Section 8.5 Vegetation) for temporary stabilization with vegetation.
- **Other Treatments & Roughening Methods:**

    - Apply gravel, recycled concrete, or asphalt to temporary roads and staging areas to prevent dust and erosion.
    - Employ soil roughening techniques (See Figure 3) by driving tracked vehicles, creating irregular patterns to disrupt runoff flow. Methods include:
        - **Stair-step Grading:** Appropriate for steep slopes or soils with soft rock, creating levels that catch eroded materials.
        - **Grooving or Track Walking:** Suitable for less steep slopes to create cleat imprints along contour lines.
        - **Deep Tillage (6-12 inches):** For large open areas to reduce runoff velocity
    - Roughening should be performed immediately after vegetation removal and grading to maximize effectiveness.
- **Installation Documentation:**
    - Provide detailed contractor illustrations and specifications for the selected surface treatment method.
    - Record installation details on the SWPPP BMP map along with any engineering calculations or design criteria.

Maintenance & Management

Regular inspection and timely maintenance are critical to ensuring the continued effectiveness of soil treatments:

- **Inspection:**
    - Inspect treated areas during each routine inspection period and after any storm events.
    - Visually monitor the adequacy of water applications for dust control; if dust is observed, adjust water treatments or implement additional measures.
- **Maintenance Actions:**
    - For areas treated with palliatives, inspect for breaks or eroded spots in the surface crust; re-treat affected areas immediately.
    - If rill erosion (small water channels) is detected, implement additional erosion control measures such as diversion dikes.
    - Re-rough or re-treat areas if heavy storms wash away the treatment, then re-seed or revegetate as necessary.
    - Ensure all equipment and personnel follow established maintenance protocols to prevent re-compaction or disturbance of the treated surface.

Performance Criteria

This BMP is considered effective when:

- Surface treatments successfully reduce runoff velocity, increase infiltration, and trap sediment.
- Dust emissions are minimized, and the soil remains sufficiently stabilized to allow for seed germination and vegetation establishment.
- The treatment maintains its integrity for the required stabilization period, with any rill erosion or treatment breaks addressed promptly.

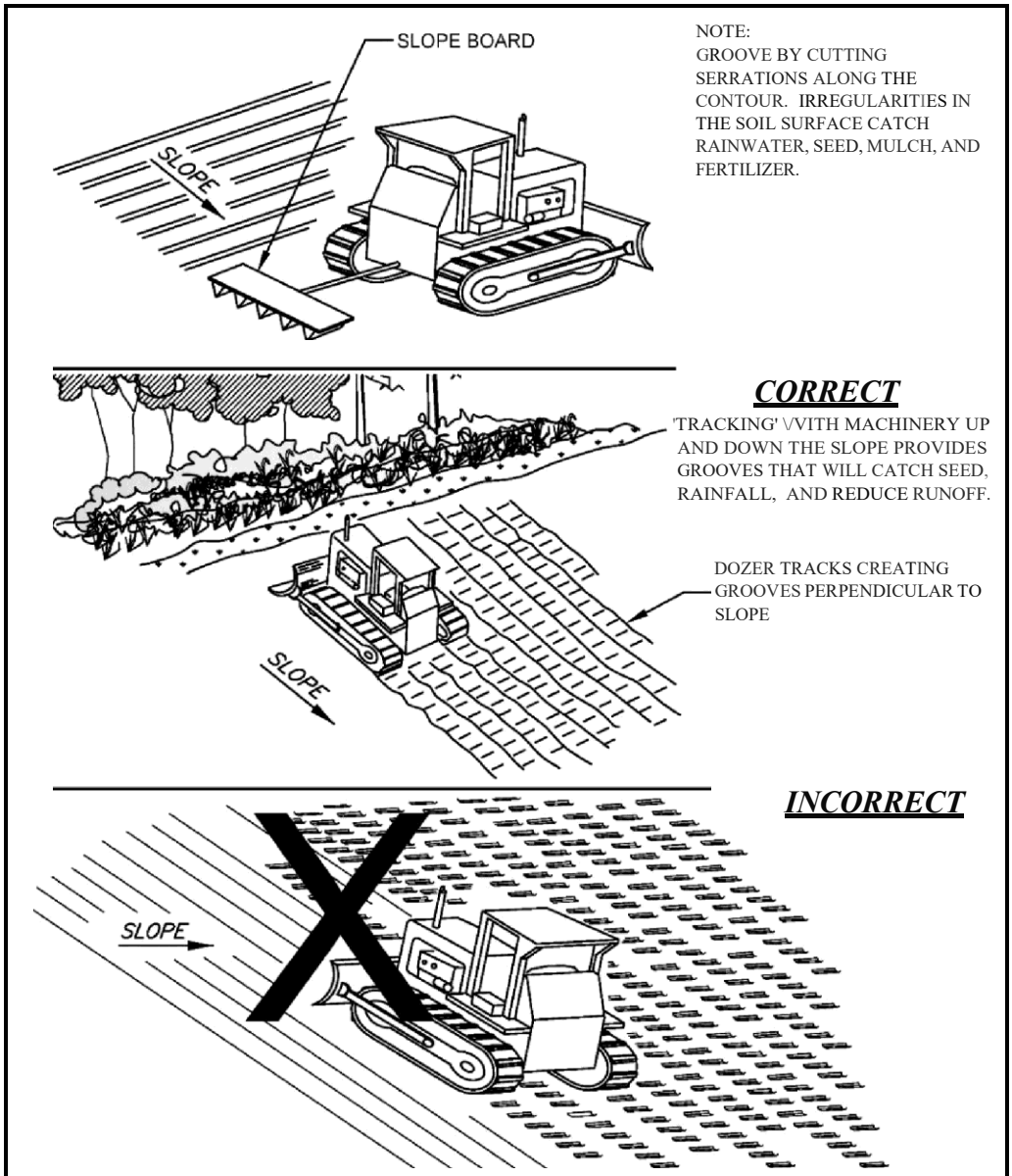


Figure 3: Graphic showing proper implementation of soil roughening

8.3. BMP 3: Mulching

Purpose & Applicability

Mulching is used to temporarily stabilize bare soil areas and promote vegetation establishment by protecting the soil surface from erosive forces and moisture loss. Mulch reduces the velocity of sheet flow, minimizes sediment-laden runoff, and promotes vegetative growth by reducing raindrop impact, conserving soil moisture, and moderating soil temperatures.

- **Applicability:**
    - Use on areas disturbed by construction that require surface protection, including freshly seeded or planted areas, disturbed zones unsuitable for immediate vegetation, or areas needing temporary stabilization.
    - Applicable on steep slopes (up to 2:1 or, with proper anchoring, slopes between 3:1 and 1.5:1) when mulch is anchored using soil stabilizers, netting, or crimping.
    - Mulching may be used alone or with seeding for final stabilization. When used with commercially available polymers for soil surface treatment, it is especially useful on steep slopes.
    - Note: Hay is not acceptable as mulch.

Installation & Use Procedures

Proper design and installation are critical to achieve the desired erosion control and vegetation establishment. The following procedures must be followed:

- **Design Criteria:**
    - The designer shall specify the type of mulch to be used, the application rate (or thickness), and the anchoring method (if required) based on site conditions (slope, soil type, and material availability).
    - Choice of mulch is based on factors including slope, soil type, and availability (See Table 1). Organic mulches (straw, wood fiber, chipped vegetation) are commonly used for temporary stabilization, while permanent controls in arid areas may use gravel or decomposed granite.
    - When applied on slopes steeper than 2:1, additional anchoring methods (e.g., netting, adhesive polymers, crimping) are required. Do not apply mulch on slopes steeper than 1.5:1 unless proper anchoring is provided.
- **Application Methods:**
    - Organic mulches may be applied by hand or mechanically (e.g., mulch-blowing equipment) ensuring an even and uniform layer.
    - For straw mulch:
        - Straw must be free of weed and grass seed, air-dried, and free of mold or rot
        - Straw fibers must be between 4 and 8 inches in length.
        - Anchor straw mulch using a tractor-drawn crimper, degradable netting, or appropriate soil stabilizer.

Table 1: Mulch Standards and Guidelines			
Mulch Material	Quality Standards	Application Rates	Notes
Straw	Air-dried, free of mold and not rotten. Certified Weed Free.	1.5 to 2 tons per acre	Cost-effective when applied with adequate thickness. Straw must be held in place by crimping, netting, or soil stabilizer.
Chipped Site Vegetation	Should include gradation from fine to coarse to promote interlocking properties. Must be free of waste materials such as plastic bags, metal debris, etc.	10 to 12 tons per acre	Cost-effective method to dispose of vegetative debris from site. Best application is for temporary stabilization where construction will resume. Use cautiously on areas where vegetation will be established, as wood chips will deplete soil nitrogen.
Erosion Control Compost (Wood Chip and Compost Mixture)	Shall not contain materials that can contaminate stormwater.	Approx. 10 tons per acre	Special caution is advised regarding the source and composition of wood mulches. Ensure compost is free of herbicides. Ensure wood chips are from unpainted and untreated wood.
Hydraulic Mulch	Must not contain sawdust, cardboard, paper, paper byproducts, plastics, or synthetics. No petroleum-based tackifiers.	Follow the manufacturer's recommendations. Application rate increases with slope steepness.	May be particularly effective on slopes steeper than 3:1. Ensure wood fibers are from unpainted and untreated wood.

    - For chipped vegetation:
        - Ensure vegetation is free of trash, litter, and debris before spreading.
        - Chipped pieces should range from 2 to 6 inches in length.
    - For hydraulic mulch:
        - Use a mixture of shredded wood fiber and a stabilizing binder (non-petroleum-based) applied according to manufacturer recommendations.
        - Protect hydraulically mulched areas from traffic for at least 24-48 hours until the mulch cures.
- **Documentation:**
    - Attach detailed contractor illustrations, design calculations (if applicable), and manufacturer specifications to the SWPPP BMP documentation.
    - Record all mulching application rates and anchoring methods in the SWPPP.

Maintenance & Management

Regular inspection and maintenance are essential to ensure continued erosion control and vegetation establishment:

- **Inspection Schedule:**
    - Inspect mulched areas during each routine inspection period and after any storm events for thinning or bare spots due to natural decomposition or weather-related events.
    - In high-traffic areas, inspect more frequently and replace mulch on a scheduled basis to maintain uniform protection.
- **Maintenance Actions:**
    - Reapply or replenish mulch where needed and use stockpiled excess mulch to dress problem areas.
    - For mulched areas used with seeding for final stabilization, ensure fertilization and soil treatment have been completed prior to mulching (except for hydroseeding or winter straw mulch applications).
    - Repair any areas where mulch has been washed away or where anchoring has failed.
- **Additional Considerations:**
    - Monitor mulch performance and, if necessary, supplement with additional erosion control measures such as geotextile mats or netting on steep slopes.
    - Document maintenance activities and schedule reapplications as required to ensure consistent soil protection.

Performance Criteria

This BMP is considered effective when:

- Mulch is applied uniformly and remains intact during rainfall events, protecting the soil from raindrop impact and reducing overland flow velocity.
- Soil moisture is conserved, and conditions are favorable for vegetation establishment.
- The mulch layer reduces sediment transport by increasing infiltration and providing a protective barrier against erosion.

- Mulch remains in place until vegetation is established; any significant washout, bare spots, or failure of anchoring methods indicates BMP failure and requires corrective action.
- Performance is enhanced when used in conjunction with additional erosion control practices (e.g., seeding, netting, or diversion dikes).

8.4. BMP 4: Preservation of Vegetation

Purpose & Applicability

This BMP is designed to preserve and protect existing natural vegetation, including trees, vines, bushes, and grasses, during construction activities. Preserving vegetation provides multiple benefits such as erosion control, stormwater detention, biofiltration, and enhanced aesthetic value both during and after construction.

- **Applicability:**
  - Applicable to all construction sites where vegetation exists in the predevelopment condition.
  - Particularly beneficial in environmentally sensitive areas such as floodplains, wetlands, stream banks, and steep slopes where erosion controls are difficult to establish.
  - Employed when only the land necessary for building activities and vehicle traffic is cleared, preserving as much natural vegetation as possible.

Installation & Use Procedures (Planning Considerations)

Proper planning and installation are critical to effectively protect existing trees and vegetation (See figure 4):

- **Preconstruction Planning:**
  - Conduct a vegetation inventory and delineate the limits of existing trees, vines, bushes, and grasses on the site.
  - Identify environmentally sensitive areas.
  - Limit clearing to only the areas required for building and vehicle traffic.
- **Protective Measures:**
  - Stake off root system limits (e.g., the drip line of each tree) to prevent inadvertent damage.
  - Fence or mark trees meant to remain in place using barriers or flagging systems.
  - Apply protective mulching (e.g., rock mulch) in accordance with applicable specifications to minimize soil compaction and erosion.
  - Where applicable, incorporate preplanned revegetation measures to enhance existing vegetation during and after construction.
- **Design Considerations:**
  - Ensure that construction operations are coordinated to avoid improper grading that could alter hydrology and lead to vegetation die-off.
  - Consider site hydrology to maintain adequate water supply for preserved vegetation.
  - Attach detailed site plans and design drawings illustrating protective measures and vegetation preservation zones on the SWPPP site map.

Maintenance & Management

Ongoing maintenance is essential to ensure that protected vegetation remains healthy and intact during construction:

- **Routine Inspections:**
  - Clearly mark the limits of disturbance and conduct regular inspections to ensure

that protective measures (e.g., exclusion fencing) remain intact.
    - Inspect vegetation regularly and immediately repair or replace any damaged trees or plants if applicable to site plans.
- **Irrigation & Care:**
    - Implement irrigation or maintenance programs in accordance with the landscaping plan to support the health of preserved vegetation.
    - Remove any construction debris that may interfere with the growth and health of protected vegetation.
- **Postconstruction Integration:**
    - Incorporate both protected and newly planted vegetation into final landscaping plans to form buffer zones, especially in environmentally sensitive areas.
    - In areas such as streams or natural washes, ensure that buffer zones are a minimum of 50 feet wide and include vegetated ground cover to contain stormwater runoff.

Performance Criteria

This BMP is considered effective when:

- Most natural vegetation remains intact and healthy throughout construction.
- Protective measures (e.g., staking, fencing, tree wells) are in place and maintained, preventing damage to key vegetation.
- Erosion control and stormwater management are enhanced by the preserved vegetation, contributing to improved water quality and site aesthetics.
- Buffer zones are successfully protected, and the preserved vegetation functions by providing additional stormwater filtration.

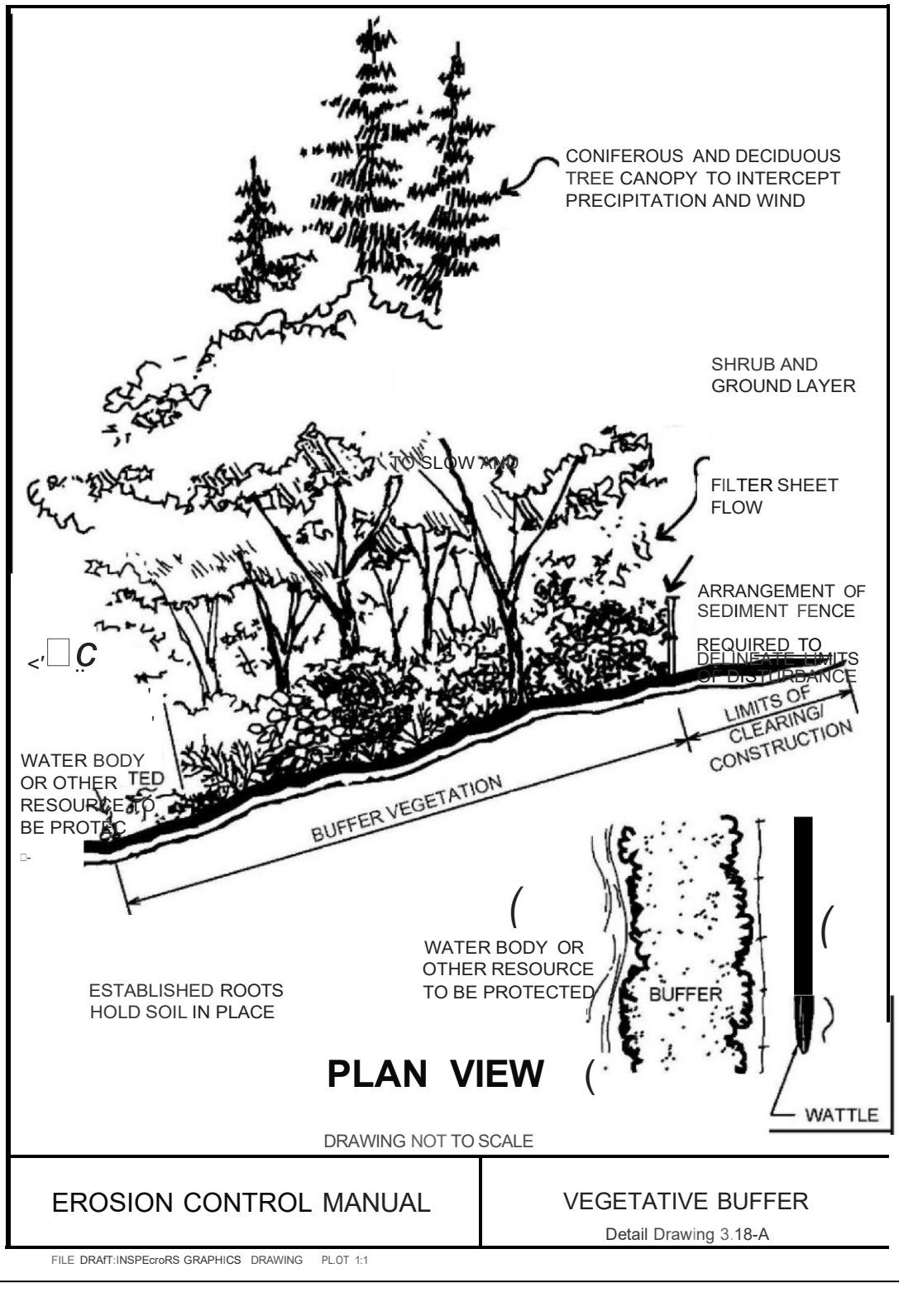


Figure 4: Schematic diagram of a vegetation buffer zone

8.5. BMP 5: Vegetation and Stabilization

Purpose & Applicability

Vegetation is used as both a temporary and final stabilization measure to control erosion on construction-disturbed areas. As a temporary control, vegetation stabilizes stockpiles, earthen dikes, and barren areas inactive for more than 30 days. As a final control, grasses and other plants protect against erosion and filter overland runoff while enhancing site aesthetics.

- **Applicability:**
    - Use for temporary stabilization of stockpiles, earthen dikes, and barren areas until vegetation is established.
    - Use for final stabilization of construction areas by achieving vegetative cover that is at least 70% of the native background.
    - Applicable to channels, swales, mild to medium slopes, and as perimeter protection for utility and site development areas.
    - May be used in conjunction with additional erosion control measures (e.g., erosion control blankets, mulching, diversion dikes, proper grading) to direct flow around newly seeded areas.

Installation & Use Procedures

- **Design Criteria:**
    - Vegetation becomes highly effective once fully established; until then, supplemental controls are needed, and existing sediment controls should not be removed until vegetation is secure.
    - On slopes steeper than 20:1 (5%), use anchored mulch or erosion control blankets to protect seeded areas until establishment.
    - Vegetation alone may stabilize channels if channel grade is less than 2% and runoff velocities (under a 2-year, 24-hour storm) are below 6 ft/s; if velocities exceed 2 ft/s, incorporate erosion control blankets, and if above 6 ft/s, use turf reinforcement mats.
    - Stabilization of channels with vegetation is limited to those with side slopes of 3:1 or flatter.
    - Initiate vegetation establishment (seeding or sodding) immediately after grading, and no later than 30 days following completion of grading on highly erodible areas.
- **Surface Preparation:**
    - Remove and stockpile existing topsoil at the start of grading.
    - Complete interim or final grading before seeding or sodding; limit vehicle and equipment traffic to minimize soil compaction.
    - Install necessary erosion structures (e.g., dikes, swales, diversions) prior to seeding.
    - Spread stockpiled topsoil evenly over disturbed areas to a minimum depth of 4 inches (6 inches over rock or unsuitable material; if needed, amend with compost in a ratio of 3 parts topsoil to 1 part compost.

    - Prepare a uniform seed bed by pulverizing and loosening the soil to at least 3 inches depth; on slopes steeper than 3:1, groove or furrow along the contour.
- **Plant Selection, Fertilization, and Seeding/Sodding:**
    - Use high-quality USDA-certified seed or sod adapted to the local climate and soil conditions. Consult local NRCS or extension services for species recommendations and planting schedule (Also see table 2).
    - Follow prescribed seeding rates or use appropriate seeding equipment (seed drills, cultipackers, hydroseeders).
    - For immediate stabilization, sodding may be employed and planted under optimal moisture conditions.
    - After planting, water seeded or sodded areas immediately at a rate that moistens the top 6 inches without causing runoff; provide adequate watering for the first 14 days, then as needed.
    - Use mulching techniques (avoid chipped vegetation mulch if high wood content could deplete nitrogen) to enhance seed protection, moisture retention, and erosion control.

Table 2: Optimal Seeding Window Timeline Guide	
Elevation	Date
Below 4,000 ft	October 15 to December 31
4,000 to 6,000 ft	September 15 to November 30
Above 6,000 ft	September 1 to November 15

Maintenance & Management

Proper maintenance is essential to ensure long-term vegetation establishment and erosion control:

- **Inspection & Early Maintenance:**
    - Protect newly seeded areas from excessive runoff and vehicle traffic until vegetation is well established.
    - Follow a detailed watering and fertilizing schedule in the construction plan to facilitate plant establishment.
    - Inspect vegetated areas during each routine inspection period and after any storm events; reseed bare spots and apply mulch or other erosion control measures as necessary.
    - Remove accumulated sediment from the vegetation to prevent smothering and determine the source of excessive sediment to implement further erosion controls.

Performance Criteria

This BMP is considered successful when:

- The established vegetation effectively stabilizes the soil, reduces erosion, and filters stormwater runoff.
- Temporary vegetation (via seeding) supports stabilization until final vegetation reaches at least 70% cover of the native background.

- Supplemental erosion controls (mulching, erosion control blankets, diversion dikes) remain in place until the vegetation is fully established.
- Vegetative cover is maintained according to design criteria, and any bare spots are promptly reseeded.

8.6. BMP 6: Check Dam

Purpose & Applicability

Check dams are installed in swales, drainage ditches, or constructed channels to reduce erosive velocities, provide a barrier to sediment transport, and help disperse concentrated flows. They are used in combination with other channel protection measures (such as vegetation lining and turf reinforcement mats) and may be paired with outlet sediment traps to enhance sediment capture.

- **Applicability:**
    - Use in long drainage swales or ditches along linear projects (e.g., roadways) to mitigate increased runoff and control erosive velocities.
    - Suitable for short swales down steep slopes (e.g., highway embankments) to reduce flow velocities.
    - Do not install check dams in actively flowing stream channels.
    - Install before the contributing drainage area is disturbed; if the swale is graded during construction, install check dams immediately after grading to control velocities until stabilization is complete.
    - It is appropriate for temporary sediment control and energy dissipation and can be used in conjunction with other sediment reduction techniques.

Installation & Use Procedures

Follow these procedures to properly install check dams (See figure 5):

- **General Design Criteria:**
    - **Dimensions & Spacing:**
        - Dam height should generally be between 9 and 36 inches, always less than one-third the channel depth.
        - Space dams so the top of the downstream dam aligns with the toe of the upstream dam; allow spacing to form small pools between dams.
        - The top of the dam's side must be at least 6 inches higher than the center, and the sides must be embedded at least 18 inches into the channel to minimize bypass erosion.
    - **Materials & Construction:**
        - Do not use loose soil, wood chips, compost, or other floatable materials for construction.
    - **Flow Considerations:**
        - Design dams so that larger flows (exceeding a 2-year, 24-hour storm) pass without causing excessive upstream flooding.
        - Use in conjunction with additional sediment reduction measures prior to releasing flow off-site.

- **Alternative Check Dam Options:**
    - **Rock Check Dams:**
        - For dams <24 inches in height, use well-graded stone sized 3-6 inches; for dams >24 inches, use stone sized 4-8 inches.
        - Typical cross-sectional design is triangular, with a minimum top width of 2 feet and side slopes of 2:1 (or flatter).
    - **Rock Bag Check Dams:**
        - Construct with a minimum top width of 16 inches, using bags (24–30 inches long, 16–18 inches wide, 6–8 inches thick, ~40 lbs each) filled with pea gravel or filter stone.
        - Assemble in a pyramid stack (one row on top of two rows) with the dan always one row wider than it is high.
        - Bag material must meet specified strength and durability criteria.
    - **Sack Gabion Check Dams:**
        - Suitable for channels with a drainage area of ≤ 5 acres.
        - Construct using well-graded stone (3-6 inches) contained in sack gabions wrapped in 20-gauge, 1-inch hexagonal woven wire mesh and staked with ¾-inch rebar at ≤ 3-foot spacing.
    - **Organic Filter Tube Check Dams (See BMP 8.8):**
        - Use tubes with a minimum diameter of 12 inches filled with organic material (e.g., coir, straw, aspen fiber) that is slow to decay.
        - Stake tubes at a maximum spacing of 4 feet, alternating stakes through the tube and on the downstream face.
- **Documentation:**
    - Include detailed manufacturer illustrations and specifications for any applicable proprietary products.
    - Record installation locations on the SWPPP site map.

Maintenance & Management

Routine inspection and maintenance are essential for long-term effectiveness:

- **Inspection Schedule:**
    - Inspect the check dam system during each routine inspection period and after any storm events.
- **Maintenance Actions:**
    - Remove accumulated sediment from the upstream side when it reaches approximately one-third the dam height.
    - Inspect for erosion along dam edges, especially where the dam meets the channel, and repair as needed.
    - If erosion persists or dam performance degrades, modify the dam design or add additional controls.

- Exercise caution during removal to avoid leaving loose rock, which can create hazards during subsequent site operations (e.g., mowing).

Performance Criteria

The check dam BMP is considered effective when:

- The system reduces flow velocities to levels that prevent deep erosive gullies and excessive sediment bypass.
- Sediment accumulates primarily on the upstream side of the dam, within acceptable maintenance tolerances.
- The check dams remain in place, conform to design specifications, and are not compromised by erosion or construction operations.

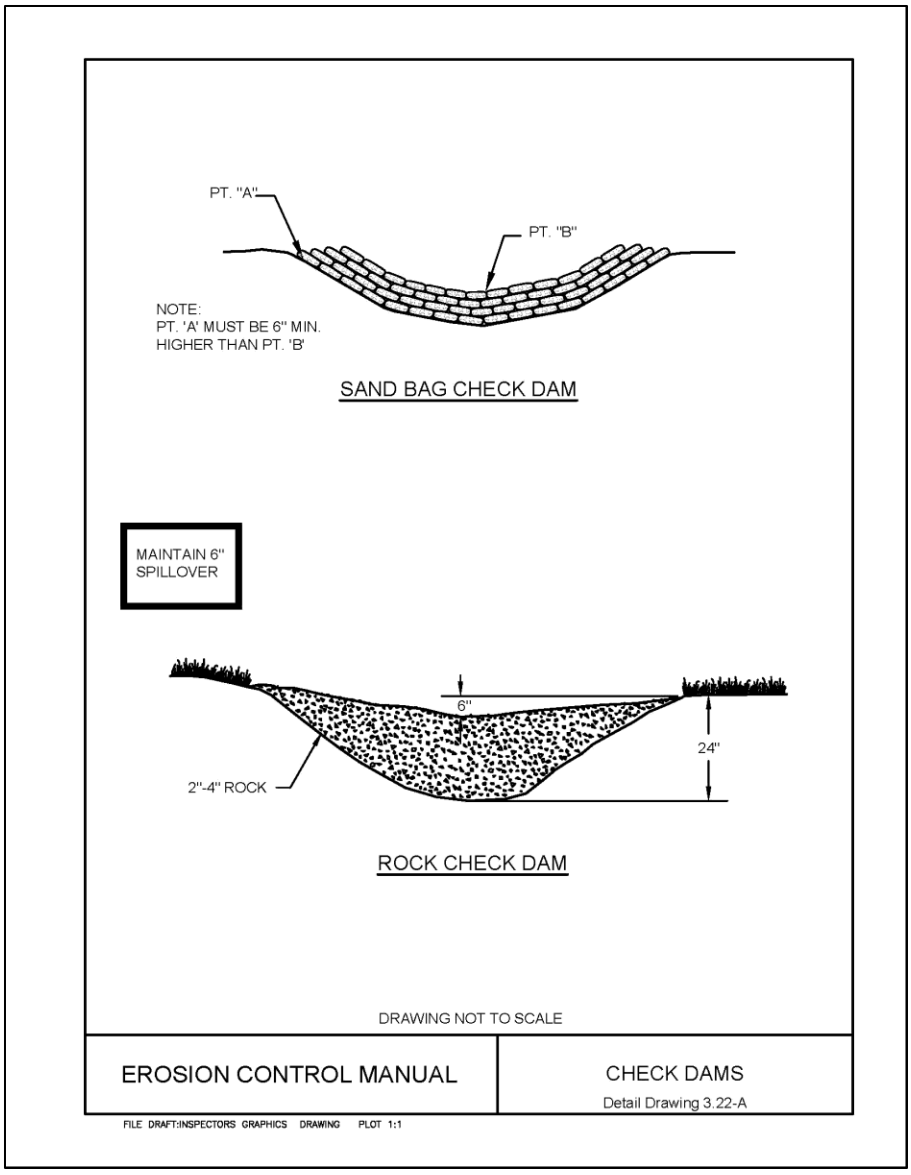


Figure 5: Schematic diagram for check dam installation

8.7. BMP 7: Velocity Dissipation Devices

Purpose & Applicability

This BMP is designed to reduce the velocity and energy of concentrated stormwater flows at discharge points, thereby preventing erosion in downstream vegetated or natural drainage channels. By dispersing flow and encouraging sediment settlement, velocity dissipation devices help protect channel integrity.

- **Applicability:**
  - Use at outlets of constructed conveyance systems (e.g., storm drain pipes, concrete flumes, roadside ditches, culverts) that discharge to unlined or natural channels.
  - Suitable for locations where concentrated flows can cause erosion in unlined channels or where channel protection is pending installation.
  - Can be designed as temporary measures or, when constructed permanently, must meet the municipality's drainage design criteria.

Installation & Use Procedures

To ensure effective operation of velocity dissipation devices, follow these procedures:

- **General Installation Guidelines:**
  - Install temporary velocity dissipation devices at all discharge points where the design storm velocity exceeds 4 feet per second and the flow is directed to an unlined or natural channel.
  - Ensure that temporary devices do not block flow or cause flooding during larger storm events.
  - Coordinate the design and installation of temporary devices with the overall stormwater infrastructure design; permanent devices should be constructed early in the first phase of construction when feasible.
- **Rock Riprap Systems (Primary Option) (See figure 6):**
  - Use well-graded rock (natural stone or recycled concrete) for temporary velocity dissipation.
  - Follow storm water design calculations, including drainage computations, discharge velocity, stone size, and apron dimensions.
  - Select stone with sizes that are a minimum of 6 inches, with a maximum diameter not exceeding 9 inches. The rock surface should be homogeneous with no voids larger than 1½ inches.
  - Construct a riprap apron with a minimum depth of 1.5 times the max stone diameter, a length of at least 4.5 times the outlet pipe diameter (or equivalent for other outlets), and a width of at least 4.0 times the outlet pipe diameter.
  - Place the riprap on a filter fabric lining keyed into the ground at least 6 inches to prevent soil intrusion.
  - Align the riprap apron with the flow direction, ensuring that it does not cause undue blockage or flooding.
  - Note: Riprap systems should not be used where there is a significant elevation difference between the outlet and the receiving channel.

- **Other Devices (Alternative Options):**
    - Alternative devices (e.g., articulating concrete blocks, gabions, stilling basins, manufactured velocity dissipaters) may be used if the designer provides calculations to document the appropriate size and dimensions for the design storm flow.
    - Temporary baffled chutes, gabion drop structures, or stabilized grade breaks may be installed where an elevation difference exists at the outlet until permanent structures are installed.
- **Documentation:**
    - Attach all design calculations, manufacturer illustrations, and product specifications to the SWPPP, and indicate their locations on the site map.
    - Reference additional design guidance if necessary.

Maintenance & Management

Regular inspection and maintenance are critical to ensuring that velocity dissipation devices continue to function effectively:

- **Inspection Schedule:**
    - Inspect discharge points during each routine inspection period and after any storm events.
- **Maintenance Actions:**
    - Repair or replace dislodged or missing rock riprap as necessary.
    - Monitor for the development of head-cuts, channel deepening, or widening, which indicate that additional velocity dissipation measures are needed.
    - Inspect the underlying filter fabric and rekey or repair as required.
    - Remove any debris that may block flow or interfere with the functioning of the velocity dissipater.
    - If temporary devices are used, ensure they are removed once the surrounding drainage area is stabilized or at the completion of construction.

Performance Criteria

This BMP is considered effective when:

- The velocity dissipation device reduces discharge energy and flow velocity sufficiently to prevent erosion in the receiving channel.
- Suspended sediments are allowed to settle within the device, thereby reducing sediment transport downstream.
- The device maintains its structural integrity and does not block flow or cause flooding during larger storm events.
- There is minimal evidence of downstream erosion (e.g., head-cuts, channel widening) attributable to the discharge.

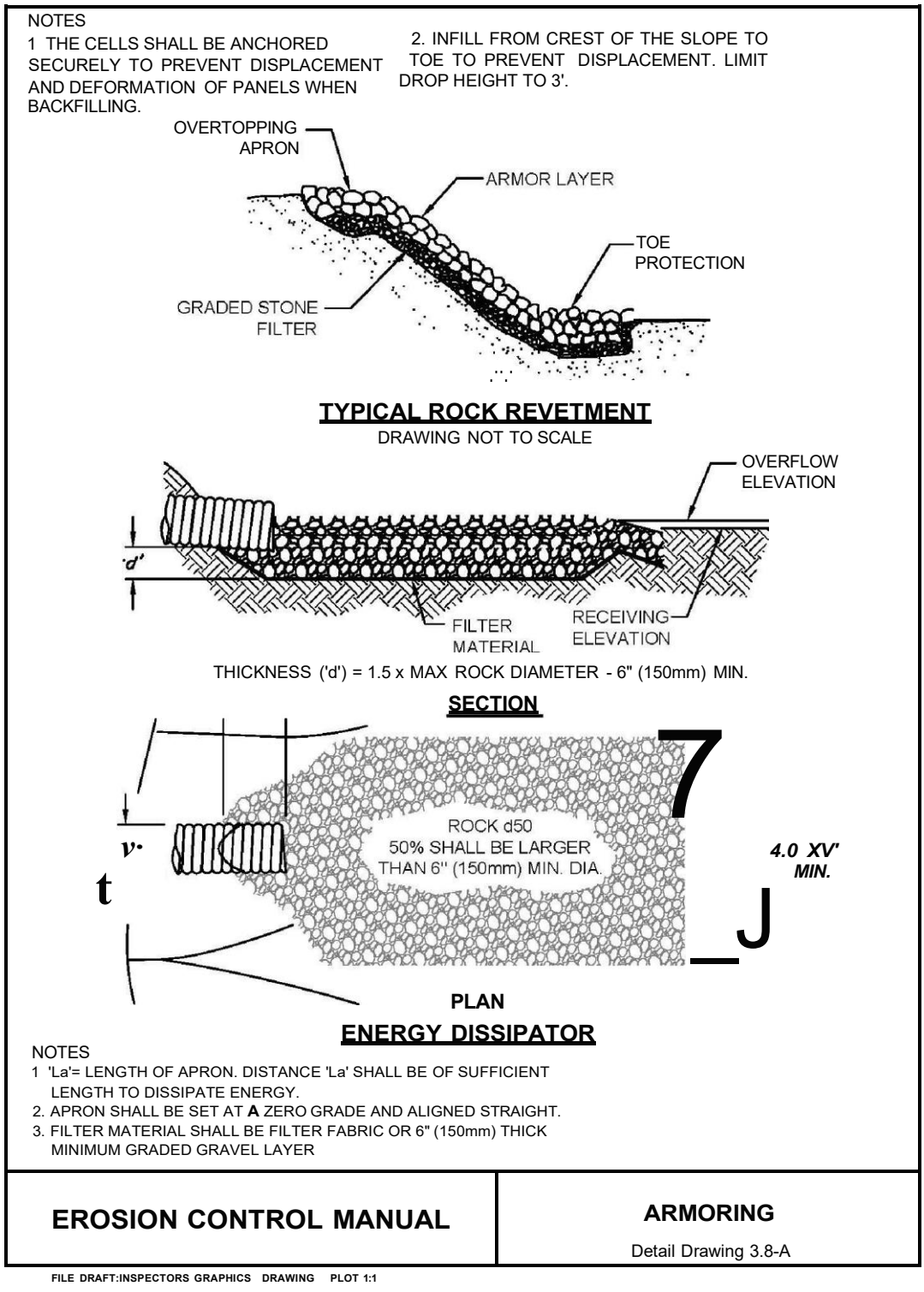


Figure 6: Schematic diagram for velocity energy dissipater installation

8.8. BMP 8: Straw Wattle Check Dam

Purpose & Applicability

This BMP is designed to reduce flow velocities and control sediment in swales and drainage ditches, including those along linear projects such as roadways, using straw wattle check dams. Straw wattle check dams are a temporary measure used during construction, particularly prior to final stabilization, and are not intended for use in live (flowing) stream channels.

- **Applicability:**
  - Use in swales and drainage ditches to mitigate increased runoff effects and reduce velocities.
  - Suitable for short swales down steep slopes to control flow.
  - Must not be installed in in actively flowing stream channels.
  - Install before disturbing the contributing drainage area, or immediately after grading a swale, to control velocities until final stabilization is achieved.

Installation & Use Procedures

Follow these procedures to properly install and operate straw wattle check dams (See figure 7):

- **Design & Dimensions:**
  - The dam height should be between 9 and 36 inches and less than one-third the depth of the channel.
  - Dams should be spaced so that the top of the downstream dam is at the same elevation as the toe of the upstream dam.
  - The top of the side of the check dam shall be at least 6 inches higher than the middle of the dam.
  - Embed the sides of the dam a minimum of 18 inches into the channel, swale, or drainage ditch to minimize the potential for erosive flows around the dam.
  - Stake tubes at a maximum spacing of 4 feet, alternating stakes through the tube and on the downstream face.
- **Supporting Measures:**
  - Use straw wattles in conjunction with other sediment reduction techniques before releasing flow off-site.
  - Do not use loose soil, wood chips, compost, or other floatable materials that may be transported during runoff for the construction of the check dam.
- **Documentation:**
  - Refer to the BMP 6 for alternative design options.
  - Attach contractor illustrations and manufacturer recommendations if necessary and mark the installation location on the SWPPP site map.

Maintenance & Management

Regular maintenance and inspections are critical to ensure the check dam system performs as intended:

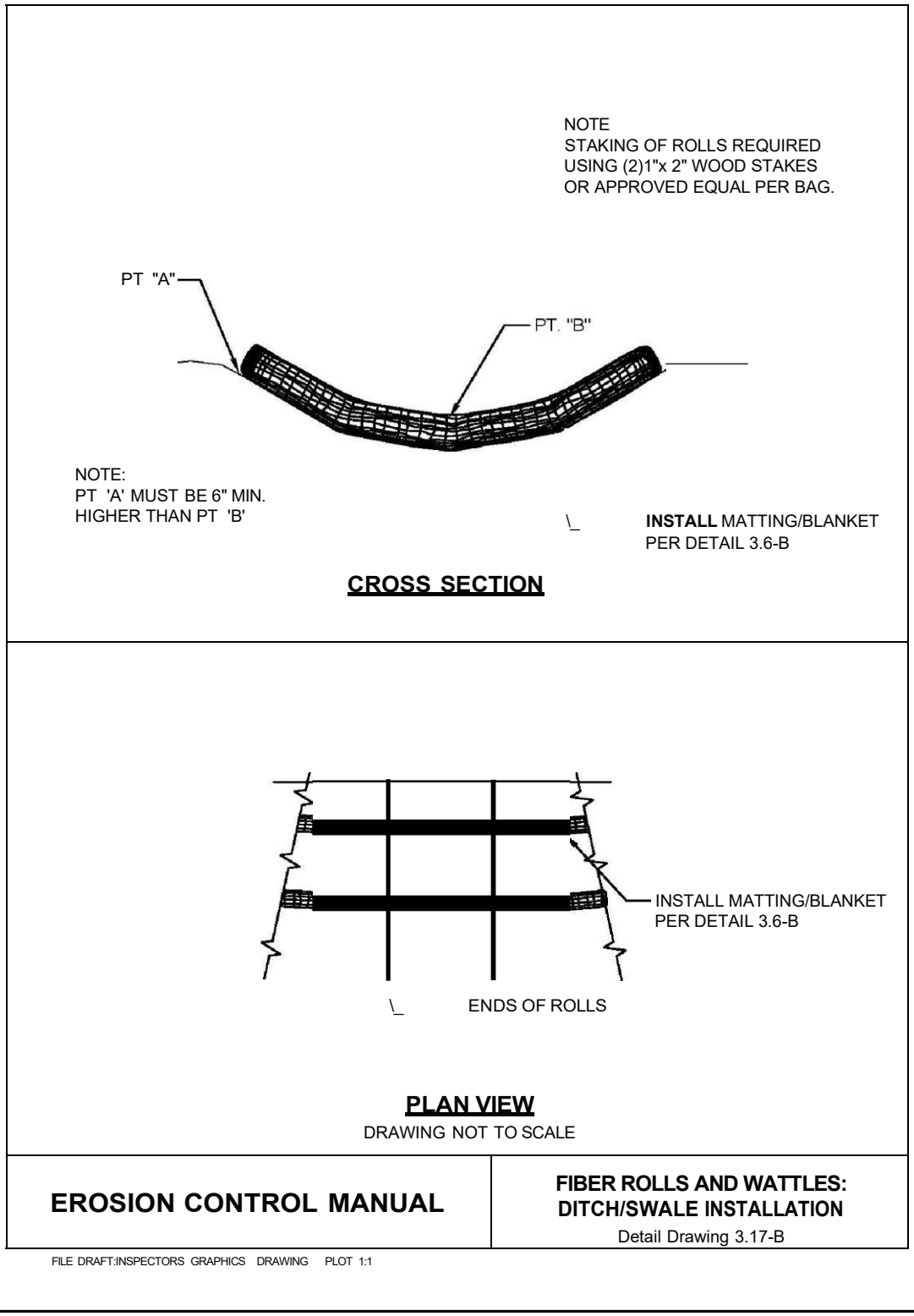


Figure 7: Schematic drawing for installation of straw wattle check dams

- **Inspection Schedule:**
    - Inspect the check dam system during each routine inspection period and after any storm events.
- **Sediment and Erosion Management:**
    - Remove accumulated silt when sediment buildup reaches approximately one-third the height of the dam.
    - Inspect for erosion beneath and around the check dam, particularly where the dam meets the side of the channel and restore or reinforce as needed during each reporting period.
    - If erosion persists, engineer modifications to the check dam or implement additional controls.

Performance Criteria

This BMP is considered effective when:

- The drainage channel protected by the check dams does not develop deep erosive gullies between dams.
- The dam itself remains intact, is not undercut by erosion, and maintains its design dimensions.
- Sediment accumulation on the upstream side of the dam is within acceptable maintenance tolerances.

8.9. BMP 9: Straw Wattle on Slopes

Purpose & Applicability

This BMP utilizes straw wattle, also known as fiber rolls, fiber logs, filter tubes, mulch socks, or coir rolls, as a temporary sediment and erosion control measure on slopes. These tubes can be filled with organic materials (compost, wood chips, straw, coir, aspen fiber, or a mixture) or geosynthetic material. This BMP focuses on managing sheet flow on slopes and controlling sediment discharge.

- **Applicability:**
  - Use on slopes to treat sheet flow over a short distance, functioning as both sediment and erosion control.
  - Can be installed along the contours of a slope as a linear barrier or as a perimeter control downslope of a disturbed area.
  - When filter tubes are intended to remain on-site as part of final stabilization (especially in arid and semi-arid areas with extended stabilization timelines), they must be constructed of 100% biodegradable natural fibers (jute, coir, sisal, etc.) or 100% UV photodegradable plastic, polyester, or geosynthetic material.
  - Most effective in coarse to silty soil types; additional controls may be needed for fine silts and clays.

Installation & Use Procedures

Follow these procedures to properly install and deploy straw wattles on slopes (See figure 8):

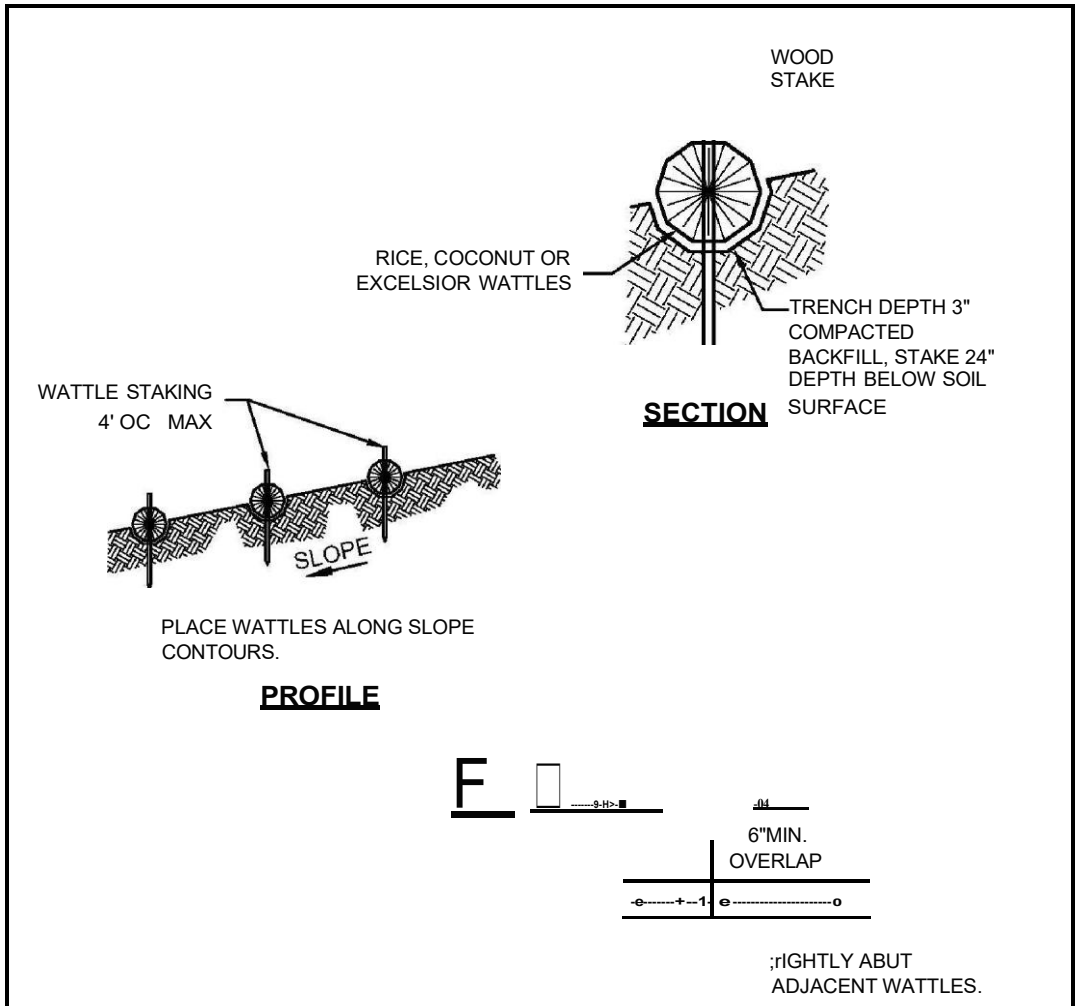


Figure 8: Schematic diagram of straw wattle slope installation

- **Placement and Alignment:**
  - Install filter tubes along the contour of the slope to maximize sediment capture and flow detention.
  - When using manufactured wattles, follow the manufacturer's recommendations for tube diameter, spacing, and installation based on slope, flow velocity, and other site-specific conditions; document these in the SWPPP.
  - Use Table 3 for spacing unless otherwise specified in manufacturer's recommendations.
- **Staking and Embedding:**
  - Stake tubes using 2-inch by 2-inch wooden stakes (or equivalent rebar/metal stakes) at a maximum spacing of 4 feet.
  - When placed on soil, embed filter tubes a minimum of 3 inches to ensure stability.
- **Connection and Overlap:**
  - When multiple tubes are connected to form a continuous linear barrier, overlap adjacent tubes by at least 6 inches.
- **Upstream Protection and Bypass Prevention:**
  - If necessary, place loose sediment or mulch material against the upstream side of the tubes to promote continuous contact with the soil.
  - At the ends of a line of tubes, turn the last 10 feet (or more) upslope to prevent runoff bypass. On longer installations, additional upslope turns may be required every 200–400 linear feet, depending on the slope traverse.
- **Size Considerations:**
  - Common tube diameters range from 6 to 24 inches; tubes as small as 4 inches or as large as 36 inches are available.
  - Tubes less than 8 inches in diameter, when filled, will require more frequent maintenance.

Table 3: Maximum Spacing for Slope Protection

	Tube Diameter (minimum)			
Slope (H:V)	9 inches	12 inches	18 inches	24 inches
10:1 to 5:1	35 feet	40 feet	55 feet	60 feet
4:1	30 feet	40 feet	50 feet	50 feet
3:1	25 feet	35 feet	40 feet	40 feet
2:1	20 feet	25 feet	30 feet	30 feet
1:1	10 feet	15 feet	20 feet	20 feet

Maintenance & Management

Regular maintenance and inspections are critical to ensure the wattle system performs as intended:

- **Inspection Schedule:**
  - Inspect organic filter tubes during each routine inspection period and after any storm events.
  - Verify that the tubes remain in continuous contact with the soil at the bottom of the embedment trench.
- **Maintenance Actions:**

- Check for the development of rill erosion under the filter tubes; repair eroded spots immediately and monitor for recurrence. If erosion persists, implement additional controls.
- Inspect staking to ensure filter tubes remain secure and are not shifting due to stormwater runoff, repair and re-stake any slumping tubes.
- Replace or repair any tubes that are split, torn, or unraveling.
- Remove accumulated sediment from behind the filter tubes before the sediment reaches half the height of the exposed portion.

Performance Criteria

This BMP is considered effective when:

- The filter tube barrier effectively detains flow and captures sediment as runoff passes over or through it, with minimal bypass.
- The barrier minimizes off-site sediment discharge and prevents the development of erosive rills or gullies between tubes.
- Tubes are not undercut or eroded on either side, maintaining structural integrity throughout the storm event.

8.10. BMP 10: Diversion Dikes

Purpose & Applicability

Diversion Dikes are temporary, earthen structures constructed to intercept and divert runoff, thereby reducing erosion from disturbed areas. Depending on their location and design, they can prevent surface sheet flow runoff from entering a disturbed construction site when located upslope or divert sediment-laden runoff from a disturbed area toward sediment trapping devices when installed downslope.

- **Appropriate Applications:**
  - Intercept and divert runoff to avoid sheet flow over sloped surfaces.
  - Direct runoff toward sediment basins, drainage pipes, or channels.
  - Divert runoff from paved surfaces.
- **Installation Locations:**
  - Below steep grades where runoff begins to concentrate.
  - Along roadways and facility improvements subject to flood drainage.
  - At the top of slopes to divert run-on from adjacent undisturbed areas.
  - At mid- to bottom-slope locations to intercept sheet flow and convey concentrated flows.
- **Limitations:**
  - Best suited for upstream drainage areas of 10 acres or less and slopes less than 5%; larger areas require more permanent structures.
  - Must comply with hydraulic design standards set by the local municipality or Flood Control District.
  - Earth dikes may create additional disturbed areas and can impede construction equipment; stabilization and immediate maintenance are required.
  - Diverted stormwater flow may cause flood damage to adjacent areas if not properly managed.
  - Diversion dikes are not intended as sediment trapping devices on their own.

Installation & Use Procedures

To construct effective diversion dikes, follow these design and installation guidelines (See figure 9):

- **Design Considerations:**
  - Determine the primary function: to prevent erosion by diverting runoff away from steep slopes or to direct runoff into a sediment control device.
  - Use diversion dikes as upslope perimeter controls for sites with significant off-site flow or as downslope controls to convey runoff to a sediment basin or protected inlet.
  - An interceptor swale may be installed on the upslope side to enhance performance; refer to applicable swale design criteria (See BMP 11).
- **Design Criteria:**
  - Maximum contributing drainage area should be 5 acres or less, depending on site conditions.
  - Maximum depth of flow at the dike shall be 1 foot based on a 2-year, 24-hour design storm.
  - Side slopes of the diversion dike shall be 3:1 or flatter (2:1 acceptable for

installations under 3 months duration).
    - Minimum width at the top of the dike shall be 2 feet.
    - Minimum embankment height shall be 18 inches (measured from the toe on the upgrade side).
    - For slopes less than 2% and flow velocities below 6 feet per second, stabilization may include grass, erosion control blankets, or anchored mulch; for steeper slopes or higher velocities, turf reinforcement mats or riprap are required.
    - Use on-site soil that is free of rocks larger than three inches in diameter and has adequate plasticity (soil stickiness) or provide armoring if working with loose soils.
    - Ensure the flow line at the dike has a positive grade draining to a controlled outlet.
- **Construction Timing & Location:**
    - Construct diversion dikes prior to clearing and grading, or immediately after grading if the swale is part of the project, to intercept runoff before it impacts disturbed soils.
    - Situate the dike so that diverted runoff is conveyed to a sediment control device (e.g., sediment basin, interceptor swale) without collecting water from wetlands or high groundwater areas.
    - Attach contractor illustrations, design calculations, and referenced topography within the SWPPP and site map.
- **Safety & Coordination:**
    - Ensure that dikes are installed only within property limits where failure would not result in loss of life, property damage, or interruption of public services.
    - Comply with local ordinances and specifications.

Maintenance & Management

Regular inspection and timely maintenance are critical to ensuring the diversion dike remains effective:

- **Inspection Schedule:**
    - Inspect the diversion dike during each routine inspection period and after any storm events.
- **Maintenance Actions:**
    - Check for sediment build up behind the dike and remove sediment in a timely manner.
    - Inspect the face of the dike for erosion; if erosion occurs, stabilize the slopes with mulch, seeding, or by flattening the slope.
    - Ensure that all structural components (e.g., berms, outlets) remain in compliance with the design criteria.
    - Repair any damage immediately to prevent runoff from bypassing the dike.

Performance Criteria

The diversion dike is considered effective when:

- It successfully intercepts and diverts runoff away from disturbed areas, preventing erosion on steep slopes.
- Diverted runoff is conveyed to a designated sediment control (e.g., sediment basin or

interceptor swale) without causing flood damage to adjacent areas.

- The dike maintains its structural integrity under the design storm conditions (up to a 2-year, 24-hour event) with minimal sediment buildup and erosion.

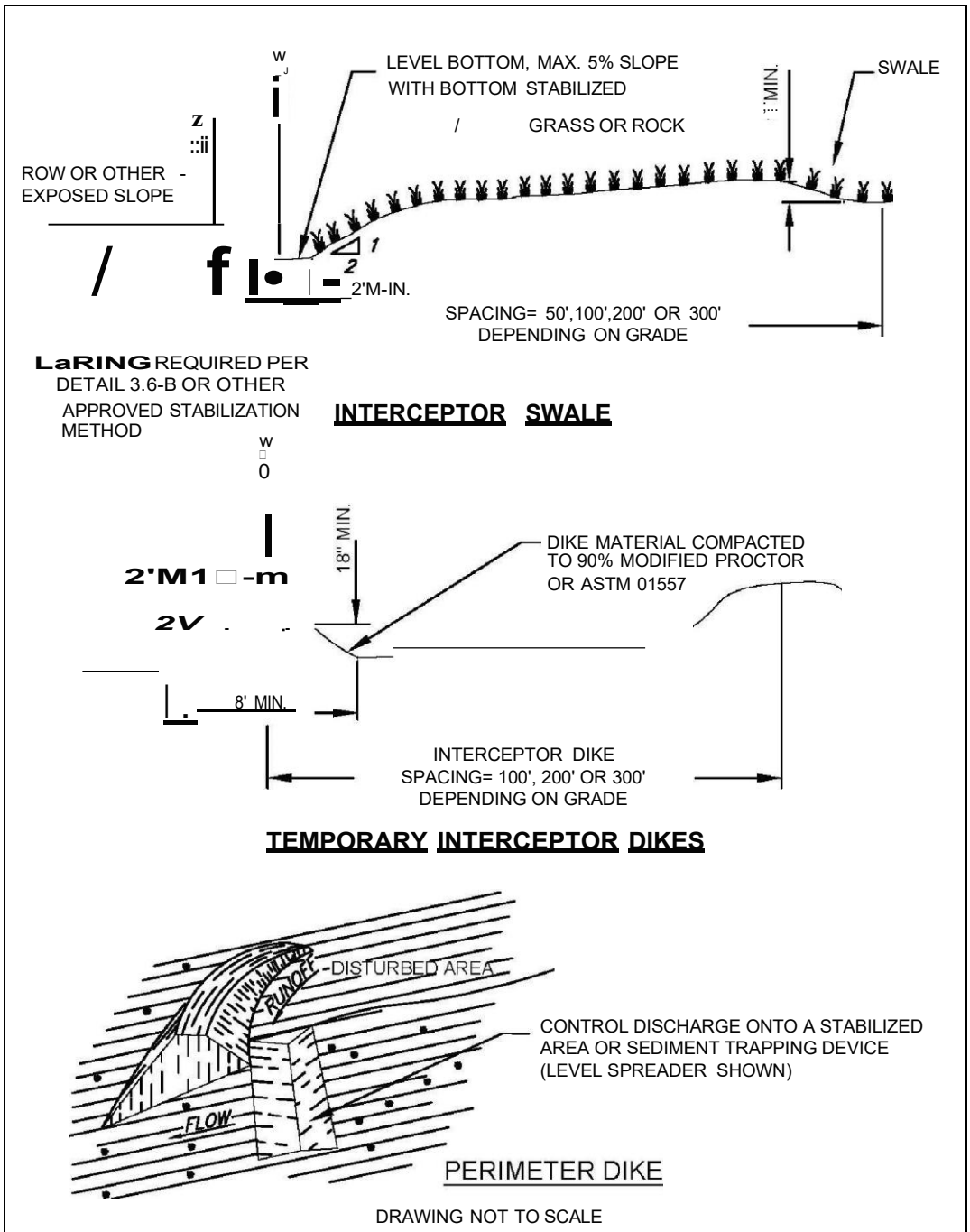


Figure 9: Schematic diagram of diversion dike and drainage swale installation

8.11. BMP 11: Drainage Swales

Purpose & Applicability

Drainage swales are designed to intercept and divert runoff from disturbed areas without causing erosion. They act as a first line of defense by reducing runoff volumes, slowing flow velocities, and directing flows to sediment control devices. Swales can be used either to convey sediment-laden flows to a sediment basin or to divert relatively "clean" runoff around disturbed areas.

- **Applicability:**
  - Convey surface runoff down sloping land while minimizing erosion.
  - Intercept and divert runoff from steep or disturbed slopes, paved surfaces, and concentrated flows.
  - Serve as temporary or permanent controls (e.g., vegetated swales for final stabilization).
  - Can be used in conjunction with diversion dikes, check dams, velocity dissipation devices, and other erosion controls.

Installation & Use Procedures

Proper design and installation of drainage swales require engineered calculations and careful construction practices (See figure 9):

- **Design & Calculations:**
  - Prepare drainage computations to determine channel shape, dimensions, slopes, and freeboard.
  - Design the swale to convey the calculated runoff volume from a 2-year, 24-hour storm.
  - The maximum contributing drainage area should generally be 5 acres or less, depending on site conditions.
  - Set the maximum flow depth to 1.5 feet (with provisions for overflow during larger storms); permanent swales if designed to local municipal standards.
- **Channel Geometry:**
  - Channels may be trapezoidal, parabolic, or V-shaped; note that V-shaped channels are generally used only where flow volumes and velocities are low.
  - For interceptor swales, side slopes should be 3:1 or flatter; temporary swales (less than 3 months) may use slopes of 2:1.
  - Provide a minimum freeboard of 6 inches.
- **Stabilization & Vegetation:**
  - For grades less than 2% and velocities under 6 feet per second, stabilize with grass, erosion control blankets, or anchored mulch.
  - For grades above 2% or velocities exceeding 6 feet per second, use turf reinforcement mats or riprap as appropriate.
  - Vegetated swales should be established to filter sediment and pollutants while reducing erosion.
- **Outlet & Integration:**

    - Design the outlet (discharge point) to ensure non-erosive velocities or incorporate velocity dissipation devices.
    - Ensure diverted runoff from disturbed areas is conveyed to a sediment control (e.g., sediment basin) or treatment facility.
    - Where applicable, integrate diversion dikes with the swale.
- **Documentation:**
    - Attach contractor illustrations, design calculations, and references to applicable standards.
    - Mark swale locations and outlet points on the SWPPP site map.

Maintenance & Management

Regular inspections and timely maintenance are essential to maintain hydraulic capacity and performance:

- **Inspection Schedule:**
    - Inspect temporary swales prior to the rainy season, after rainfall events, and regularly throughout the rainy season.
    - Check channel linings, embankments, and outlets for erosion, washouts, debris, or sediment accumulation.
- **Maintenance Actions:**
    - Remove accumulated sediment to maintain channel capacity.
    - Repair any damage to berms, sidewalls, or outlet structures promptly.
    - Replace lost riprap, damaged linings, or soil stabilizers as needed.
    - Temporary swales should be completely removed once the drainage area is stabilized or at project completion.

Performance Criteria

The effectiveness of the drainage swale BMP is determined by:

- The swale's ability to convey runoff at non-erosive velocities while reducing overall flow volume across disturbed areas.
- Effective interception and diversion of sediment-laden runoff into designated sediment control devices (e.g., sediment basins) without significant bypass.
- For vegetated swales, successful establishment of vegetation that filters sediment and pollutants while reducing erosion.
- Maintenance of hydraulic capacity and proper channel geometry as verified by regular inspections.
- No adverse impacts on upstream or downstream conditions, with all overflows managed safely.

8.12. BMP 12: Dust Control

Purpose & Applicability

This BMP is designed to mitigate wind erosion and control dust emissions from construction sites. Fugitive dust generated from bare earth surfaces, whether by stormwater runoff, wind, erosion, or vehicle track-out, can negatively affect air quality and water quality if transported into storm drains. Effective dust control reduces particulate matter in the air, protecting worker health and nearby residents.

Note: *For certain counties in Utah, construction projects disturbing more than ¼ acre are required to submit a Fugitive Dust Control Plan (FDCP) to the Utah Division of Air Quality (UDAQ) before beginning work. Where required, this plan must outline measures to minimize dust emissions, ensuring compliance with opacity limits of 20% on-site and 10% at the property boundary.*

- **Applicability:**
  - Use on all bare earth areas where vegetation has been removed, such as during grading, earthmoving, or demolition operations.
  - Applicable to areas experiencing high vehicle traffic on unpaved surfaces, soil and debris storage piles, blasting, and wrecking ball operations.
  - Essential for preventing dust from being re-entrained by subsequent vehicular traffic and carried into public storm sewer systems.
  - To be used in conjunction with other erosion control and stormwater BMPs (e.g., revegetation, seeding, mulching).

Installation & Use Procedures

To effectively control fugitive dust, implement the following procedures:

- **Control Methods:**
  - **Mechanical Methods:** Install geotextiles, mats, plastic covers, or other physical barriers over bare soil.
  - **Dust Palliatives:** Apply soil binders or chemical dust suppressants as prescribed by the manufacturer; note that all dust suppressants are temporary and require curing time (often 24 hours or longer) and may need reapplication after storm events.
  - **Revegetation:** Establish vegetation in disturbed areas to provide long-term stabilization and reduce dust generation.
  - **Water Application:** Apply water using a pressurized spray to moisten exposed soils and unpaved surfaces, preventing dust without causing runoff.
- **Documentation & Planning:**
  - Attach a copy of the Fugitive Dust Control Plan and applicable UDAQ permit information.
  - Include detailed descriptions of dust control tools, equipment, and suppression methods.
  - Document the specific locations and extents of treated areas on the SWPPP site map.

Maintenance & Management

Effective dust control is an ongoing process requiring regular monitoring and reapplication as necessary:

- **Implementation:**
  - Implement the Fugitive Dust Control Plan as outlined in the UDAQ permit.
  - Establish and maintain a schedule for reapplication of dust control measures throughout the construction project.
- **Monitoring:**
  - Periodically inspect treated areas to assess the effectiveness of dust control measures.
  - Adjust suppression methods and maintenance schedules based on field performance and weather conditions.
- **Maintenance Actions:**
  - Reapply dust suppressants following a storm event or when visible failures (e.g., spot failures, undercut stabilized soil) occur.
  - Record maintenance activities and any corrective actions taken.

Performance Criteria

This BMP is considered effective when:

- Dust emissions at property boundaries do not exceed established opacity limits (e.g., 10% opacity as per applicable regulations).
- No significant dust-related complaints are received from neighbors, and inspections confirm that dust control measures are in place and effective.
- All dust-generating operations are managed according to the Fugitive Dust Control Plan, with consistent adherence to established procedures.

9. Sediment Controls

9.1. BMP 13: Sub-Grade Sediment Trap (Curb Cut-Back)

Purpose & Applicability

This BMP is designed to capture sediment by creating a depressed grade sediment trap along the back of a curb. It intercepts and retains runoff from very small drainage areas (such as parkways, medians, or pavement edges) and is especially useful at construction sites within rights-of-way or single residential lots where the drainage area is limited, and final site stabilization is pending.

- **Applicability:**
  - Use along project boundaries where the slope directs runoff toward the curb.
  - Suitable for controlling sediment from limited drainage areas at the back of curbs, medians, or where pavement sections are removed.
  - Not applicable for sites without overtopping runoff or where final stabilization is complete.

Installation & Use Procedures

To ensure effective sediment capture, adhere to the following procedures (See figure 10):

- **Excavation Design:**
  - Excavate soil behind the curb to create a depressed area with a minimum width of 4 feet.
  - The longitudinal (along-curb) slope must not exceed 2%, and the transverse (toward-curb) slope must not exceed 3%. Steeper slopes require additional sediment controls.
  - The maximum width of the contributing drainage area should be limited to 12 feet; no other drainage areas should contribute runoff to the trap.
- **Additional Measures:**
  - Install erosion control blankets at low or sag points along the curb where flow may become concentrated.
  - The excavation may be offset up to 5 feet from the curb to avoid utility boxes.
  - Where a curb cut for a driveway is encountered and no driveway is constructed, securely install a wood plank (e.g., 2×4 or 4×4) across the curb to maintain continuity.
- **Documentation:**
  - Clearly identify the location and dimensions of the curb cut-back on the SWPPP site map and attach contractor illustrations detailing the excavation design.

Maintenance & Management

Regular inspection and maintenance are critical to ensuring continued effectiveness:

- **Inspection Frequency:**
  - Inspect the depressed grade sediment trap during each routine inspection period and after any storm events.
- **Maintenance Actions:**

- Use a shovel or blade to remove accumulated sediment when it reaches at least half of the original excavation depth.
- Re-grade the depression if disturbed by construction traffic.
- Monitor low points, particularly where erosion control blankets are installed, during rain events to ensure they are effectively preventing sediment from flowing onto the pavement.
- Add additional controls as needed if erosion or sediment bypass is observed.

Performance Criteria

This BMP is considered effective when:

- Runoff is captured within the depressed area, and sediment-laden water does not overtop the curb.
- The sediment trap retains the expected volume of runoff based on the 2-year, 24-hour storm design without significant sediment loss.
- Structural integrity of the curb and depressed area is maintained, with any sediment accumulation managed through regular maintenance.

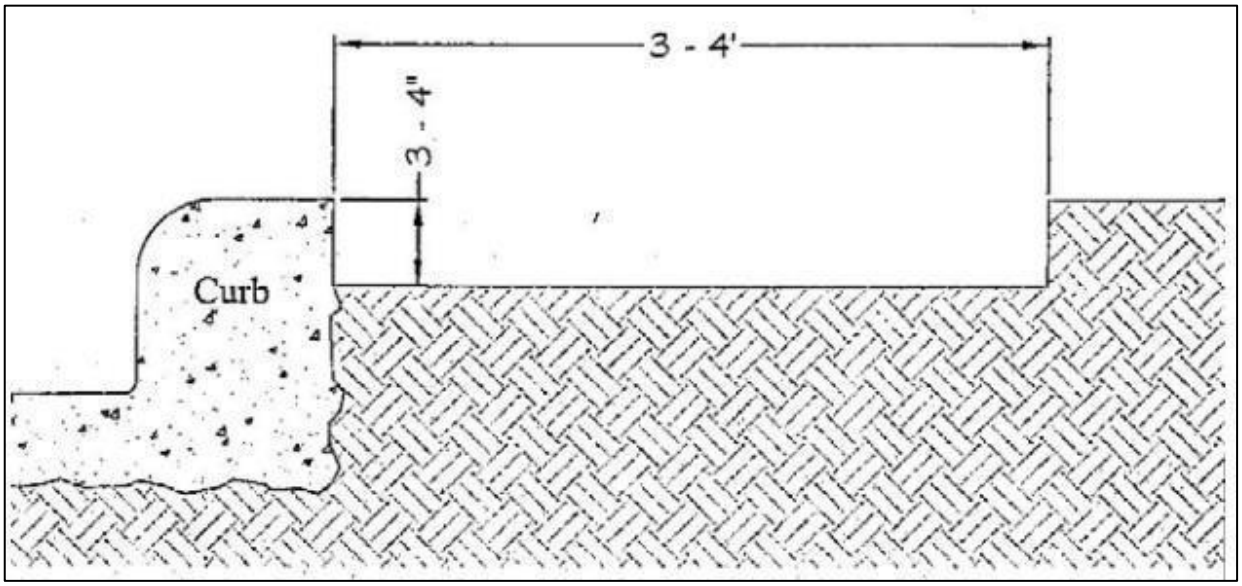


Figure 10: Schematic diagram for curb cut-back installation

9.2. BMP 14: Vegetated Filter Strips and Buffers

Purpose & Applicability

Vegetated filter strips and buffers are designed to reduce the velocity of sheet flow and promote infiltration, thereby removing sediment as runoff is filtered through vegetation. They serve as both primary (in select conditions) and secondary sediment controls.

- **Applicability:**
  - Use along development project perimeters, around stockpiles, along streams, and adjacent to roadways to intercept runoff from disturbed areas.
  - Suitable for sites where sheet flow runoff occurs, particularly on small, disturbed drainage areas (maximum contributing drainage area of 2 acres).
  - Effective when installed along contours in areas not subjected to concentrated flows.
  - Not recommended when high groundwater, shallow bedrock, or low soil permeability inhibit infiltration.

Installation & Use Procedures

To ensure effective sediment control, install vegetated filter strips and buffers following these guidelines (See figure 11):

- **Site Planning & Layout:**
  - Preserve existing vegetation along floodplains, wetlands, and natural waterways whenever possible. When disturbance is necessary, phase development to retain a vegetated buffer until final stabilization.
  - For newly planted strips, establish the filter along a line of constant elevation (contour) to maximize sheet flow interception.
  - Design the width of the vegetated filter strip to be a minimum of 15 feet; increase width based on the slope of the disturbed area, ensuring the maximum slope of the filter is 5% across its width in the direction of flow.
  - Limit the maximum sheet flow path length to 150 feet and ensure that the contributing drainage area is within design limits (e.g., less than 2 acres).
- **Vegetation & Stabilization:**
  - For newly planted areas, immediately establish sod or use erosion control blankets (ECBs) to protect the surface until vegetation is mature.
  - When using established vegetation as a buffer, clearly mark and protect the area using fencing, flagged stakes (maximum spacing 6 feet), or other protective measures to prevent disturbance.
  - If vegetated strips are used for slope protection, plant directly on slopes flatter than 2:1. For slopes of 2:1 or steeper, establish vegetation on terraces (with a transverse slope of about 1% back into the ground).
- **Documentation & Mapping:**
  - Attach contractor illustrations detailing the layout, dimensions, and design criteria (including drainage area, slope limitations, and vegetation specifications) to the SWPPP.
  - Include any engineering calculations or site-specific adjustments based on local conditions and municipal requirements.

Maintenance & Management

Regular maintenance and monitoring are critical for ensuring continued performance of vegetated filter strips and buffers.

- **Inspection Schedule:**
  - Inspect the vegetated buffer during each routine inspection period and after any storm events.
  - Check for rill erosion, bare spots in vegetation, and accumulation of sediment that could bury the vegetated area.
- **Maintenance Actions:**
  - Rake or lightly remove sediment from the vegetation as needed to prevent clogging while avoiding damage to plant cover.
  - Remove trash and debris from the vegetated area promptly.
  - Inspect the established vegetation for bare areas; re-plant sod or install seeded erosion control blankets as necessary to maintain at least 80% ground cover.
  - Mow or trim vegetation as needed after maturation to maintain the integrity of the buffer.
  - If sediment accumulation is excessive, consider installing additional secondary controls (e.g., organic filter tubes or silt fence) along the upslope edge of the buffer.

Performance Criteria

This BMP is considered effective when:

- The vegetated filter strip or buffer reduces sheet flow velocity and effectively filters sediment before runoff enters adjacent water bodies.
- The vegetation remains intact and covers at least 80% of the area, with minimal bare soil exposure.
- No significant rill erosion or sediment bypass occurs along the buffer; runoff is adequately slowed, and sediment is deposited within the buffer.
- The buffer remains stable under design storm events and is not overwhelmed by sediment load.

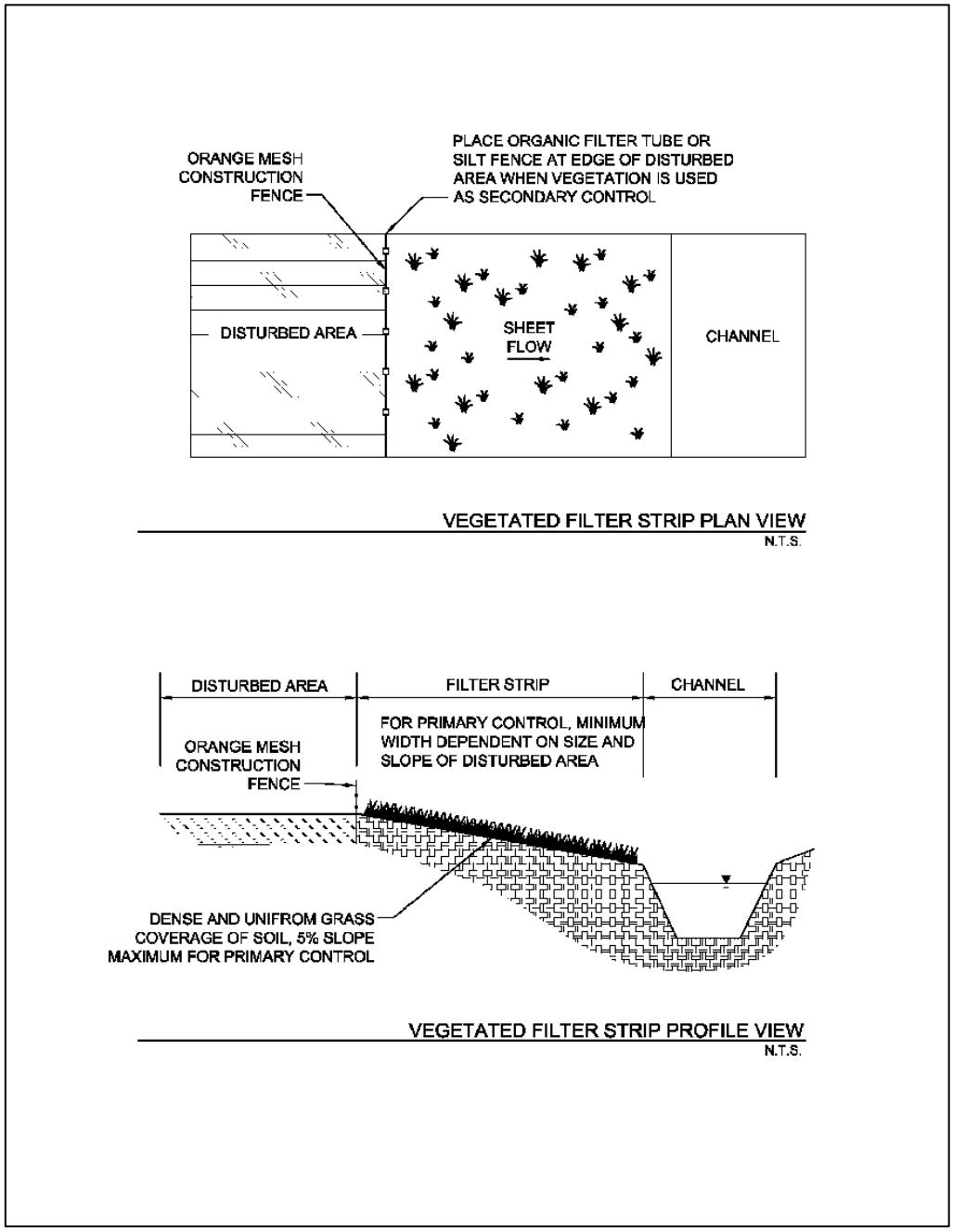


Figure 11: Schematic diagram for vegetation filter strip applications

9.3. BMP 15: Silt Fence

Purpose & Applicability

This BMP is designed to intercept and detain sediment from disturbed areas during construction and to decrease the velocity of sheet flows. It is intended to prevent sediment from leaving the site and entering sensitive downstream resources.

- **Appropriate Applications:**
  - Use along the downstream boundaries of disturbed areas, stockpiled materials, or minor channels where runoff occurs as sheet flow.
  - Apply to construction sites with relatively small drainage areas, generally, not exceeding 0.25 acre per 100 feet of fence length, with a maximum flow rate of 0.5 cfs and a maximum flow path of 200 feet (reduced further on steeper slopes).
  - Most effective in sandy or silty soils; for predominately clay soils, consult a soils engineer.
- **Limitations:**
  - Not suitable for controlling large volumes of concentrated runoff.
  - May create a temporary sedimentation pond upstream of the fence, which can cause temporary flooding if not managed.
  - Effectiveness is highly dependent on proper installation, including correct pore size selection and secure anchoring.

Installation & Use Procedures

To ensure optimal performance, install the silt fence as follows (See figure 12):

- **Installation Requirements:**
  - Construct the fence along a line of constant elevation (contour line).
  - Anchor the filter fabric below the ground surface by excavating a trench (approximately 6 inches wide and 6 inches deep) at the toe of the fence.
  - Silt fence posts shall be set at a minimum depth of 1 foot and spaced no more than 6 feet on center. Position posts on the downslope side of the silt fence.
  - Extend at least 20 inches of filter fabric into the trench and backfill with compacted 3/4-inch washed gravel or native material.
  - Overlap adjacent fabric sections by at least 3 feet and secure joints at support posts to prevent bypass.
  - The ends of the fence should be installed in a “J-hook” configuration, turning upslope for at least the last 10 feet, with additional upslope runs every 200 to 400 feet as required.
- **Design Criteria & Documentation:**
  - Ensure the drainage area contributing to the fence does not exceed the design capacity (0.25 acre per 100 linear feet of fence and maximum flow of 0.5 cfs).
  - Follow manufacturer recommendations for filter fabric selection based on soil type (consider tensile strength, puncture resistance, burst strength, apparent opening size, and UV resistance).

Maintenance & Management

Regular maintenance and monitoring are essential to ensure the silt fence continues to perform as designed.

- **Inspection Schedule:**
  - Inspect the silt fence during each routine inspection period and after any storm event.
  - Check for signs of undercutting, sags, tears, gaps at the ground interface, or clogging of the fabric.
- **Maintenance Actions:**
  - Remove accumulated sediment from the fence base when sediment buildup reaches one-half of the fence height.
  - Repair or replace damaged fabric promptly to prevent bypass or structural failure.
  - If concentrated flows or excessive sediment buildup occur, implement additional measures such as reinforcement with additional control measures.
  - Provide sufficient room for sediment removal equipment and document maintenance activities.

Performance Criteria

This BMP is considered effective when:

- The silt fence allows water to pass while effectively trapping and detaining sediment behind it.
- There is no significant bypass of runoff around, under, or over the fence.
- The fence effectively filters sediment during non-concentrated, sheet flow conditions and does not become overwhelmed by runoff from drainage areas exceeding design capacity.
- Structural integrity and installation details (proper anchoring, overlap, and toe embedment) are maintained.

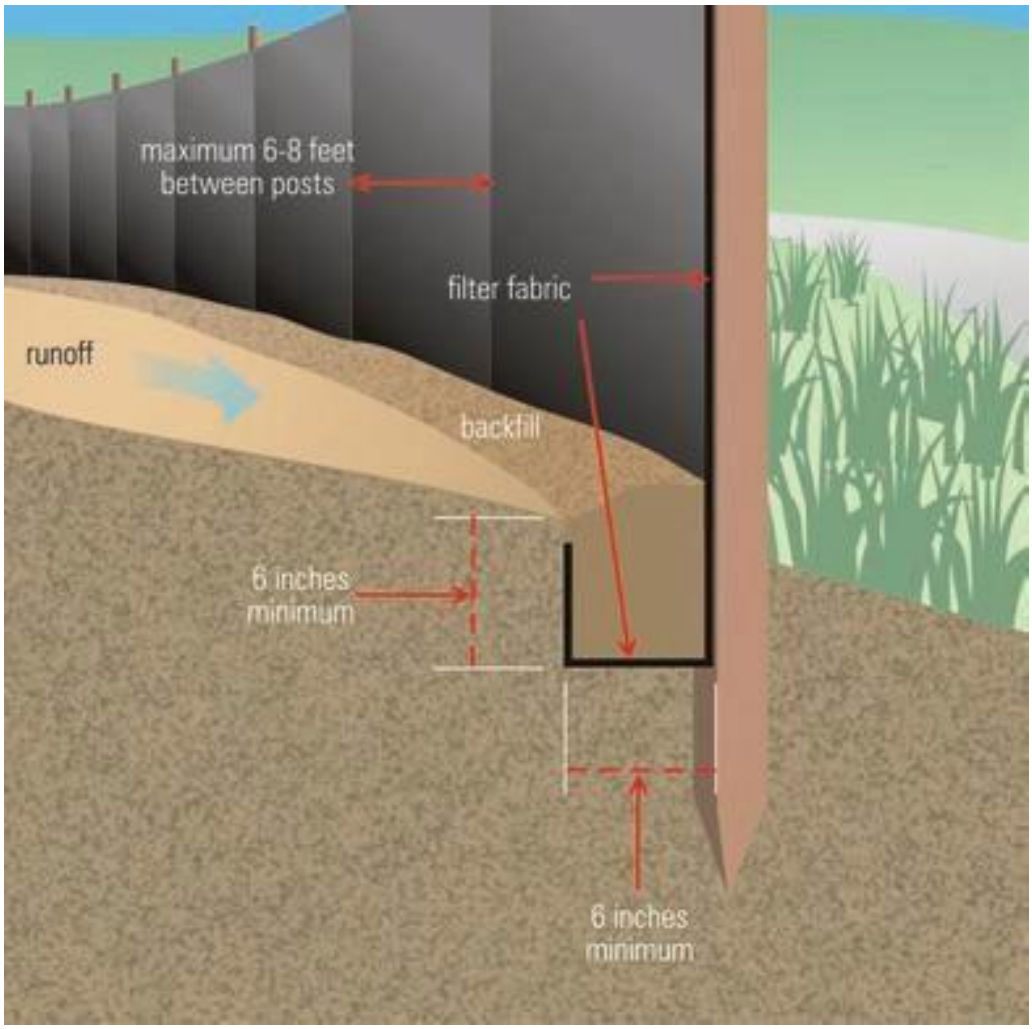


Figure 12: Image detailing installation specifications for silt fencing

9.4. BMP 16: Organic Filter Tubes (Straw Wattle)

Purpose & Applicability

Organic filter tubes are long, flexible controls installed along a line of constant elevation (contour) on slopes to intercept and slow runoff, maintain sheet flow, and capture sediment. They serve as perimeter controls downslope of disturbed areas, around temporary stockpiles, and on side slopes.

- **Applicability:**
  - Use as a temporary sediment barrier on development sites, linear projects (e.g., roadways, utilities), and individual residential lots or redevelopment sites with limited space.
  - Effective in coarse to silty soil types; additional controls may be required for fine silts and clay soils.
  - Can serve for inlet protection or, in limited cases, as check dams in small drainage swales when contact with the soil surface can be maintained.
  - When incorporated into final stabilization, tubes must be constructed of 100% biodegradable natural fibers (e.g., jute, coir, sisal) or 100% UV photodegradable plastic, polyester, or geosynthetic material.
  - Not ideal for use on paved surfaces (See BMP 20 Weighted Filter Berm), but if doing so, use gravel bags draped over the wattle at similar spacing stakes

Installation & Use Procedures

To ensure effective performance of organic filter tubes, follow these installation guidelines (See figure 8):

- **Placement & Alignment:**
  - Install filter tubes along the contour of the slope to maximize sediment capture and maintain sheet flow.
  - Secure tubes using 2-inch by 2-inch wooden stakes (or rebar/metal stakes) spaced no more than 4 feet apart.
- **Embedding & Overlap:**
  - Embed tubes at least three inches into the soil.
  - When connecting multiple tubes to form a continuous barrier, ensure an overlap of at least 6 inches between adjacent tubes.
- **Upstream Edge & Sizing:**
  - Place loose mulch material against the upstream side of the tubes to promote intimate soil contact.
  - Turn the last 10 feet (or more) at the ends of the tube line upslope to prevent bypass by stormwater. Additional upslope turns may be required every 200 to 400 feet depending on the traverse slope.
  - Typical tube diameters range from 6 to 24 inches; tubes may be available from 4 inches up to 36 inches. Note that tubes less than 8 inches in diameter when filled will require more frequent maintenance.
  - Refer to Table 4 for guidance on appropriate sizing and maximum allowable drainage area.
- **Manufacturer Guidance:**
  - When using manufactured organic filter tube products, follow the manufacturer's recommendations for diameter and spacing if they are more stringent than these

design criteria (See Table 4).

- **Material Selection:**
  - **Tube Mesh:** Specify mesh with a rated life of at least one year. The mesh must be open, evenly woven, and have openings sized appropriately for the chosen filter material (generally not exceeding ½ inch).
  - **Filter Material Options:**
    - Straw: Must be Certified Weed Free Forage, in good condition, air-dried, and free of mold.
    - Wood Chips: Use 100% untreated chips, free of inorganic debris, with sizes between 1 and 3 inches and shavings less than 5% of total mass.
    - Coir Fiber: Use natural coconut fiber rolls or mats, free of synthetic additives, suitable for sediment filtration and biodegradable over time.

Table 4: Perimeter Control Applications

Tube Diameter (minimum)	Max Flow Length to the Tube	Drainage Area Max
18 inches	145 feet	1/3 Acre per 100 feet
15 inches	110 feet	1/4 Acre per 100 feet
12 inches	85 feet	1/5 Acre per 100 feet
9 inches	55 feet	1/8 Acre per 100 feet

Maintenance & Management

Routine inspection and prompt maintenance are essential to ensure continued effectiveness of organic filter tubes.

- **Inspection Schedule:**
  - Inspect organic filter tubes during each routine inspection period and after any storm event.
  - Verify that tubes remain in continuous contact with the soil at the bottom of the embedment trench.
- **Maintenance Actions:**
  - Check for rill erosion developing beneath the tubes; repair eroded spots immediately and consider additional controls if erosion persists.
  - Ensure that staking remains secure; re-stake or repair tubes that have shifted due to stormwater runoff.
  - Inspect for signs of splitting, tearing, or unraveling; repair or replace damaged tubes as needed.
  - Remove accumulated sediment from behind the tubes before it reaches half the height of the exposed portion of the tube.
  - When sediment control is no longer required, consider splitting the tubes open and reusing the filter material for mulching during final site stabilization if it meets specified criteria.

Performance Criteria

This BMP is considered effective when:

- Organic filter tubes maintain their position along the contour with full contact at the bottom of the embedment trench.
- Runoff passes over or through the tubes, with sufficient detention to allow sediment to settle, and minimal bypass occurs.
- The tubes capture at least 75% of the sediment load (as verified by manufacturer documentation or testing), thereby reducing sediment transport off-site.
- Regular maintenance prevents clogging; sediment is removed before it reaches half the exposed tube height.

9.5. BMP 17: Earth Berm Barrier

Purpose & Applicability

Earth berms (also referred to as filter berms, diversion berms, or earth berm barriers) are constructed from compacted soil or other organic materials to slow, pond, and filter runoff. They are used as perimeter controls downslope of disturbed areas and alongside slopes to divert or intercept sediment-laden runoff. These berms are particularly well suited for sites with small, disturbed drainage areas that are not subject to concentrated flows and that will ultimately be stabilized (seeded, sodded, or landscaped).

- **Applicability:**
    - Use as a temporary sediment control measure to divert runoff from disturbed areas toward a sediment trap or basin.
    - Suitable for both development sites and linear (roadway) projects with small drainage areas.
    - Most effective on coarse to silty soil types; additional controls may be needed for fine silts and clays.
    - Economical due to ease of installation and potential to be tilled into the soil at project completion, thereby enhancing the organic content of the site.

Installation & Use Procedures

To ensure effective performance of earth berms, follow these detailed procedures (See figure 13):

- **Planning & Site Preparation:**
    - Install berms prior to any major earth-disturbing activities (e.g., clearing, grading) on the downslope boundary of the disturbed area.
    - Plan berm placement along a line of constant elevation (contour line) to maximize the available ponding area and prevent concentration of flow against the berm.
    - Coordinate berm installation with access route planning to minimize interference with construction operations.
- **Design Criteria:**
    - Limit the contributing drainage area to a maximum of 0.25 acre per 100 linear feet of berm.
    - For flow diversion, ensure that the maximum flow to any 20-foot section does not exceed 1 cubic foot per second and that the maximum flow distance to the berm is 200 feet (reduced to less than 50 feet if the slope exceeds 10%).
    - Design berms based on intended shape:
        - **Trapezoidal Berms:** Approximately 1.5 to 3 feet high, with a top width of 2 to 3 feet and a base width of 3 to 6 feet.
        - **Windrow (Triangular) Berms:** Approximately 1 to 2 feet high and 2 to 4 feet wide
    - Berm side slopes should be 2:1 or flatter.
    - Roughen the soil surface before berm placement to improve adherence of the organic filter material.

    - If berms are constructed using organic materials (e.g., compost, wood chips), ensure that the material is free of chemical contamination, trash and debris.
- **Stabilization:**
    - Stabilize berms by seeding for long-term or permanent use.
    - Provide additional erosion control measures (e.g., erosion control blankets or turf reinforcement matting) where necessary.
- **Documentation:**
    - Clearly mark the berm location and dimensions on the SWPPP site map.

Maintenance & Management

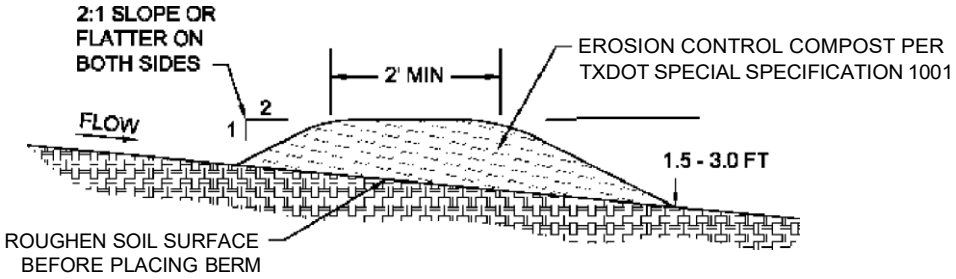
Regular monitoring and prompt maintenance are essential to ensure that earth berms continue to function as intended.

- **Inspection Schedule:**
    - Inspect berms during each routine inspection period and after any storm event.
- **Maintenance Actions:**
    - Remove accumulated sediment from the berm when sediment buildup reaches one-half the height of the berm to prevent overtopping.
    - Rake or redistribute sediment from areas where the berm is becoming clogged, ensuring the berm's dimensions and design are maintained.
    - Repair any signs of erosion, undercutting, or breaches promptly by replacing organic material or adding additional stabilization measures.
    - Stockpile excess organic material on-site for use in repairs to berms disturbed by construction activities.

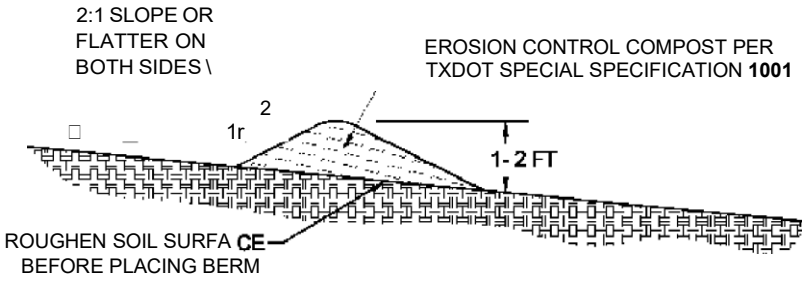
Performance Criteria

This BMP is considered effective when:

- The earth berm effectively intercepts and retains runoff, preventing sediment-laden water from bypassing and leaving the site.
- Runoff is diverted to designated sediment traps or basins, and the berm maintains its designed dimensions and stability.
- There is no significant erosion, breaching, or undercutting along or under the berm.
- Accumulated sediment is removed in a timely manner to prevent overtopping and maintain effective operation.



TRAPEZOIDAL SHAPED ORGANIC FILTER BERM
N.T.3.



TRIANGULAR SHAPED ORGANIC FILTER BERM
N.T.S.

NOTE: DIMENSIONS OF THE BERM SHALL BE DESIGNED BASED ON FLOW CONDITIONS. PROVIDE CALCULATIONS THAT DOCUMENT THE FOLLOWING PARAMETERS TO DESIGN THE SWALE:

- SIZE OF CONTRIBUTING DRAINAGE AREA
- DESIGN STORM
- FLOW RATE
- BERM HEIGHT AND WIDTH

Figure 14: Schematic diagram for earth berm barrier specifications

9.6. BMP 18: Gravel Filter Berms

Purpose & Applicability

Gravel filter berms are designed to intercept and detain sediment-laden water from unprotected areas. They function by slowing runoff, allowing sediments to settle while releasing water in sheet flow.

- **Applicability:**
  - Use as a temporary measure to retain sediments near the toe of slopes and at construction site perimeters.
  - Suitable for areas where runoff from unprotected surfaces (e.g., roadways, unsurfaced rights-of-way) must be treated before discharge.
  - Can be applied as check dams across one or more lanes of temporary construction roads or unsurfaced rights-of-way subject to construction traffic.
- **Limitations:**
  - Limit the contributing drainage area upstream of the barrier to 5 acres and to gently sloping areas.
  - Not recommended for landscaped areas due to cleanup difficulties.
  - Must be routinely maintained because of clogging from mud and soil.

Installation & Use Procedures

To achieve effective sediment retention, install the gravel filter berm according to the following guidelines (See figure 14):

- **Planning & Design:**
  - Construct the berm along a level contour to intercept sheet flow.
  - Provide an undisturbed or stabilized outlet suitable for sheet flow.
  - Ensure ample room is available between the berm and the toe-of-slope for sediment removal equipment.
  - For installations in stream beds, use large rock, secure with woven wire sheathing (gabions), and plan for daily inspections.
- **Materials & Construction (Open Graded Rock Berms):**
  - Build the berm with open graded rock sized as follows: use 3/4 to 3-inch diameter rock for sheet flow and 3 to 5-inch diameter rock for concentrated flow.
  - For non-traffic areas, construct the berm with a minimum height of 12 inches and a minimum width of 18 inches, with side slopes of 2:1 or flatter.
  - If using gravel bag berms, use bags made of woven polypropylene, polyethylene, or polyamide fabric. Typical bag dimensions are approximately 24–30 inches long, 16–18 inches wide, and 6–8 inches thick, with a fill weight of about 90–125 pounds.
  - When used as a linear control, install the gravel bag berm along a level contour, turning the ends upslope to prevent runoff bypass.
  - For concentrated flows, stack gravel bags in a pyramid configuration with upper rows overlapping joints in lower rows; provide a setback of at least 3 feet from the toe of the slope (or as far back as site conditions allow).
- **Integration with Other BMPs:**

    - Combine gravel filter berms with additional erosion control practices (e.g., seeding, mulching, silt fences) to enhance overall performance.
- **Documentation:**
    - Record the berm location on the SWPPP site map.

Maintenance & Management

Regular maintenance is essential to ensure the gravel filter berm continues to function effectively.

- **Inspection Schedule:**
    - Inspect the gravel filter berm during each routine inspection period and after any storm event.
- **Maintenance Actions:**
    - Remove retained sediments when accumulation reaches one-third of the berm height or 1 foot (whichever is less) to maintain storage capacity.
    - Reshape or regrade the berm as needed to restore its original dimensions and functionality.
    - Replace or repair any dislodged or degraded materials (e.g., lost rock in gravel bag berms or damaged bag material).
    - Ensure that any additional erosion control measures (e.g., erosion control blankets) remain intact and effective.
- **Debris Management:**
    - Remove any trash or debris from the berm promptly to prevent clogging and reduced performance.
    - Coordinate maintenance with other site BMPs to ensure overall sediment control.

Performance Criteria

This BMP is considered effective when:

- The gravel filter berm successfully intercepts and detains sediment from runoff while allowing water to pass in sheet flow.
- Sediment is retained within the berm, and any accumulated sediment is removed before reducing the berm's effective storage capacity.
- The berm maintains its structural integrity and proper dimensions over time without significant erosion, undercutting, or bypassing of runoff.
- In traffic areas, the berm functions without posing safety hazards or causing damage to vehicle tires.

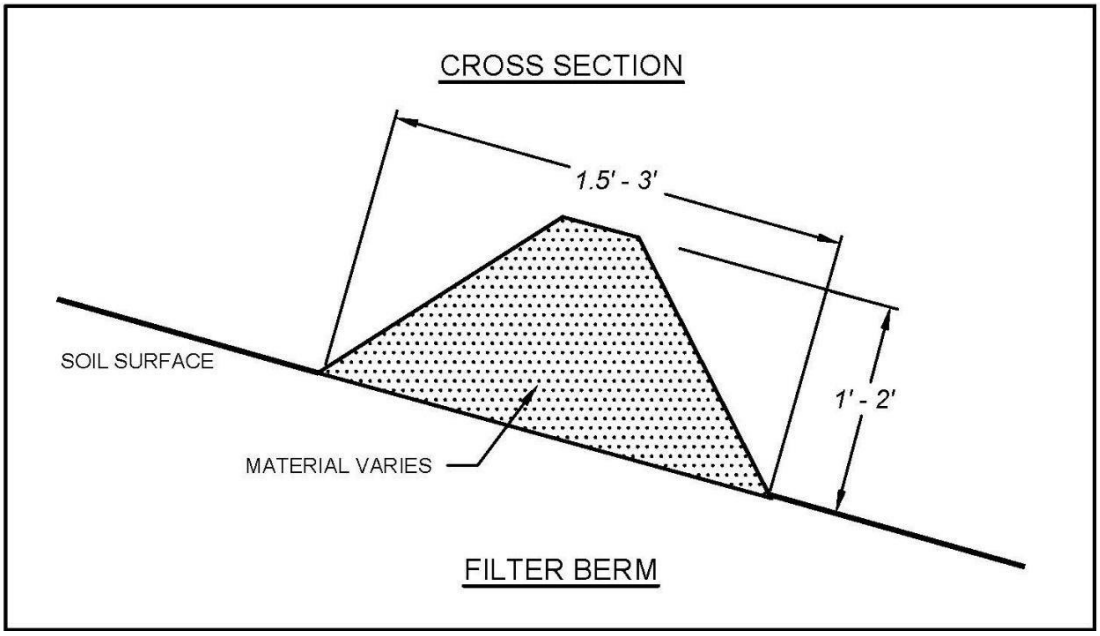


Figure 14: Schematic diagram of filter berm installation

9.7. BMP 19: Inlet Protection

Purpose & Applicability

Inlet protection is designed to reduce the amount of sediment, debris, and pollutants entering storm drain systems by acting as a secondary (or, in select cases, primary) sediment control measure. These measures serve as a backup to newly applied erosion controls or other sediment controls that alone may not achieve adequate sediment removal.

- **Primary Use:**
  - Typically used as a secondary sediment barrier at low point (sump) inlets where stormwater runoff will pond behind the protection measure and then either filter through the device or flow over an overflow weir.
  - May be used as a primary control only when all other primary measures are infeasible due to site configuration or construction activity.
- **Appropriate Applications:**
  - Best applied at low point inlets where runoff can pond, allowing sediment to settle or filter through the device.
  - Suitable for new developments with new inlets and roads not yet in public use; limited applications in developed areas (e.g., parking lot inlets during major roadway repairs) where other controls are not viable.
  - Inlet protection must allow the inlet opening to function (e.g., via inlet inserts) and should not completely block the inlet.
- **Limitations:**
  - Special caution is required on publicly traveled streets due to potential flooding, traffic, and pedestrian safety concerns.
  - Effective inlet protection depends on proper design, including a bypass capability to prevent blockage when the device becomes clogged.

Installation & Use Procedures

To ensure effective inlet protection, follow these procedures, which may be adapted based on site-specific conditions and inlet configurations (See figures 15 and 16):

- **General Installation Requirements:**
  - Evaluate drainage patterns to ensure that the inlet protection does not divert flow or cause flooding of adjacent roadways or properties.
  - Inlet protection devices must never completely block the inlet; they must include a bypass (overflow weir, positive overflow swale, or sufficient storage volume) to handle excess flows during a conveyance storm (typically a 25-year, 24-hour event).
  - Positive overflow drainage is critical; if overflow is not integrated, provide temporary routing of excess flows through established swales, streets, or watercourses.
- **Materials & Methods:**
  - **Filter Fabric and Wire Mesh:** When using fabric-based inlet protection (e.g., filter fabric fences), install according to the material requirements specified for silt fences (see BMP 15).
  - **Block and Gravel (Crushed Stone or Recycled Concrete) Protection:**
    - Use when flows exceed 0.5 cfs, allowing overtopping to prevent flooding.

- **Organic Filter Tube Protection:**
  - Use when contact with soil surface can be maintained.
  - Ensure the tube's diameter is at least 2 inches less than the inlet height and extends to a minimum of 12 inches past the curb opening on each side
- **Bagged Inlet Protection:**
  - Bags used on pavement shall be filled with aggregate, filter stone, or crushed rock (not sand) to minimize washout.
  - Filled bags should be 24-30 inches long, 16-18 inches wide, and 6-8 inches thick
  - Bags must be constructed of polypropylene, polyethylene, or polyamide woven fabric
- **Area Inlet Protection:**
  - Adapt installation methods based on inlet type (drop, "Y," etc.) and surrounding surfaces (parking lot, playground, etc.).
  - For filter fabric protection on area inlets, excavate a 6-inch by 6-inch trench at the toe of the fence, lay the fabric with 32 inches extending out, and backfill with compacted earth or gravel.

- **Documentation & Coordination:**
  - Attach all relevant proprietary illustrations, design calculations, and installation specifications to the SWPPP.
  - Clearly identify the inlet protection system's layout on the site map.
  - Coordinate with local municipalities and oversight authorities regarding any required approvals or modifications.

Maintenance & Management

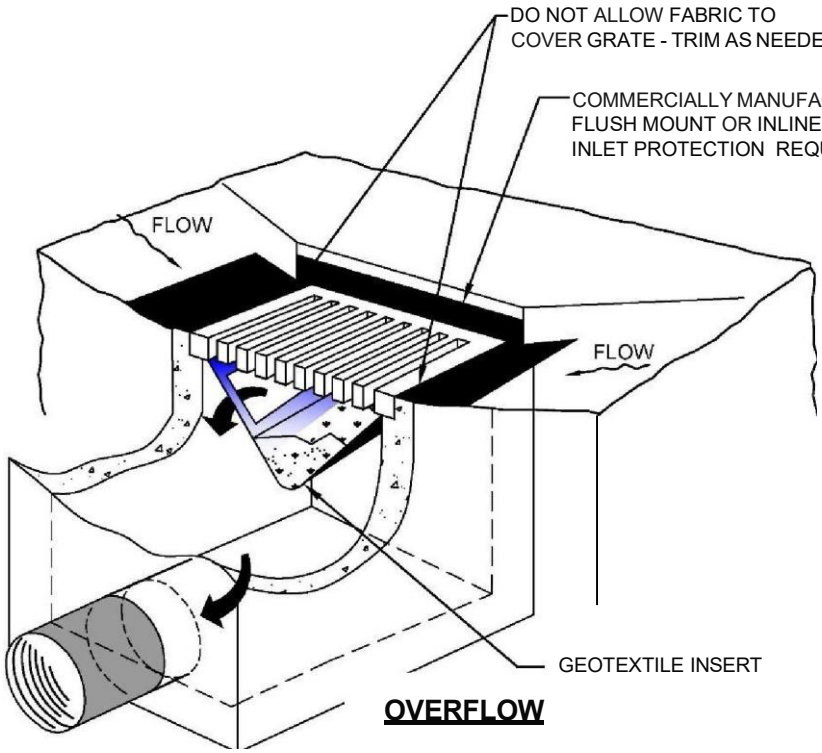
Regular maintenance and monitoring are essential to ensure inlet protection systems continue to perform effectively.

- **Inspection Schedule:**
  - Inspect inlet protection devices during each routine inspection period and after any storm event.
  - For curb inlet protection, check for any blockage, collapse, or damage that might inhibit flow through the inlet.
- **Maintenance Actions:**
  - Remove floatable debris and trash caught by the inlet protection after every storm event.
  - Remove sediment from curb inlet protection after each storm, given the limited storage capacity of curb inlets.
  - For area inlet protection, remove sediment before it reaches half the height of the device (or reduces excavation volume by 50% for impoundment systems).
  - Regularly check and clear weep holes to ensure proper drainage.
  - Inspect all components (filter fabric, organic filter tubes, bags, blocks, and wire mesh) for damage, repairing or replacing items as needed.
  - Remove inlet protection devices as soon as the drainage area contributing runoff is stabilized and permanently vegetated.

Performance Criteria

This BMP is considered successful when:

- The inlet protection system effectively reduces sediment, debris, and pollutants entering the storm drain without completely blocking the inlet.
- A bypass (overflow weir, positive overflow swale, or sufficient storage volume) is provided and functions properly during design storm events (e.g., 25-year, 24-hour storm) without causing roadway or property flooding.
- For curb inlet protection, a minimum 2-inch overflow gap or weir is maintained, and the system allows safe ponding to a depth not exceeding design limitations.
- The system maintains structural integrity, with no significant damage or clogging that compromises its function.
- Regular maintenance prevents excessive sediment accumulation (e.g., sediment must be removed before reaching half the height of the protection device), ensuring continued effective performance.



NOTE:
RECESSED CURB INLET MUST **BE** PROTECTED WHEN CURB INLET IS PRESENT.
SIZE OF FILTER FABRIC INLET SACK TO BE DETERMINED BY MANUFACTURER.

COMMERCIALLY MANUFACTURED DEVICES RATED AS "HIGH FLOW' REQUIRED IN LOCATIONS WHERE FREQUENT FLOODING OCCURS GRATES THAT ARE NOT REMOVABLE MAY UTILIZE COMMERCIALLY MANUFACTURED "TOP OF GRATE" DEVICE.

DRAVVING NOT TO SCALE

EROSION CONTROL MANUAL	STORM DRAIN INLET INSERT Detail Drawing 3.19-B

FILE DRAFT:INSPECTORS GRAPHICS DRAWING PLOT 1:1

Figure 15: Schematic diagram for storm drain inlet protection (interior protection)

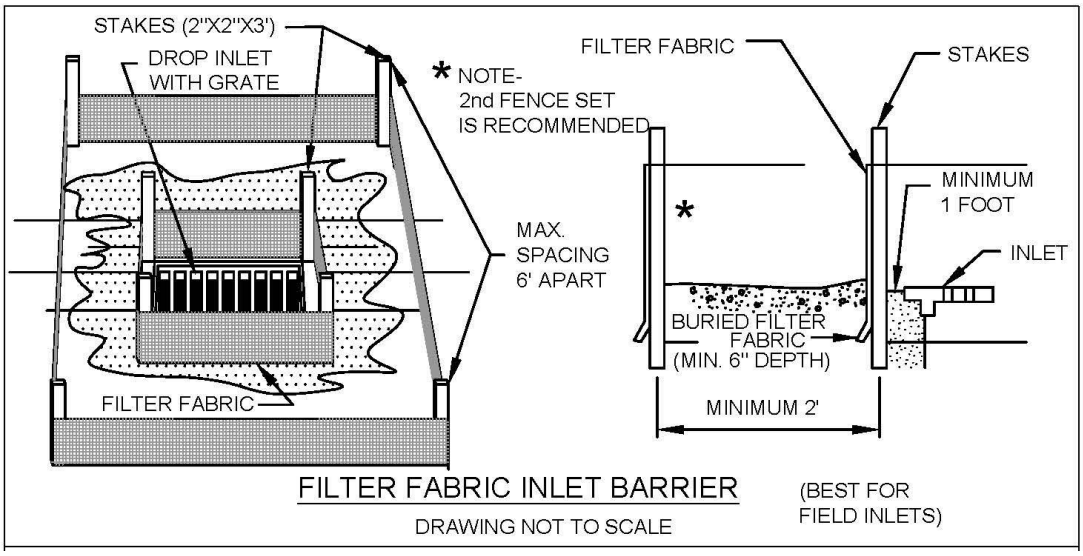


Figure 16: Schematic drawing for storm drain inlet protection (exterior protection)

9.8. BMP 20: Weighted Filter Berm

Purpose & Applicability

This BMP is designed to intercept and slow the flow of sediment-laden runoff by creating a temporary barrier using coarse material such as gravel-filled bags. The barrier allows sediment to settle before the water leaves the construction site on paved surfaces.

- **Applicability:**
  - Suitable for creating temporary sediment traps or retention basins and as an alternative to organic filter barriers or silt fences.
  - Effective for storm drain inlet protection because the sandbag barrier does not require anchoring to paved surfaces.
  - Can be used for both perimeter control (e.g., around stockpiles, along site boundaries, adjacent to fueling or chemical storage areas) and as a temporary diversion structure below the toe of exposed slopes.

Installation & Use Procedures

To ensure effective performance, follow these detailed procedures (See figures 17 and 18):

- **Design and Layout:**
  - Locate the weighted barrier on a level contour so that sheet flow runoff is intercepted and ponded.
  - For slope interruption, determine spacing based on slope steepness:
    - For slope with a 4:1 (H:V) or flatter ration, place sandbags at intervals up to 20 feet (with the first row near the slope toe).
    - For slopes between 4:1 and 2:1, reduce spacing to approximately 15 feet.
    - For slopes steeper than 2:1, use a maximum interval of 10 feet.
  - Turn the ends of the sandbag barrier upslope to prevent runoff from bypassing the barrier.
  - Provide sufficient upslope room for ponding and sediment storage; in some cases, set back the barrier from the slope toe to facilitate cleaning. Where set-back is not feasible, install the barrier at the toe and consider placing cross barriers (bags perpendicular to a berm) to prevent flows behind the barrier.
- **Materials & Construction:**
  - **Sandbag Material:** Use sandbags made of woven polypropylene, polyethylene, or polyamide fabric. Burlap is not acceptable.
  - **Bag Dimensions:** Typical sandbags should be approximately 18 inches long, 12 inches wide, 3 inches thick, and weigh about 33 lbs (nominal dimensions may vary based on locally available materials).
  - **Fill Material:** Use non-cohesive, Class 3 permeable material free from clay and deleterious substances (e.g., recycled concrete or asphalt may be acceptable if properly screened).
  - **Stacking and Layout:**
    - Stack sandbags in a continuous row, at least three bags high, using apyramid approach.
    - Butt the ends of bags tightly; overlap the butt joints of each successive row to create a continuous barrier.
    - Ensure the barrier is constructed to withstand sheet flow without being

overtopped or compromised.

Maintenance & Management

Regular inspection and timely maintenance are critical to ensure continued performance.

- **Inspection Schedule:**
  - Inspect the sandbag barrier during each routine inspection period and after any storm event.
  - Inspect for physical damage, gaps, or signs of sandbag degradation due to UV exposure or mechanical wear.
- **Maintenance Actions:**
  - Remove accumulated sediment when it reaches one-third of the barrier height (or 1 foot, whichever is less) to maintain effective storage capacity.
  - Reshape or replace sandbags as needed; sandbags exposed to sunlight may need to be replaced every 2–3 months.
  - Repair any washouts, breaches, or damage promptly and re-compact or re-stabilize the area as necessary.
  - Ensure that any disturbed or damaged sections are restored to the original design specifications.

Performance Criteria

This BMP is considered effective when:

- The sandbag barrier effectively slows runoff, creating a temporary ponding area that allows sediment to settle out before water leaves the site.
- The barrier maintains its structural integrity with no significant gaps, undercutting, or overtopping during runoff events.
- Regular maintenance keeps sediment accumulation below one-third of the barrier height, ensuring continued performance.

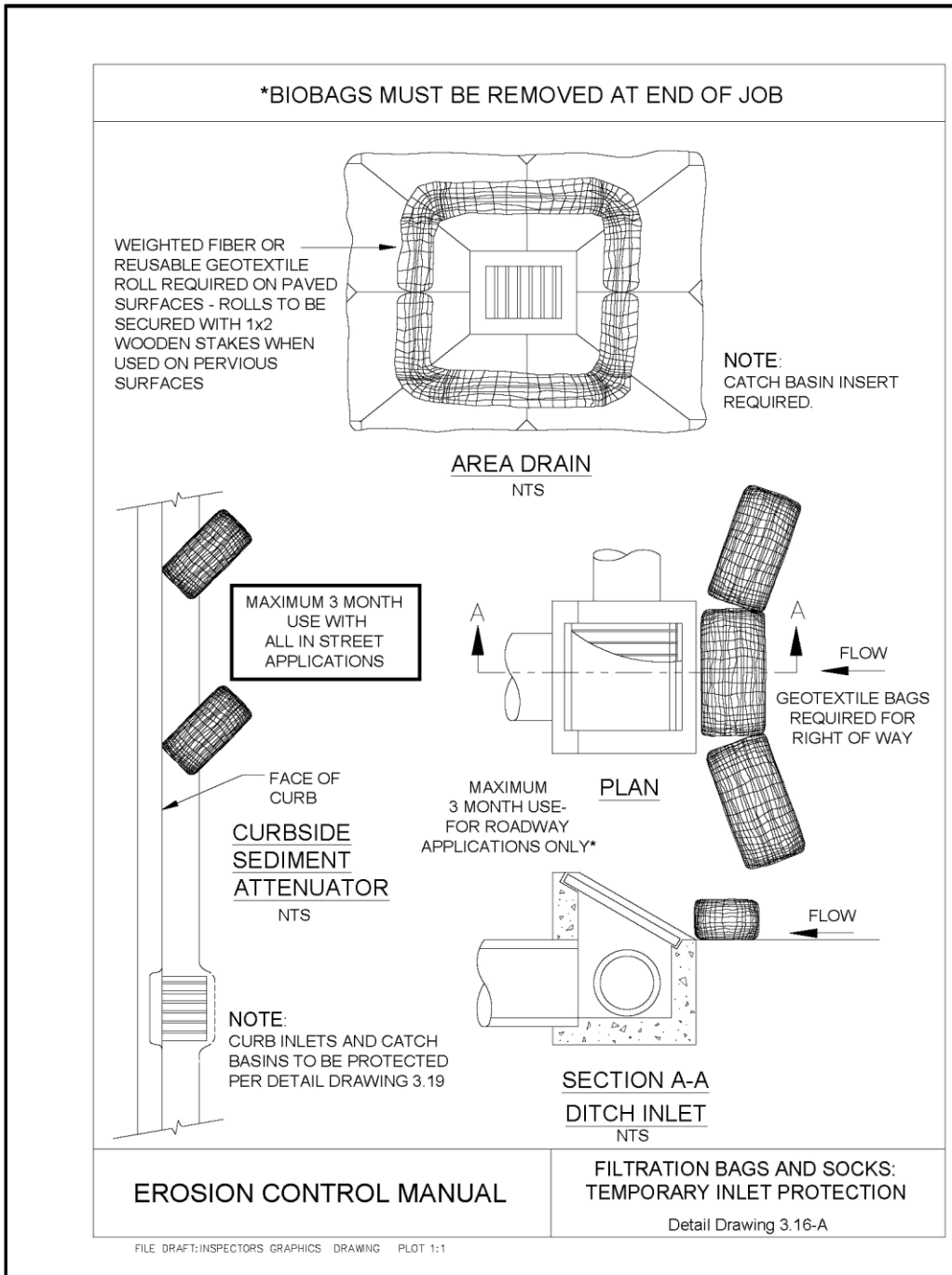


Figure 17: Schematic diagram of weighted filter berms for inlet protection

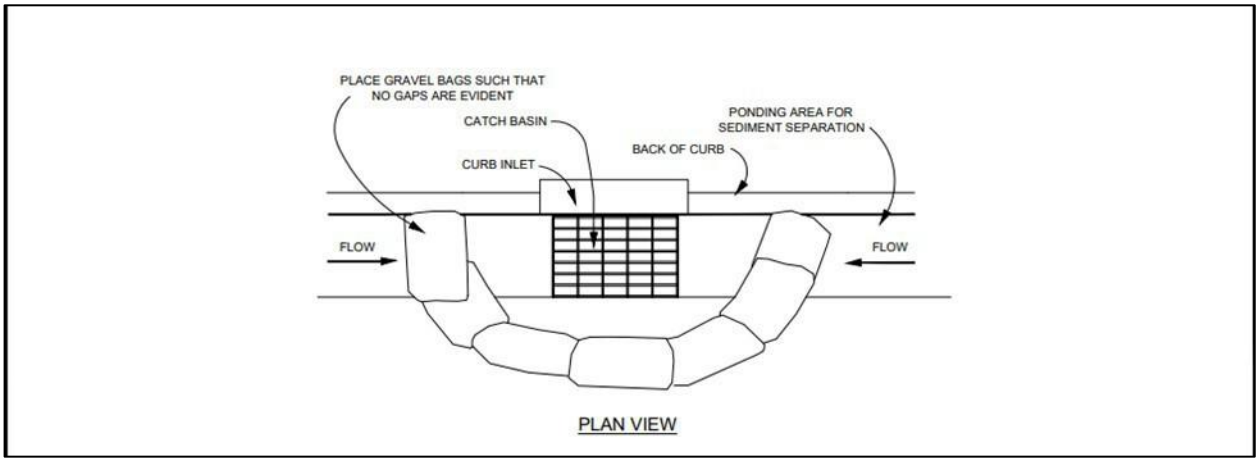


Figure 18: Schematic diagram of weighted filter berms for curb inlet protection

9.9. BMP 21: Gutter Dam

Purpose & Applicability

This BMP is designed to filter sediment-laden stormwater by slowing down flow in the gutter, thereby allowing sediment deposition before water reaches downstream inlets. It serves as a secondary control measure to inlet cover-only BMPs, ensuring that sediment bypass is minimized.

- **Applicability:**
  - Use where sediment-laden runoff is expected to be contained from downstream BMPs, such as in subdivisions with multiple builders.
  - Ideal for protecting inlets by slowing flow, particularly when coupled with other erosion control measures.
  - Not intended for high-flow areas without additional support measures.
  - Warning: This BMP is easily damaged by vehicles parked along the curb and gutter and by snow removal operations.

Installation & Use Procedures

To ensure effective sediment control with a gutter dam system, follow these procedures (See figure 19):

- **Installation Requirements:**
  - Install sand or gravel bags with a minimum diameter of 6 inches; double up bags as necessary.
  - Position the gutter dam upstream of storm drain inlets.
  - Ensure that the system is designed so that the first (upstream) dam holds more sediment than the downstream dams. Equal sediment accumulation among dams indicates system malfunction.

Maintenance & Management

Regular maintenance and inspections are essential to ensure the gutter dam system remains effective:

- **Inspection Schedule:**
  - Inspect the gutter dam system during each routine inspection period and after any storm event.
- **Maintenance Actions:**
  - Repair any damage and remove sediment deposits before storm events that could scour the sediment from the dam.
  - Ensure that following a storm event, the first (upstream) dam holds more sediment than subsequent dams. If sediment accumulation is equal among dams, additional or alternative BMPs may be necessary.
  - Monitor and repair any damage caused by vehicle parking or snow removal operations.
  - Maintain clear access around the gutter dam to facilitate inspections and to prevent hazardous driving conditions due to surface water.

Performance Criteria

This BMP is considered successful when:

- The gutter dam system slows the flow of runoff sufficiently to allow for effective sediment deposition.
- The system operates as a secondary control, in conjunction with erosion control measures, to minimize sediment bypass.
- Under rainfall events, the gutter dam does not experience significant scour. If significant scour occurs, an alternative BMP is warranted.
- The upstream dam consistently collects more sediment than downstream dams. If sediment deposits are equal or greater in downstream dams following storm events, the BMP is not performing as intended.
- Regular damage from traffic or snow removal that impairs function is addressed; persistent damage indicates that an alternative BMP should be considered.

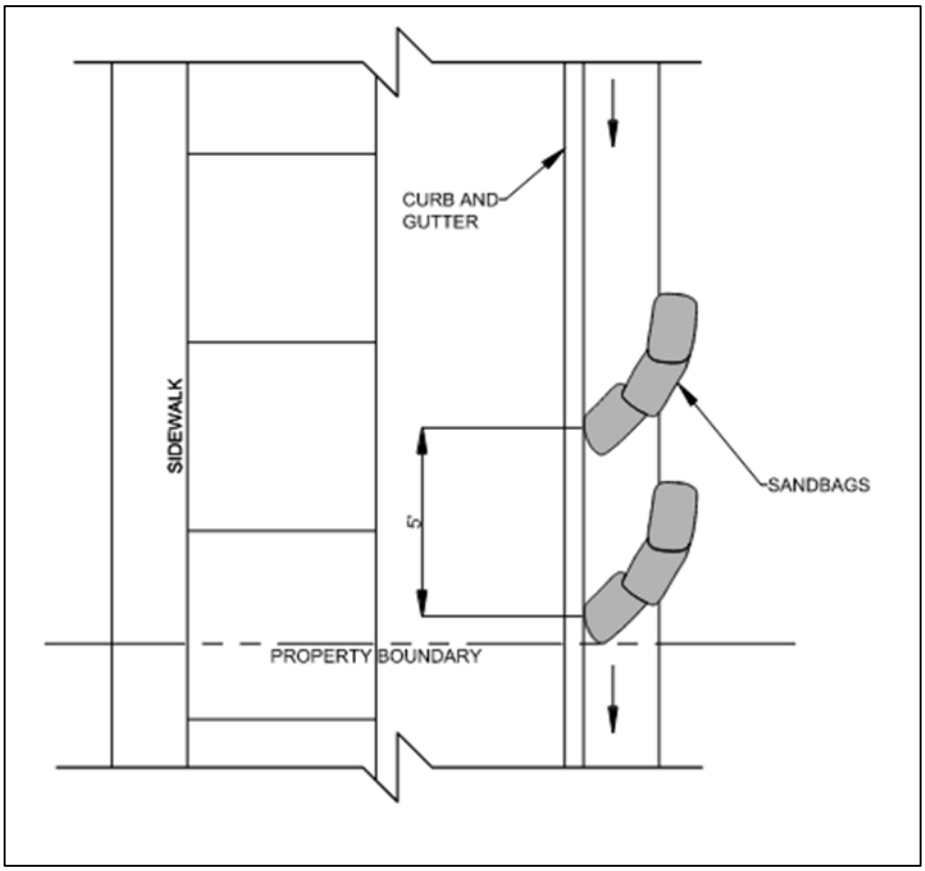


Figure 19: Schematic diagram of gutter dam installation

9.10. BMP 22: Sediment Basins and Traps

Purpose & Applicability

Sediment basins and traps are designed to collect and store sediment-laden water generated during construction activities. They act as treatment devices that temporarily impound runoff, allowing sediment to settle before the water is discharged. These measures help control silt-laden runoff until permanent erosion controls or stabilization measures (e.g., vegetation, permanent detention basins) are implemented.

- **Applicability:**
  - Use on construction projects where large drainage areas contribute runoff (e.g., disturbed areas ≥5 acres) or where a minor stream or off-line drainage channel crosses the site.
  - Applicable at sites where sediment-laden water is expected to enter the drainage system and where sediment control is critical prior to final stabilization.
  - Suitable for temporary use (design life <1 year) until the site is permanently protected against erosion.
  - Sediment traps are best for capturing larger particles (e.g., gravel, sand) and may be used in combination with additional treatment systems for finer particles.

Installation & Use Procedures

To ensure effective sediment capture and storage, install sediment basins and traps according to the following guidelines (See figures 20 and 21):

- **Basin Design & Sizing:**
  - Determine the number and size of basins or traps required based on the contributing drainage area. For smaller drainage areas (≤ 5 acres), multiple smaller basins may be more effective than one large basin.
  - Design the basin to provide for either:
    - The calculated runoff volume from a 2-year, 24-hour storm event, or
    - A volume of approximately 3,600 cubic feet per acre drained.
  - For sediment traps, ensure the structure is designed to capture and temporarily impound runoff from concentrated flows, typically at outlets of diversion structures, channels, or slope drains.
- **Construction Timing & Location:**
  - Construct basins and traps before clearing and grading begin to minimize sediment generation.
  - Locate the basin/impoundment on property limits, away from waters of the state, natural buffers, wetlands, or high groundwater areas.
  - Ensure that the basin is accessible for periodic cleanout and maintenance. Attach relevant topographic maps, grading sheets, and SWPPP site maps showing the basin location.
- **Structural Elements:**
  - **Basin Embankment:** May be formed by partial excavation and/or by constructing a compacted embankment. Embankments should be designed with side slopes of 3:1 or flatter and constructed with clay (meaning with sufficient plasticity) placed in 8-inch lifts and compacted.

- **Outlet & Spillway:**
  - Incorporate a primary outlet (e.g., a solid riser or surface skimmer) with a design dewatering time of at least 36 hours for the 2-year, 24-hour storm.
  - Provide an emergency overflow spillway with a crest elevation approximately 1 foot above the top of the riser.
  - Design the outlet to withdraw water from near the surface, minimizing sediment loss, and to pass the difference between a conveyance storm (e.g., 25-year, 24-hour) and the design storm without damaging the basin.
- **Sediment Trap Specifics:**
  - For excavated sediment traps, maintain a minimum depth of 1 foot (up to 2 feet maximum) and ensure that the volume of the trap is not reduced by more than 50% by sediment accumulation.
  - Install outlet protection (e.g., stone riprap, baffles, or anti-seep collars) to reduce erosion at the discharge point.
- **Emergency Spillway & Safety:**
  - Ensure the basin has a defined emergency spillway and is located such that failure would not result in loss of life or damage to public infrastructure.
  - Install fencing if required by local ordinances to prevent access by children.

- **Integration with Other BMPs:**
  - Use sediment basins and traps in conjunction with upstream erosion controls (e.g., seeding, mulching, diversion dikes) to reduce sediment load and enhance overall effectiveness.

Maintenance & Management

Regular maintenance and inspections are critical for ensuring sediment basins and traps continue to function as designed.

- **Inspection Schedule:**
  - Inspect the sediment basin/trap before and after each rainfall event and as part of regular scheduled inspections.
  - Monitor embankment integrity, outlet function, and the condition of erosion controls and spillways.
- **Maintenance Actions:**
  - Repair any damage to berms, spillways, sidewalls, or outlet structures promptly.
  - Remove accumulated sediment when it reaches approximately one-third of the basin's designed sediment storage capacity to maintain effectiveness.
  - If using an excavated trap, drain the basin within 36 hours after a rainfall event if runoff has not completely drained.
  - Regularly clear obstructions (trash, debris) from the outlet and spillway to maintain proper flow.
  - Coordinate sediment removal and disposal as per site-specific plans, either redistributing sediment to in-fill areas or removing it to an approved off-site location.
  - After the site is permanently stabilized, convert temporary sediment basins to permanent detention basins if required, ensuring that stabilization measures meet local and UPDES requirements.

Performance Criteria

This BMP is considered successful when:

- The sediment basin or trap effectively intercepts and retains sediment, achieving a sediment capture efficiency of approximately 70–80%.
- Runoff is detained long enough to allow for significant sediment settling before discharge, without causing excessive ponding or localized flooding.
- Outlet structures function properly, with the basin draining within the design timeframe (preferably less than 72 hours) and providing adequate overflow capacity for extreme events.
- Regular maintenance prevents clogging, embankment deterioration, or loss of storage capacity.

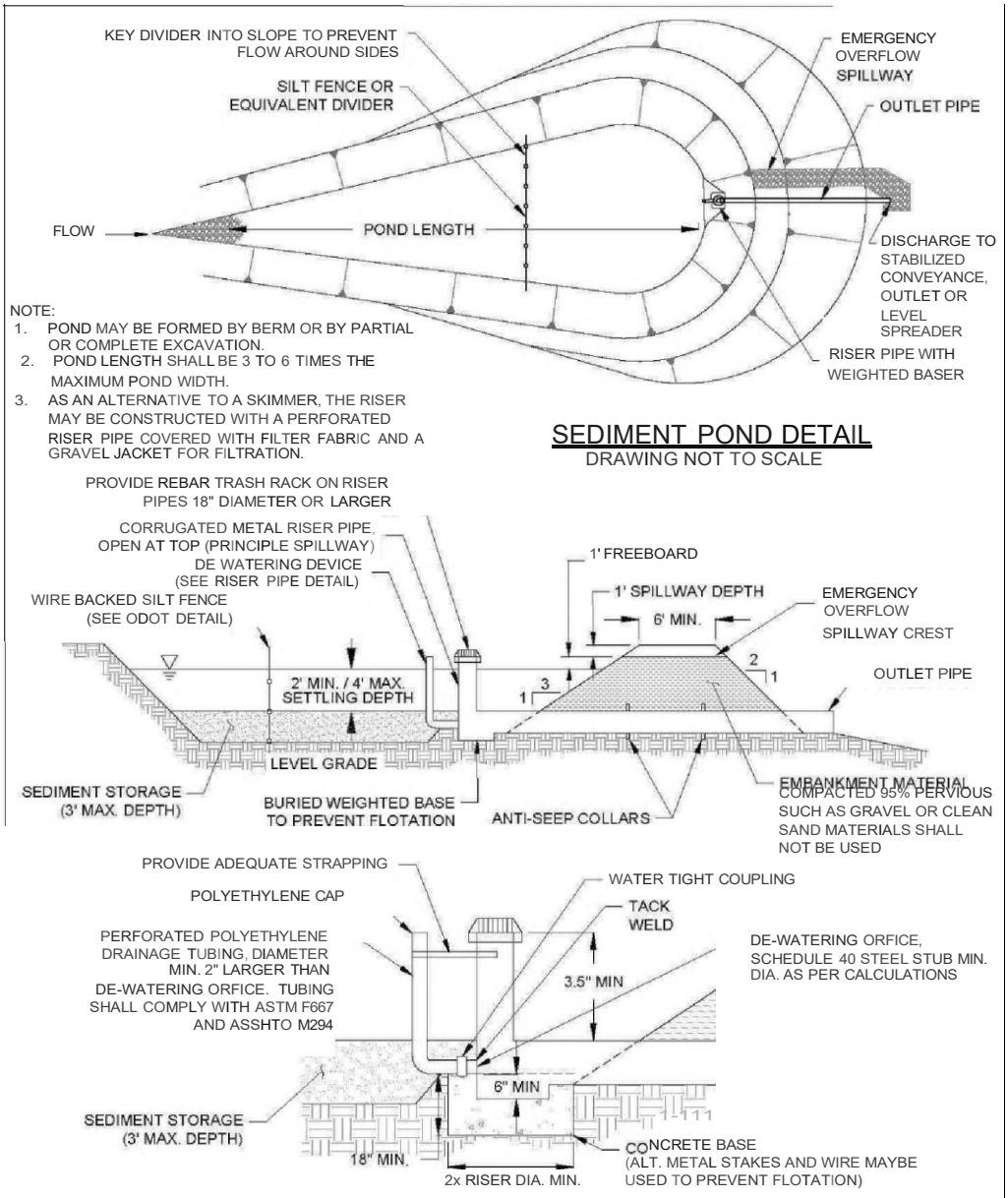


Figure 20: Schematic diagram of sediment basin installation

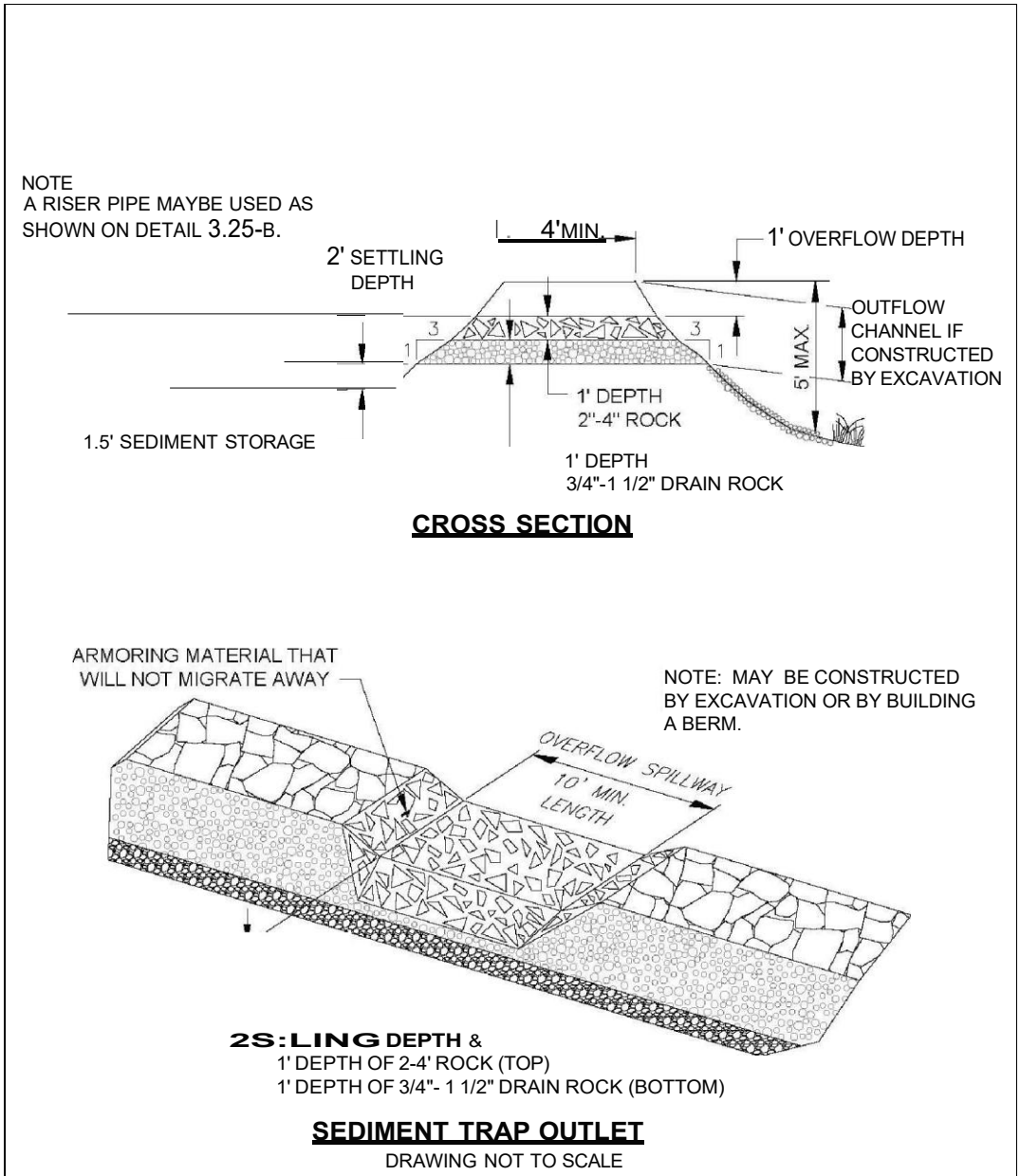


Figure 22: Schematic diagram of sediment trap installation

9.11. BMP 23: Stabilized Construction Entrance

Purpose & Applicability

This BMP is designed to reduce or eliminate the tracking of sediment, soil, and other pollutants onto public rights-of-way by providing a designated, stabilized construction exit for vehicles and equipment. By concentrating vehicle movements to a single area, the BMP minimizes disturbed areas, aids traffic control, and reduces the potential for sediment deposition into storm drains and the production of airborne dust.

- **Applicability:**
  - Use at all points of construction egress where vehicles and equipment may track dirt or mud onto public roads.
  - Particularly applicable on sites adjacent to water bodies, in areas with clay or silty soils, or where dust is problematic during dry conditions.
- **Limitations:**
  - Stabilized entrances may not completely prevent sediment deposition on adjacent paved surfaces; supplementary sweeping or wheel cleaning is recommended.

Installation & Use Procedures

To ensure an effective stabilized construction entrance, follow these guidelines (See figure 22):

- **Planning & Site Design:**
  - Limit construction access to designated, stabilized exits. For larger or linear projects, restrict access to one (or two) defined routes.
  - Design the entrance so that it is located at the upslope side of the construction site, not at the lowest point, to prevent runoff from leaving the site.
  - Incorporate barriers (e.g., silt fence or construction safety fencing) to prevent vehicles from bypassing the full length of the entrance.
- **Design & Construction Requirements:**
  - Construct the entrance apron with washed, well-graded stone or crushed rock having a nominal size of 3 to 5 inches.
  - Ensure the dimensions meet a minimum of 50 feet in length and 20 feet in width (adapted to specific site conditions). The exit should be properly graded to direct runoff away from the site.
  - Install a washrack at ground level to aid in cleaning vehicle tires. If a wheel cleaning system is provided, the entrance width may be reduced to funnel traffic effectively.
  - Construct the stabilized surface to a minimum thickness of 6 inches using stone or recycled concrete with little or no fines.
  - Overlay soil with geotextile fabric beneath the rock as needed in soft soils to prevent rock mixing with underlying soil.
  - When wash areas are provided, ensure that washing is conducted on a stabilized surface that drains into a properly constructed sediment trap or basin.
- **Integration with Other BMPs:**
  - Use in conjunction with other BMPs such as Wheel Washing (BMP 24), Street Sweeping (BMP 25) and Dust Control (BMP 12).

Maintenance & Management

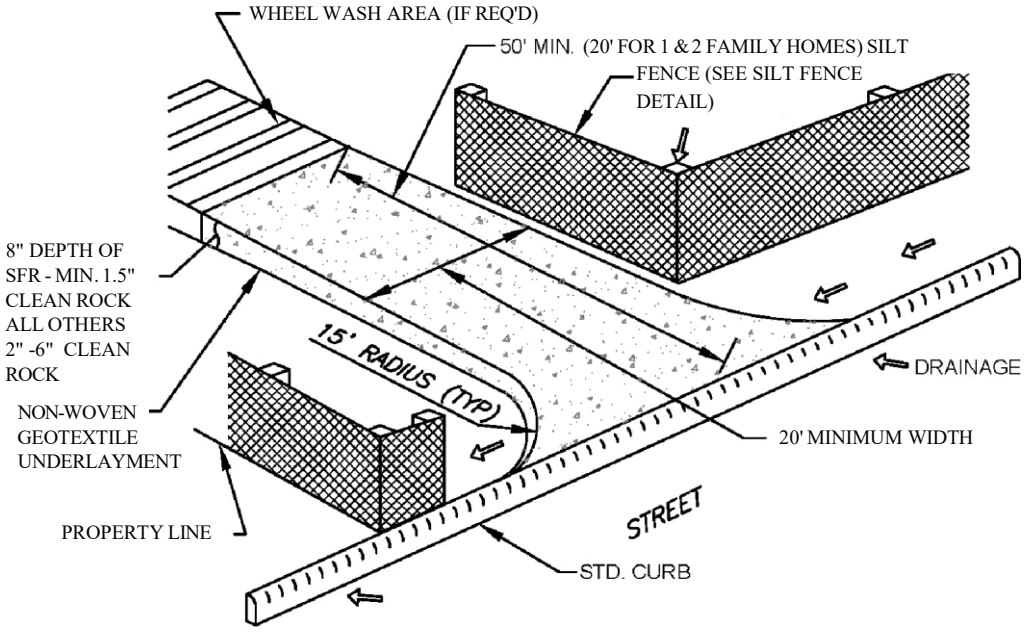
Regular inspections and maintenance are essential to ensure the stabilized entrance continues to function effectively:

- **Inspection Schedule:**
  - Conduct inspections during each routine inspection period and after any storm event.
- **Maintenance Actions:**
  - Periodically re-grade and top dress the entrance with additional stone to maintain a continuous, stable surface.
  - Replace or refresh the gravel mat when surface voids or ruts become evident.
  - Remove any sediments deposited on adjacent paved areas.
  - Upon completion of construction, remove the temporary hardened surface, gravel, and filter fabric and restore the site to blend with the natural ground.

Performance Criteria

This BMP is considered effective when:

- The stabilized construction exit substantially reduces the tracking of soil, mud, and other pollutants onto public roads.
- Traffic is consistently directed to the designated exit, minimizing the number of disturbed areas.
- The entrance surface effectively removes sediment from equipment and does not allow significant sediment to be tracked onto adjacent paved surfaces.
- When used in conjunction with supplementary BMPs (e.g., wheel cleaning systems or road sweeping), overall track-out is minimized.



STABILIZED CONSTRUCTION ACCESS

NOTE
CURB RAMP INSTALLATION SHALL NOT IMPEDED STORMWATER FLOWS, VEHICLE TRAFFIC, AND/OR BICYCLE TRAFFIC.

EROSION CONTROL MANUAL	STABILIZED CONSTRUCTION ACCESS Detail Drawing 3.12-A

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Figure 22: Schematic diagram for stabilized construction access installation

9.12. BMP 24: Wheel Washing

Purpose & Applicability

Wheel cleaning systems are designed to remove soil, mud, sediment, and debris from the tires and undercarriages of construction vehicles and equipment before they exit the site. These systems serve to minimize the tracking of soil onto public roadways and reduce subsequent sediment-related water quality issues. They are especially critical on sites where a stabilized construction exit alone is insufficient.

- **Applicability:**
  - Use when vehicles and equipment egress from the construction site to ensure tires are thoroughly cleaned before entering paved streets.
  - Particularly beneficial on sites with large, disturbed areas (>10 acres), high vehicle/equipment turnover, clay soils, wet conditions, or potentially contaminated soils.
  - Serve as an additional control measure to reduce the need for extensive street cleaning operations.

Installation & Use Procedures

To ensure proper operation of wheel cleaning systems, follow these detailed guidelines (See figures 23 and 24):

- **Site Design & Location:**
  - Determine and mark designated egress locations on the SWPPP site map.
  - Position the wheel cleaning system within the stabilized construction exit, maintaining at least 25 feet of stabilized exit between the cleaning system and the adjacent paved road, to prevent vehicles from picking up additional sediment on disturbed areas.
- **System Components & Operation:**
  - **Rumble Racks:**
    - Install a minimum system consisting of steel grate “rumble racks” that are 10 feet wide and 8 feet long.
    - Ensure the length of the rack is at least equal to the circumference of the largest tire on site; typically, two to three consecutive lengths of grates are needed.
    - Place the grates over an excavated pit (minimum 1 foot deep) and design bar spacing and support based on the expected vehicle size and weight.
  - **Wheel Washes:**
    - Provide a hose or pressure washer for manual or automated cleaning of all wheels
    - Instruct drivers to move forward and reverse as needed to dislodge all mud and debris, and check for rocks edged in dual tires.
  - **Wash Water Collection:**
    - Ensure that all wash water is collected in a designated sediment basin or equivalent sediment control system. Document the required retention volume and attach this information to the BMP documentation.

    - **Safety & Signage:**
        - Post clear signage requiring that all vehicles use the wheel cleaning system before leaving the site.
- **Documentation & Training:**
    - Train the workforce on proper usage, emphasizing that only water (not soap) be used for cleaning and that cleaning must occur in the designated area.

Maintenance & Management

Regular maintenance and prompt management are essential for ensuring continuous effective operation of wheel cleaning systems.

- **Inspection & Routine Maintenance:**
    - Inspect the wheel cleaning system during each routine inspection period and after any storm event.
    - Rake or wash the surfaces (e.g., rumble racks) as necessary if sediment accumulates.
    - Ensure the wash water retention basin is maintained, with sediment removed when accumulation reaches 50% of its capacity.
    - Expand or adjust the wash water basin if necessary to meet the required retention volume.
    - Enforce that vehicles use the system exclusively at the designated area.
- **Debris Management:**
    - Promptly remove any rock, gravel, or sediment track-out from adjacent roadways following observed BMP failure or misuse.
    - Conduct street clean-up operations as needed, noting these are separate from routine wheel cleaning system maintenance.
- **Training & Communication:**
    - Continuously train employees and subcontractors on proper operation, maintenance, and cleaning procedures for the wheel cleaning system.

Performance Criteria

This BMP is considered successful when:

- The wheel cleaning system effectively removes soil, mud, and debris from vehicle tires and undercarriages, significantly reducing off-site tracking.
- The sediment retention basin collects wash water effectively, with minimal visible sediment or a petroleum sheen indicating contamination.
- The system maintains proper operational conditions, with rumble racks and wash areas functioning without obstruction, and regular maintenance prevents clogging and excessive sediment buildup.
- Light tracking, defined as minor residual dirt that does not pose a safety hazard, is managed through routine cleaning.

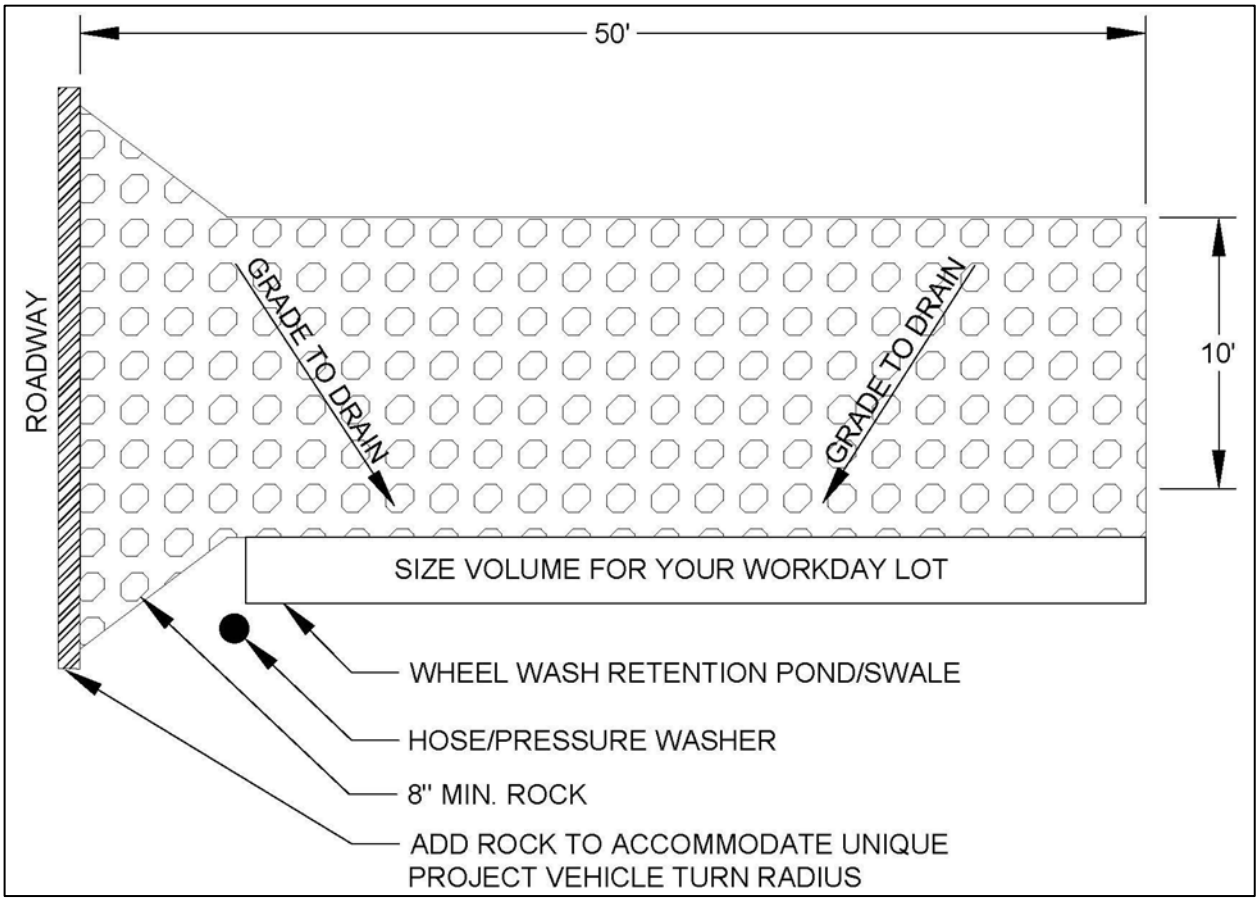
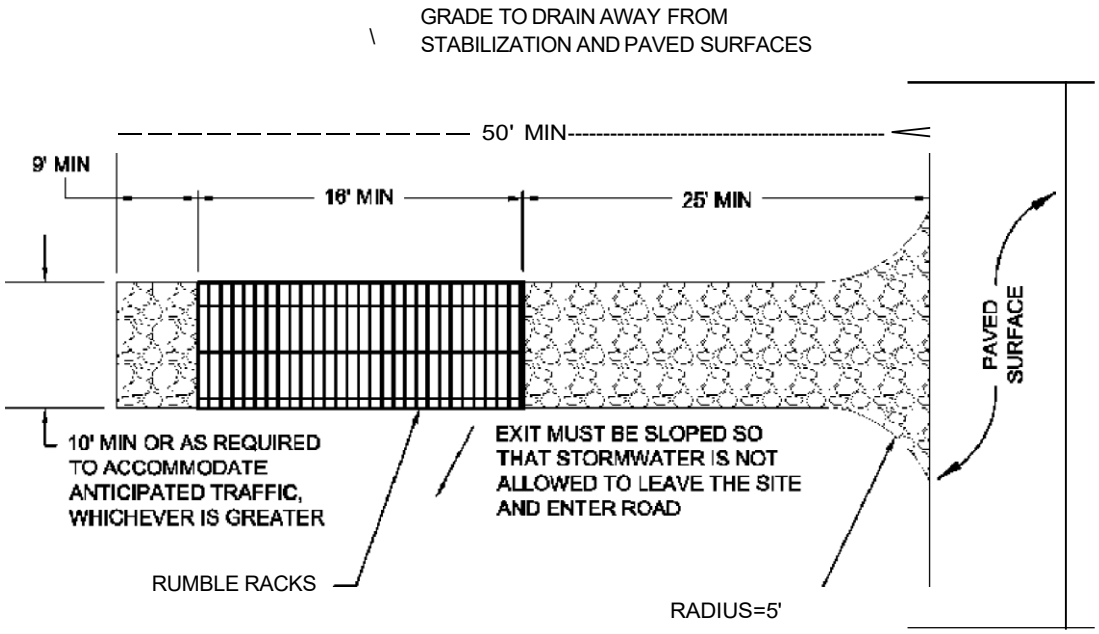
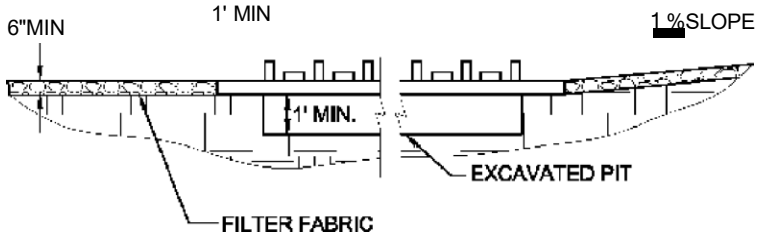


Figure 23: Schematic grading diagram for wheel wash installation



RUMBLE RACK PLAN VIEW
N.T.S.



RUMBLE RACK EXAMPLE INSTALLATION
N.T.S.

NOTE: DESIGNER SHALL SPECIFY **SIZE Ar-ID** SPACING OF THE STEEL BARS AND SUPPORT BEAMS BASED ON SIZE AND WEIGHT OF VEHICLES EXPECTED TO BE EXITING THE CONSTRUCTION SITE.

Figure 25: Schematic diagram of a rumble rack wheel wash installation

9.13. BMP 25: Street Sweeping

Purpose & Applicability

Street sweeping is implemented to remove sediment, debris, and residual mud from roadways and access areas. Effective cleaning of track-out prevents sediment from entering storm drains or watercourses, thereby protecting water quality and ensuring safety.

- **Applicability:**
  - Use at points of egress where sediment is tracked from the project site onto public or private paved roads.
  - Suitable as a supplemental BMP to address the limitations of designated egress track-out controls.
  - Particularly effective when implemented using vacuum or regenerative air street sweepers, which can remove fine dust particles and provide significant runoff quality benefits.

Installation & Use Procedures

To ensure effective street sweeping operations, follow these procedures:

- **Equipment & Operation:**
  - Utilize vacuum-type sweeping machinery to efficiently collect road sediment and debris. For smaller areas, kick brooms may be used; for larger areas, mechanical brush or vacuum sweepers are recommended.
  - Plan sweeping operations to occur at the end of each workday and, if needed, additional sweeps during the day based on the extent of track-out.
- **Site Coordination:**
  - Integrate sweeping operations into the overall site maintenance schedule.
- **Workforce Training:**
  - Train the workforce on proper track-out BMP requirements and the correct operation of sweeping equipment.
  - Instruct personnel to adjust brooms frequently and ensure that any unknown substances or potentially hazardous objects are properly disposed of.

Maintenance & Management

Regular and timely maintenance is critical to ensure the effectiveness of street sweeping operations.

- **Operational Procedures:**
  - Conduct sweeping operations at the end of each workday, and additional sweeps as needed based on site conditions (more frequent during rainy seasons).
  - Inspect ingress/egress access points daily and perform sweeping as needed to remove visible sediment track-out.
  - Adjust sweeping equipment (e.g., brooms) frequently to maximize cleaning efficiency.
- **Debris Management:**

- Properly dispose of any unknown or hazardous substances removed during sweeping.
- After sweeping, ensure that any collected wash water is either reused or disposed of at an approved dump-site in compliance with local regulations.
- The operator is responsible for complying with the Fugitive Dust Control Plan.

Performance Criteria

This BMP is considered effective when:

- Roadways and access areas are maintained free of significant sediment, debris, and residual mud.
- The sweeping operations consistently remove visible sediment and reduce the risk of sediment entering storm drains or watercourses.
- Slick conditions, slurry, mud chunks, and other track-out materials are minimized, thereby reducing water quality risks and driver hazards.
- Light tracking, defined as minor residual dirt not easily picked up by a square-nose shovel, is limited and addressed through regular maintenance.

9.14. BMP 26: Dewatering Practices

Purpose & Applicability

This BMP is designed to manage and correctly discharge water accumulated on construction sites, including stormwater from excavated areas, non-stormwater discharges (e.g., groundwater, cofferdam water, or water from drilling) and water collected in depressed areas, before work proceeds. It encompasses active treatment systems (ATS) for removal of fine silt and clay particles that traditional sediment controls cannot effectively capture, as well as conventional dewatering methods for non-stormwater.

Note: *In Utah, construction projects that involve discharging groundwater or surface water, such as from excavation dewatering or hydrostatic testing, must obtain a UPDES Construction Dewatering and Hydrostatic Testing General Permit (UTG070000) prior to discharge. Operators are required to develop a Dewatering Control Plan (DCP), implement appropriate BMPs, and submit a Notice of Intent (NOI) through the EPA's NeT system to receive permit coverage. Always contact the local MS4 and/or flood control district prior to discharge from dewatering activities; additional local permitting may be required.*

- **Applicability:**
  - Use on sites where water must be removed from excavated work areas, utility repairs, or depressed areas prior to continuing operations.
  - Applicable when sediment-laden water contains a high percentage of fine silt and clay that require extended detention (days or weeks) to settle, beyond the capability of sediment basins.
  - Particularly useful where sensitive receiving waters (e.g., wetlands, spring-fed systems, or waters with TMDLs) require higher levels of treatment or where turbidity effluent limits are established.
  - Dewatering controls are necessary when discharging non-stormwater that may impact water quality and when an UPDES Construction Dewatering permit is required for off-site discharges.

Installation & Use Procedures

Implementation of dewatering practices involves proper design and installation of active treatment systems (ATS) and conventional dewatering measures:

- **Active Treatment Systems (ATS):**
  - **Design & Setup:**
    - An ATS is used when traditional sediment controls cannot remove fine silt and clay particles.
    - Provide a source of electricity (or diesel generators until site power is available) to operate the ATS continuously; maintain generators on-site to cover potential outages.
    - Integrate the ATS with a sediment basin, tank, or retention structure designed to capture the temporary control design storm (typically a 2-year, 24-hour event) while also withstanding larger storm events without damage.
    - ATS can be configured as batch flow or continuous flow (flow-through) systems based on site conditions.

- **Design Considerations:**
  - Consult with ATS suppliers and technical experts to tailor the system to the site's runoff characteristics, including turbidity, pH, suspended solids, and soil particle sizes.
  - Ensure the design accounts for available detention space, required discharge concentrations, flow rate, and overall cost.
  - Ensure the design accounts for available detention space, required discharge concentrations, flow rate, and overall cost.
  - Equip the ATS with instrumentation to automatically record influent/effluent turbidity, pH, and flow rate.
  - Incorporate a recirculation or safe shutdown mode that activates upon system upset, power failure, or other emergencies.
  - Install a velocity dissipation device at the ATS discharge point.
- **Filtration & Chemical Treatment:**
  - Filtration is typically achieved by pumping water through vessels filled with granular media (e.g., sand, gravel, anthracite), with bag or cartridge filters used if extremely low turbidity is required.
  - For sites using chemical-aided flocculation, design the ATS with proper chemical injections (using agents such as chitosan, PAM, alum, or polyaluminum chloride) based on jar tests and monitor residual concentrations and toxicity with field tests or daily bioassays.
  - Pre-treat stormwater with a sediment trap or basin before pumping to the filter to extend the filter life.

- **Conventional Dewatering Controls:**
  - For non-stormwater removal (e.g., from excavated areas, cofferdams, or water diversions), install dewatering tanks or similar systems that separate sediment and debris using fabric filters.
  - Ensure that water used for dust control or diverted to infiltration basins is managed per site-specific plans.
  - Where feasible, employ gravity bag filters (dewatering bags) on a slight slope to facilitate water flow and sediment removal (See figure 25).
- **Documentation & Coordination:**
  - Attach detailed engineering drawings, ATS supplier literature, and manufacturer specifications to the SWPPP.
  - Record the layout of sediment basins, dewatering tanks, and any associated drainage structures on the site map.
  - Include a copy of the Construction Dewatering Permit in the SWPPP.

Maintenance & Management

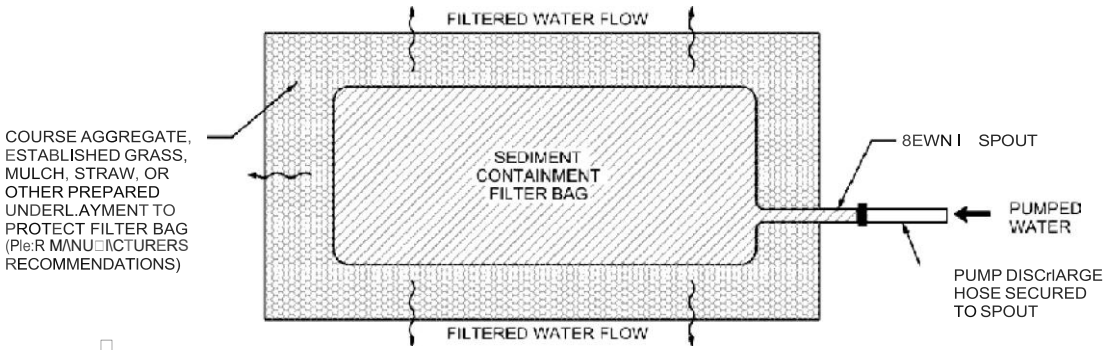
Regular maintenance and monitoring are crucial to the effective operation of dewatering practices and ATS.

- **Inspection Schedule:**
  - Inspect the overall ATS and conventional dewatering system per the DCP.
  - Regularly check sediment basins, dewatering tanks, and associated structures for physical damage, sediment accumulation, and proper function of outlet structures and overflow systems.
- **Maintenance Actions:**
  - For ATS: Monitor as stormwater characteristics change; regularly sample effluent to ensure turbidity and residual chemical levels are acceptable.
  - For filtration systems: Clean or backwash filters when differential pressure indicates loading; replace media or cartridges when necessary.
  - For conventional dewatering: Remove accumulated sediment from basins or traps when it reaches approximately one-third of the designed capacity and ensure that the system drains within the specified time frame (preferably less than 72 hours) to prevent mosquito breeding.
  - Maintain all components (e.g., pumps, instrumentation, electrical systems) per manufacturer recommendations.
  - Train on-site personnel in system operation, routine maintenance, and emergency response procedures.

Performance Criteria

This BMP is considered effective when:

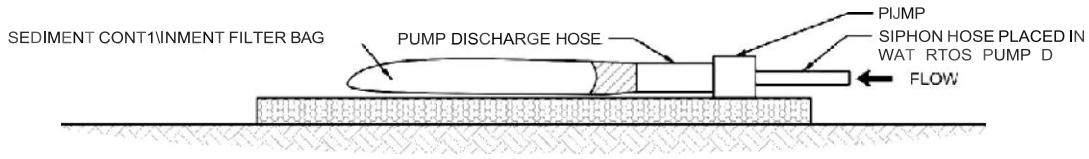
- The ATS or dewatering system consistently removes fine silt, clay, and other suspended solids to achieve discharge water quality that meets local, state, and federal standards.
- Instrumentation readings (e.g., turbidity, pH, flow rate) indicate that the system operates within the design parameters, with chemical residuals maintained at safe levels.
- The sediment basin or dewatering tank effectively captures the design storm volume (e.g., 2-year, 24-hour event) and drains within the specified time without excessive standing water or clogging.
- Regular maintenance prevents system overload or failures that could result in untreated water discharge.



SEDIMENT FILTER BAG PLAN VIEW

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□ HE DRAWINGS.



SEDIMENT FILTERBAG PROFILE

DEWATERING CONTROL GENERAL NOTES:

1. THE BAG SHOULD BE A NON-WOVEN, NEEDLE-PUNCHED, GEOTEXTILE THAT MEETS ASTM CRITERIA-D4632, 04833, 0-3786, 0-4355, D-4491, AND D-4751.

2. CAPACITY, INSTALLATION, 1JMAINTENANCE, AND REMOVAL OF BAGS AND PUMPS SHOULD CONFuRM TO PUBLISHED MANUFACTURER LITERATURE.

Figure 26: Schematic diagram for sediment filter bag installation

10. Pollution Prevention Controls

10.1. BMP 27: Sanitary Waste Management (Portable Toilets)

Purpose & Applicability

Portable sanitary facilities are provided to properly contain and manage human waste generated on-site during construction activities. This BMP minimizes the risk of sanitary waste exposure to stormwater and nearby waters by ensuring that waste is contained, properly maintained, and promptly serviced.

- **Applicability:**
  - Use at construction sites where permanent sanitary facilities are unavailable or are located too far from active work areas.
  - Applicable to sites where temporary sanitary waste management is necessary to prevent pollutant discharges into stormwater systems.
  - Essential for protecting water quality and public health, particularly at sites with high workforce numbers or extended construction durations.

Installation & Use Procedures

To ensure effective performance and compliance with regulatory requirements, install and operate portable toilets according to the following guidelines (See figures 26-28):

- **Site Selection & Placement:**
  - Locate portable toilets at least 10 feet away from drainage features (i.e., curbs, channels, inlets, etc.). If a 10-foot setback is not feasible due to site configuration, provide secondary containment to manage any spills.
  - Clearly identify and mark the location of portable toilets on the SWPPP site map.
  - Position units in areas accessible to maintenance and service trucks without causing damage to erosion and sediment controls or creating tracking issues.
  - For installations, choose natural, undisturbed ground if feasible.
- **Structural Requirements & Security:**
  - Ensure that portable toilets are fully enclosed to minimize exposure of waste to precipitation and stormwater runoff.
  - Secure portable toilets against tipping using anchoring methods such as stakes or tie-downs.
  - Design facilities to minimize contact between sanitary waste and stormwater, adhering to applicable 40 CFR Part 450 guidelines.
- **Spill Prevention & Response:**
  - Immediately notify the service provider if a toilet is tipped or damaged, potentially resulting in a discharge.
  - In the event of a spill, the responsible company shall vacuum discharged solids and clean contaminated surfaces with a solution of 10 parts water to 1 part bleach.
  - Maintain written spill response procedures and provide training to all relevant personnel.

Maintenance & Management

Regular inspection and servicing of portable toilets are critical to ensure their proper functioning and to prevent environmental contamination.

- **Routine Maintenance:**
  - Portable toilets must be serviced at the frequency recommended by the supplier, typically daily or as specified based on the number of users (commonly one toilet per 10 workers during a 40–50-hour work week).
  - Inspect units daily for signs of leaks, spills, or structural damage, and ensure they remain secure and stable.
  - Confirm that waste is properly collected and transferred to a sanitary sewer system or an approved treatment facility.
- **Repair & Spill Response:**
  - Immediately repair or replace any damaged units to prevent waste discharge.
  - In the event of a spill, implement the established spill response procedures and document the incident for reporting purposes.
  - Notify the municipal system authority if any discharge from the portable toilets reaches the storm drain system or a natural watercourse.

Performance Criteria

This BMP is considered effective when:

- Portable toilets contain all sanitary waste with no exposure to stormwater runoff.
- Units remain secure, leak-free, and fully operational throughout the period of use.
- Waste is consistently and properly serviced and transferred to an approved treatment facility.
- Spill response measures are implemented immediately, and any contamination is promptly cleaned, preventing adverse impacts on water quality.

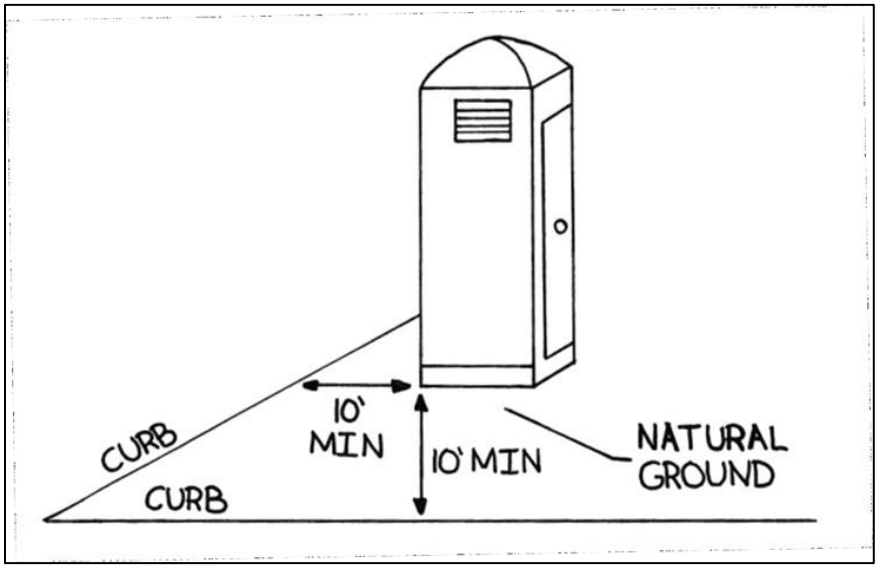


Figure 26: Schematic diagram showing proper placement of portable toilets



Figure 27: Photo showing staking of portable toilets to secure from tipping



Figure 28: Photo showing portable toilet secured with tie-down straps

10.2. BMP 28: Washout Areas (Concrete, Stucco, Paint, etc.)

Purpose & Applicability

Washout areas are designated zones where washout operations for concrete, stucco, paint, and related materials are conducted. These areas are designed to contain and properly manage washout wastewater and solid waste to prevent the discharge of pollutants into storm drains or natural watercourses.

- **Applicability:**
  - Use on construction sites where concrete waste management is required, including operations such as saw cutting, coring, grinding, grooving, or hydro-concrete demolition, as well as at mortar-mixing stations.
  - Applicable when concrete truck drums, chutes, hoses, and other equipment are washed on-site, and complete off-site disposal is not feasible.
  - Can be used for both above-grade and below-grade washout facilities, provided they are designed to contain all liquid and concrete waste generated during washout operations.

Installation & Use Procedures

To ensure effective washout area performance and environmental protection, implement the following procedures (See figures 29 and 30):

- **Site Location & Setup:**
  - Locate the washout facility at least 50 feet from storm drain inlets, open ditches, water bodies, wetlands, or planned infiltration features. If a 50-foot setback is not practicable due to site constraints, provide secondary containment measures.
  - Clearly mark the washout area with signage to instruct concrete equipment operators to use the designated facility for washout.
- **Structural Requirements:**
  - **Above-Grade Facilities:**
    - Construct the facility with a minimum length and width of 10 feet (or larger as needed to provide sufficient capacity).
    - Use a watertight, impermeable design with a plastic lining (minimum 10- mil polyethylene sheeting) that is free of holes, tears, or defects.
  - **Below-Grade Facilities:**
    - Similarly, ensure a minimum footprint of 10 feet by 10 feet with proper volume to contain all liquid and concrete waste generated.
    - Prepare the soil base free of rocks or debris that could compromise the lining's integrity.
  - **Operational Procedures:**
    - During concrete operations, empty excess concrete onto the ground near the pour site until only liquid cement remains on tools and equipment.
    - Wash cement off chutes pump equipment, and tools directly into the washout facility
    - If concrete washout is collected in an impermeable bag, ensure it is properly sealed for adequate disposal.

- **Documentation & Coordination:**
    - Attach detailed contractor illustrations and design specifications (including dimensions, liner details, and secondary containment if applicable) to the SWPPP.
    - Clearly record the washout facility's location on the site plan.
    - Inform and train the workforce, including concrete suppliers and subcontractors, on proper washout procedures and equipment handling.

Maintenance & Management

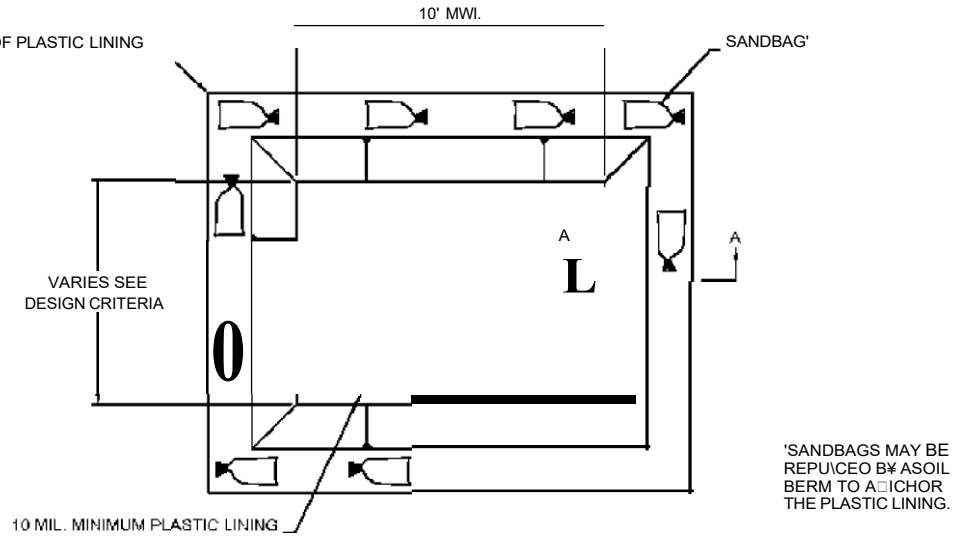
Regular maintenance is essential to ensure that washout areas function as designed and remain compliant with water quality standards.

- **Inspection Schedule:**
    - Inspect washout facilities at least weekly and before and after each concrete operation.
    - During extended wet weather conditions, perform additional inspections to verify that overflow is not occurring.
- **Maintenance Actions:**
    - Maintain a minimum freeboard of at least one foot by removing waste concrete or slurry when the facility reaches 70% capacity.
    - Remove accumulated sediment and debris promptly to prevent overflow or seepage.
    - Repair any damage to the plastic lining or structural components immediately.
    - After the completion of concrete work, if the facility is temporary, remove hardened concrete and debris, then backfill, re-grade, and stabilize the area to prevent erosion.
    - Ensure all waste disposal methods comply with applicable federal, state, and local regulations; discharges to waterways, storm drains, or directly onto the ground are prohibited.

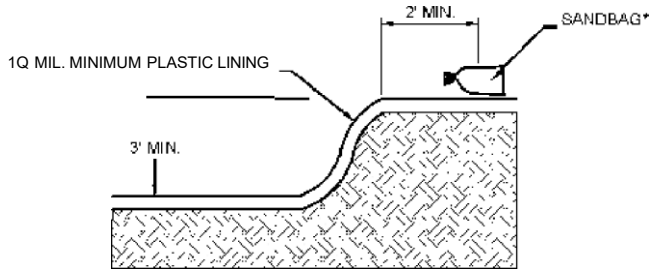
Performance Criteria

This BMP is considered effective when:

- The washout facility remains watertight and maintains sufficient volume with at least one foot of freeboard throughout operations.
- All concrete waste (liquid and solids) is contained with no discharge of pollutants into storm drains or natural watercourses.
- The facility effectively prevents track-out of concrete waste by directing all washout water and debris into the designated area.
- Regular maintenance ensures that the facility does not overflow, leak, or become compromised.



CONCRETE WASHOUT PLAN VIEW



CONCRETE WASHOUT SECTION VIEW

CONCRETE WAHSOUT NOTES:

1. WASHOUT AREA MUST BE CLEARLY MARKED WITH SIGNAGE NOTING THE WASHOUT AREA

2. WASHOUT STRUCTURES SHALL BE CLEANED OUT WHEN THE STRUCTURE IS 75% FULL. TEMPORARY CONCRETE WASHOUT FACILITY SHOULD BE MAINTAINED TO PROVIDE ADEQUATE HOLDING CAPACITY

Figure 29: Schematic diagram of below-grade concrete washout installation

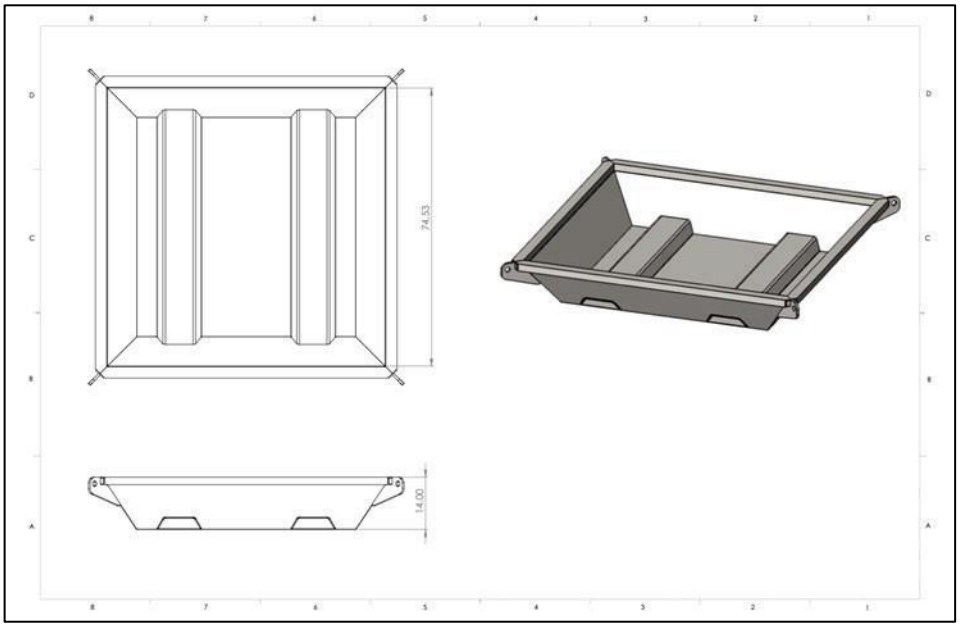


Figure 30: Image of a small-scale portable concrete washout pan

10.3. BMP 29: Concrete Sawcutting Management

Purpose & Applicability

Concrete Sawcutting Management is designed to control and manage waste generated during pavement sawcutting operations. This BMP addresses both wet and dry cutting methods to prevent concrete, mortar, and associated slurry from contaminating stormwater or causing dust and debris track-out.

- **Applicability:**
    - Use for pavement sawcutting operations when a wet saw is employed (wet cutting) to control slurry and reduce airborne dust, particularly in curb and gutter applications where dry cutting is not permitted or dust control is critical.
    - Use for dry pavement cutting operations on directly connected pavements or where cutting dust can be safely managed through drainage systems.
    - Applicable for both new construction and repair/maintenance projects where concrete waste (slurry, cuttings, dust) must be collected and disposed of properly to prevent environmental contamination.

Installation & Use Procedures

- **For Wet Cutting Operations:**
    - Install a series of sand or gravel bags (minimum 6-inch diameter) around the perimeter of the cutting area to intercept and contain slurry moving downslope. Double up bags as needed based on anticipated slurry volume.
    - **Operational Scheduling & Slurry Management:**
        - Schedule cutting operations during dry weather to minimize premature slurry dispersion.
        - Remove accumulated slurry at the end of the day or before forecasted rain events. In wet conditions, mix the slurry with dirt or another absorbent material and immediately remove it:
            - Dump waste into an approved concrete washout containment system.
            - Dry the waste in a contained area and dispose of it in a designated waste management container.
    - **Cleanup Procedures:**
        - Thoroughly sweep the cutting area using a square nose shovel and wire broom until no additional waste is recoverable.
        - Do not sure water for rinsing; employ dry cleanup methods exclusively.
- **For Dry Cutting Operations:**
    - Conduct dry cutting during periods of dry weather to avoid moisture- related complications.
    - **Dust Removal:**
        - Immediately remove cutting dust following the cutting operation by sweeping the area thoroughly with a square-nose shovel until all dust is recovered.
    - **Waste Disposal:**
        - Collect and dispose of the cutting dust in a designated concrete waste

container or approved waste management container.

- **General Concrete Sawcutting Waste Management:**
  - **Slurry Collection & Containment:**
    - For projects where concrete sawcutting generates slurry and cuttings, continuously vacuum or recover waste during operations to prevent discharge from the site.
    - Where pavement is near a storm drain inlet, temporarily block the inlet (e.g., with sandbags) to prevent slurry from entering the system, then remove the blockage promptly after operations (including cleanup).
    - Ensure that slurry and cuttings are not allowed to dry on the pavement.
  - **Disposal Procedures:**
    - Designate safe slurry disposal areas or on-site containment (e.g., excavated or bermed pits lined with plastic, minimum 10-mil thick) and ensure these areas are located at least 50 feet from inlets, swales, or water bodies.
    - If on-site containment is used, remove waste concrete when the containment is half full, maintaining a minimum of one foot freeboard.
    - Alternatively, consider using commercially available portable, prefabricated washout containers.
  - **Integration with Other BMPs:**
    - Coordinate concrete sawcutting waste management with overall concrete waste management practices and ensure employee training and enforcement of proper procedures.

Maintenance & Management

Regular maintenance and prompt management are critical to ensuring that concrete sawcutting waste management systems perform effectively.

- **Inspection Schedule:**
  - Inspect the cutting area and containment facilities during each routine inspection period and after any storm event.
  - For wet cutting operations, verify that all slurry has been removed from the containment system before the onset of additional rain.
  - For dry cutting operations, inspect the pavement each day after operations to ensure all dust has been adequately removed.
- **Maintenance Actions:**
  - Ensure that sand or gravel bag systems used for wet cutting are reinstalled for each new operation and that any accumulated waste is removed and disposed of.
  - Confirm that designated waste management containers (for dust or slurry) are emptied and cleaned regularly to prevent overflow or contamination.
  - Address any deficiencies (e.g., overflow of containment, incomplete removal of dust) immediately with corrective actions.
  - Maintain records of all maintenance activities and disposal methods for review.

Performance Criteria

This BMP is considered successful when:

- **Wet Cutting Operations:**
  - The sand or gravel bag containment system holds all generated slurry with no

overflow, and all slurry is removed and disposed of per BMP procedures before the end of the cutting day or prior to rainfall.

- **Dry Cutting Operations:**
  - All cutting dust is promptly removed from the pavement, with no dust entering drainage systems or affecting water quality.
- **General Sawcutting Waste Management:**
  - Waste (slurry, cuttings, and dust) is collected and contained effectively, preventing any discharge into storm drains or natural water bodies.
  - Contractor and site personnel consistently adhere to established procedures, with documentation reflecting proper cleanup and waste disposal.

10.4. BMP 30: Solid Waste Management (Trash and Debris)

Purpose & Applicability

Solid waste management is implemented to properly collect, store, and dispose of construction-related debris and trash, thereby minimizing floatable/dissolvable pollutants in stormwater. By effectively managing solid waste on-site, overall stormwater quality is improved and cleanup efforts at the end of a project are reduced.

- **Applicability:**
    - Use on all construction sites where workers and equipment generate solid waste, including construction and demolition debris (e.g., lumber, metals, insulation, brick, mortar) and domestic waste (e.g., packaging, food containers, paper, plastics, Styrofoam).
    - Applicable when the waste produced poses a potential risk of contaminating stormwater if not managed appropriately.
    - Emphasizes proper segregation of non-hazardous, hazardous, and recyclable waste.

Installation & Use Procedures

To establish an effective solid waste management system, implement the following procedures:

- **Selection of Waste Containers:**
    - Use durable, watertight containers (e.g., dumpsters, trash receptacles) sized appropriately for the volume of waste generated.
    - Ensure that containers are clearly marked for non-hazardous, hazardous, and recyclable waste, according to site requirements.
- **Placement & Storage:**
    - Position waste storage areas on flat, stabilized surfaces away from storm drains, swales, drainage ways, channels, and watercourses.
    - Locate storage areas a minimum of 50 feet away from sensitive drainage features; if not feasible, maintain at least 20 feet separation and provide secondary containment.
    - Place dumpsters on designated parking or track-out pads to prevent tracking during servicing and to avoid disruption of stormwater controls.
    - Ensure that waste containers are covered to prevent exposure to precipitation, minimize leaching of contaminants, and reduce the risk of wind dispersal.
- **Usage & Handling:**
    - Instruct all personnel to place all construction waste into the designated containers; waste should not extend beyond the sides or top of the container.
    - Segregate hazardous waste from non-hazardous waste by using separately labeled and secured containers.
    - Prohibit on-site disposal methods such as dumping, burning, or burying of waste.
    - Ensure that collected waste is removed at regular intervals (e.g., when containers reach 90% full) by waste haulers approved by the local municipality.
- **Communication & Training:**
    - Clearly communicate waste management procedures through training sessions and regular safety meetings.

- Designate a site supervisor or foreman responsible for monitoring and enforcing waste management protocols.
- Post visible signage indicating proper waste disposal practices and identify container locations on the SWPPP site map.

Maintenance & Management

Regular and systematic maintenance is essential to ensure the solid waste management system remains effective throughout the project.

- **Inspection & Cleaning:**
  - Inspect waste storage areas and containers daily to ensure that waste is contained properly and that no containers are overflowing.
  - Check for any signs of leaks or damage to waste storage units, and repair or replace them as necessary.
  - Collect and remove scattered debris from around the site, particularly in high-traffic areas and near drainage inlets, to prevent potential contamination.
- **Waste Removal & Recycling:**
  - Arrange for waste removal by licensed waste haulers on a regular schedule (e.g., when containers reach 90% capacity, or more frequently if required).
  - Ensure that recyclable materials are segregated and sent to approved recycling facilities.
  - Follow local municipal requirements for the storage and disposal of solid waste.
- **Worker Training & Enforcement:**
  - Regularly train workers and subcontractors on proper waste handling, segregation, and disposal practices.
  - Monitor compliance and enforce waste management procedures through site inspections and corrective action if necessary.

Performance Criteria

This BMP is considered successful when:

- All construction and domestic waste generated on-site is fully contained within designated waste storage containers, with no overflow or spillage.
- Waste storage areas are maintained free of visible litter and debris, and waste is segregated appropriately (hazardous vs. non-hazardous).
- Waste is removed and disposed of on a regular schedule, ensuring that stormwater is not contaminated by leachate or spilled materials.
- The system supports proper recycling or re-use of materials where possible.

10.5. BMP 31: Chemical/Hazardous Materials Management

Purpose & Applicability

Proper chemical management is essential to prevent, or at least minimize, the pollution of stormwater runoff through spills, leaks, or improper handling of chemicals and hazardous materials. This BMP is not intended to replace normal site assessment and remediation procedures but serves to provide controls at the point of storage and use.

- **Applicability:**
  - Use at all construction sites where chemicals or hazardous materials are stored or used.
  - Target chemicals include paints, solvents, stains, wood preservatives, fuels, lube oils, grease, cutting oils, roofing tar, pesticides, herbicides, fertilizers, and antifreeze.
  - Chemical management practices should be implemented in accordance with applicable OSHA, UDOT, and EPA guidelines and in conjunction with related BMPs such as Solid Waste Management (BMP 30), Vehicle and Equipment Management (BMP 32), and Spill and Leak Containment (BMP 33).

Installation & Use Procedures

To ensure that chemicals and hazardous materials are managed properly, the following procedures must be implemented:

- **Storage and Labeling Procedures:**
  - Store chemicals in their original, sealed, and clearly labeled containers.
  - Where possible, cover stockpiled materials indoors or under a temporary roof to prevent water ponding around stored drums.
  - When multiple drums are moved (e.g., on a pallet), secure them with shrink wrap or steel bands; mark any damaged containers.
  - Do not store chemicals, drums, or bagged materials directly on the ground; instead, use secondary containment platforms or wooden pallets.
- **Secondary Containment:**
  - Provide spill containment dikes around chemical and fuel storage tanks, lining the containment with plastic film (or other compatible material) to prevent soil contamination.
  - For containers larger than 55 gallons or when site conditions require, install secondary containment (e.g., drip pans, spill containment pallets, or berms with impermeable liners).
  - Do not drain containment areas that have collected precipitation until it is confirmed by the site supervisor that drainage will not contaminate surrounding soil.
- **Waste Handling and Disposal:**
  - Ensure that adequate hazardous waste storage space and properly labeled hazardous waste collection containers are available on-site.
  - Store hazardous waste in containers that meet EPA, OSHA, and UDOT regulations.
  - Dispose of oil-based paints, solvents, thinners, and mineral spirits regularly through a licensed waste management firm.

    - Follow manufacturer recommendations for disposal of construction chemicals (e.g., curing compounds, form releases) and use proper devices for chemical transfer.
- **Additional Measures:**
    - Keep Safety Data Sheets (SDS) readily accessible for all chemicals stored or used on-site.

Maintenance & Management

Continual maintenance and proactive management are critical to the effectiveness of chemical management practices:

- **Educating Workers:**
    - Train all employees and subcontractors in safe chemical storage, handling, and spill response procedures.
    - Establish a continuing education program for new and existing workers regarding chemical management risks and procedures.
- **Quality Assurance:**
    - Designated personnel (e.g., foreman or site supervisor) must regularly monitor chemical storage and disposal procedures.
    - Document and, if necessary, discipline workers who violate established procedures.
    - Verify that any hazardous waste disposal contractors are reputable and licensed.
- **Emergency Response:**
    - Maintain an up-to-date Emergency Response Plan for chemical spills.
    - If a spill occurs that equals or exceeds the reportable quantity (as defined by EPA regulations in 40 CFR Parts 110, 117, and 302), report it immediately to the National Response Center (1-800-424-8802), Utah Department of Environmental Quality (1-385-552-0539) and notify local emergency management authorities.

Performance Criteria

This BMP is considered effective when:

- All chemicals and hazardous materials are securely stored in accordance with manufacturer and regulatory requirements, preventing any pollutants from reaching stormwater systems.
- Secondary containment measures remain intact and are sufficient to contain spills or leaks.
- Regular inspections reveal no evidence of spills, leaks, or improper storage practices.
- Spill response procedures are effectively executed, with any incidents promptly addressed and documented.
- Ongoing training and quality assurance measures ensure continuous compliance with applicable regulations.

10.6. BMP 32: Vehicle and Equipment Management

Purpose & Applicability

Proper vehicle and equipment management is critical to minimizing pollutants entering stormwater from fueling, washing, and maintenance activities. By establishing proper procedures for vehicle washing, fueling, storage, and maintenance, this BMP aims to reduce the discharge of fuels, oils, antifreeze, solvents, and other pollutants.

- **Applicability:**
    - Use on all construction sites where vehicles and equipment are present.
    - Applies to both fueling operations and routine maintenance tasks, including vehicle washing and storage of maintenance fluids.
    - Works in conjunction with spill and leak containment procedures (BMP 33) and supports compliance with relevant OSHA, UDOT, EPA, and DEQ requirements.

Installation & Use Procedures

To ensure effective management of vehicles and equipment, the following procedures must be implemented:

- **Fueling Operations:**
    - **Location & Setback:**
        - Locate fueling operations at least 50 feet from receiving waters, drainage features, and storm drain inlets.
        - If a 50-foot setback is not feasible, document the reasons in the SWPPP.
    - **Storage & Handling:**
        - Store fuels in sealed, clearly labeled containers.
        - Provide secondary containment for fuel tanks and containers (e.g., curbing, spill berms, or double-walled tanks).
        - Use drip pans or spill containment devices during fueling operations.
    - **Operational Requirements:**
        - Discourage topping-off of tanks.
        - Ensure fueling is performed only in designated areas; if many vehicles are fueled, consider using an off-site fueling station.
        - Train workers on proper fueling procedures and spill response.
- **Vehicle Washing:**
    - **Designated Wash Area:**
        - If vehicle washing is required on-site, designate a specific wash area.
        - Ensure the wash area is graded so that all wash water is directed intoa sediment basin or equivalent sediment control.
    - **Prohibitions:**
        - Do not use soap during vehicle washing, as soaps are not removed by sediment controls and may lead to water quality violations.
        - Use water solely to remove soil and debris from tires and undercarriages.
    - **Additional Controls:**
        - Ensure that any wash water collected is treated by a sediment control (e.g., sediment basin or swale) before discharge.
- **Maintenance Operations:**

    - **On-site Repairs:**
        - Limit on-site maintenance to routine preventive measures.
        - If maintenance is required that involves fluids, ensure these fluids are stored in closed, appropriate containers and under cover.
        - Place drip pans under parked vehicles and equipment to catch leaks.
    - **Vehicle Removal:**
        - Remove vehicles or equipment that consistently leak or drip until repairs are completed.
- **Documentation & Signage:**
    - Clearly mark the locations of fueling and wash areas on the SWPPP site map.
    - Provide contractor illustrations and detailed specifications for fueling, washing, and maintenance setups.

Maintenance & Management

Regular maintenance and vigilant management are essential to the long-term effectiveness of vehicle and equipment management:

- **Inspection & Monitoring:**
    - Inspect fueling tanks, hoses, and storage areas regularly for signs of leaks or damage.
    - Check vehicle wash areas for proper function and ensure that wash water is directed to the designated sediment control.
    - Monitor maintenance areas for spills or leaks from equipment fluids; use drip pans where necessary.
- **Worker Training & Communication:**
    - Train all workers and subcontractors on proper fueling, washing, and maintenance procedures, including spill response protocols.
    - Conduct regular safety meetings to reinforce proper handling and disposal of vehicle and equipment fluids.
- **Repair & Response:**
    - Immediately repair any damaged equipment or containment systems.
    - Remove vehicles or equipment with persistent leaks from the site until repairs are made.
    - Ensure that any spilled fuels, oils, or other pollutants are promptly cleaned up and disposed of using approved methods.

Performance Criteria

This BMP is considered effective when:

- No fuel, oil, lubricants, or other maintenance fluids discharge into stormwater or adjacent water resources.
- Fueling and vehicle washing operations are confined to designated areas with appropriate secondary containment.
- Maintenance areas and equipment storage locations remain free of leaks, spills, and improperly managed waste.
- Regular inspections and worker training confirm compliance with established procedures.

10.7. BMP 33: Spill and Leak Containment

Purpose & Applicability

This BMP is designed to prevent and control spills and leaks of chemicals, fuels, hazardous materials, and wastes at construction sites to minimize or prevent pollutant discharges into stormwater drainage systems and watercourses. It provides procedures for immediate spill response and proper containment to protect human health and the environment.

- **Applicability:**
  - Use on all construction sites where chemicals, fuels, or hazardous substances are stored or used.
  - Applicable to emergency spill situations involving soil stabilizers, dust palliatives, herbicides, fertilizers, deicing chemicals, fuels, lubricants, sanitary wastes, and other hazardous materials.
  - Functions as a secondary control to prevent contaminants from entering storm drains and water bodies, complementing primary chemical management practices.

Installation & Use Procedures

To ensure effective spill and leak containment and response, implement the following procedures:

- **Spill Prevention Setup:**
  - **Material Storage:**
    - Store chemicals and hazardous materials in sealed, clearly labeled containers within designated storage areas.
    - Ensure storage areas are located at least 50 feet from storm drain inlets, swales, and other sensitive water bodies; if not possible, provide secondary containment measures.
  - **Secondary Containment:**
    - For containers larger than 55 gallons or as required by site conditions, install secondary containment systems (e.g., drip pans, spill containment pallets, or spill berms lined with impermeable material).
    - Submit detailed design illustrations of secondary containment systems with the SWPPP.
  - **Spill Kits & Emergency Equipment:**
    - Equip the site with spill containment kits appropriate for the types and quantities of chemical stored.
    - Post emergency contact information and spill response procedures in an open, conspicuous, and accessible location near storage areas.
- **Spill Response Procedures:**
  - **Immediate Actions:**
    - Upon detection of a spill, immediately cease operations in the affected area and clear the area upwind of the spill.
    - Remove ignition sources and notify the designated Spill and Leak Response Coordinator.
    - If the spill poses an immediate danger, contact 911 and then the local emergency response team.

    - **Containment & Cleanup:**
        - For small spills (typically less than 5 gallons), use on-site spill kits and absorbent materials to contain and clean up the spill promptly.
        - For spills that exceed reportable quantities, follow federal and state reporting requirements (e.g., notify the National Response Center at 1-800-424-8802, Utah Department of Environmental Quality at 1-385-552-0539, and local emergency management agencies).
    - **Post-Spill Actions:**
        - Do not bury or wash the spill with water.
        - Collect and properly dispose of all contaminated materials and cleanup residues using a licensed waste hauler.
        - Document the spill incident, including quantity, cleanup actions taken, and corrective measures implemented.
- **Documentation & Training:**
    - Attach a site-specific Spill Response Plan to the SWPPP.
    - Train all employees and subcontractors on spill identification, response procedures, and proper use of spill kits and containment equipment.

Maintenance & Management

Ongoing maintenance and management are essential for effective spill and leak containment and response:

- **Routine Inspections:**
    - Inspect spill containment materials (spill kits, secondary containment structures, posted procedures, and emergency contact information) at least weekly and after any spill event.
    - Verify that all storage areas and containment systems are intact, properly labeled, and free of leaks or degradation.
- **Replenishment & Repairs:**
    - Immediately replenish or repair any used or damaged spill kits, secondary containment structures, or signage.
    - Update the Spill Response Plan and associated documentation whenever changes occur in the types or quantities of chemicals stored on-site.
- **Employee Training:**
    - Maintain a continuing education program for all employees regarding spill prevention, containment, and response procedures.
    - Ensure that new hires receive training and that regular safety meetings reinforce proper practices.
- **Documentation:**
    - Retain records of all spill incidents, cleanup actions, repairs, and training sessions for regulatory review and internal quality assurance.

Performance Criteria

This BMP is considered successful when:

- Spill containment materials are readily available, intact, and effective, with emergency contact information and spill response procedures posted visibly on-site.
- All spills or leaks are promptly contained, cleaned up, and documented in accordance with the Spill Response Plan, with no discharge of pollutants into stormwater or nearby watercourses.
- Regular inspections and employee training ensure that spill prevention and response procedures are followed consistently.

11. Template for Operator BMP Modification or Replacement

Operators are invited to use an alternative BMP or modify a BMP from the State Preferred List so long as the BMP has the same performance criteria or better as the preferred BMP. Any deviations from the preferred BMP installation and use parameters must be reviewed and accepted by the oversight authority.

Replace all blue text in brackets with BMP specific data. Then delete any remaining unnecessary blue instructional text.

[BMP Title]

[Insert the BMP detail drawing specific to the proprietary device you will use. It should illustrate the structure of the BMP, installation requirements, and any typical variances due to site conditions.]

[IMAGE]

Purpose and Applicability

- [Describe specifically when and where this BMP will be used on site]

Installation and Use Procedures

- [Describe how this BMP should be installed or how it should be practiced]
- [Describe further so that it is very clear, such as minimum length of structure, etc]

BMP Replacement or Modification Justification

Use only one of the two following bullets

- This BMP is replacing or augmenting [list the preferred BMP that is being replaced] OR
- This BMP is being added and implemented as the conditions or operations cannot be adequately managed by a BMP from the State Preferred List.

Maintenance and Management

- [Add maintenance criteria for proper BMP performance]
- [Describe how the BMP should look or function during an inspection]
- [Describe when maintenance is necessary]
- [Describe when replacement is necessary]
- [Describe when no action is needed]

Performance Criteria

- [Describe performance expectations of the alternative BMP. This includes how it protects water resources, manages hazards, and limits public complaints]

STORM WATER QUALITY REPORT

Date: _____
Project Name: _____
Project ID: _____
Design Engineer: _____

Is the project within a watershed that is 303(d) listed?

If yes:

Name of Receiving Water(s): _____

Listed Impairment(s): _____

Does the watershed have an approved TMDL?

If yes:

Approved TMDL(s): _____

I have reviewed the storm water quality design and find this report to be complete, accurate, and current.

_____
(Name), Project Manager

_____
(Name), Permittee's Designated Storm Water Coordinator

(PE stamp required)

_____
(Name), Permittee's Head of Maintenance

Project Information

Type of Project (New Development, Redevelopment): _____

Area of Land Disturbance (acre): _____

Project Impervious Area (acre): _____

Project Imperviousness (%): _____

Project Runoff Coefficient, R_v: _____

90th Percentile Storm Depth (in): _____

Project 90th Percentile Volume, V_{goal}(cf): _____

Groundwater Information

Depth to Groundwater (ft): _____

Historical High Depth to Groundwater, if known (ft): _____

Source: _____

Soil Information

Infiltration Rate (in/hr): _____

Source: _____

LID Drainage Areas

(add additional rows as needed)

Contributing Drainage Area	Area (acre)	Impervious Area (acre)	Imperviousness (%)	Runoff Coefficient, R_v	Water Quality Volume WQV (cf)
				Total WQV (cf)	

LID BMP Design

(add additional rows as needed)

Contributing Drainage Area	LID BMP Type	Water Quality Volume WQV (cf)	Runoff Retained (cf)	Percent of Runoff Captured (%)
Total Volume Retained (cf)				

Percent of V_{goal} captured by LID BMPs: _____%

If 100% of V_{gpal} is not captured, document and provide narrative of technical infeasibilities and/or alternate compliance measures below:

_____

_____

_____

_____

Describe additional storm water quality measures incorporated into the site:

_____

_____

_____

_____

SWPPP Template (Utah) – Instructions

DWQ has developed this Storm Water Pollution Prevention Plan (SWPPP) template for construction sites permitted under the Construction General Storm Water Permit (CGP). The template gives you a framework to ensure that your SWPPP addresses the necessary elements required by the permit. Additional resources are available on the DWQ's General Construction Storm Water Website.

This template covers most of the SWPPP elements that the Utah CGP requires, however, you are encouraged to customize this template to reflect unique conditions at the site or address a requirement not covered in the provided sections.

Using the SWPPP template

This Word template provides instructions and space for project details. Read each section's instructions before filling it out, referring to the permit section for exact wording or additional resources if needed. Delete instructions for a cleaner document. Add tables or text as needed. Some sections may require minimal or no input, while others may need detailed explanations.

Tips for completing the SWPPP template

- Utilize the EPA's guidance on Developing Your Storm Water Pollution Prevention Plan (SWPPP Guide).
- If multiple parties are responsible for storm water management on your project, consider coordinating with them when developing your SWPPP.
- Modify this SWPPP template to meet your project's specific requirements. Be sure to include important aspects of the SWPPP that go beyond the boundaries of the project.
- Utah Code § 19-5-108.3 directs DWQ to publish a Preferred List of Stormwater Best Management Practices (BMPs). You may, but are not required to, use this BMP manual resource to help select BMPs for the project, and cite the BMP manual as needed to meet Description of Storm water Controls requirements (CGP Part 7.3.5) in Sections 4, 5, and Appendix H of the SWPPP template.
- Make sure you inform subcontractors about limitations or special requirements if their work intersects with SWPPP requirements. You might write a section of your SWPPP specifically for a subcontractor and deliver that section to the sub-contractor before his work commences.

Recordkeeping:

Keep all required documents (paper or electronic), including the SWPPP, inspection reports, corrective-action logs, NOI and other permit required records, readily available on-site for review during inspections (CGP Parts 4.7.3, 5.4.4, 7.3.9 and 7.4.1). Retain records for at least three years after final stabilization (CGP Part 9.18).

Storm Water Pollution Prevention Plan (SWPPP)

For Construction Activities At:

Insert Project Name
Insert Project Site Location/Address
Insert City, State, Zip Code
Insert Project Site Telephone Number (if applicable)

Operator:

Insert Company or Organization Name
Insert Name
Insert Address
Insert City, State, Zip Code
Insert Telephone Number
Insert Fax/Email

SWPPP Prepared By:

Insert Company or Organization Name
Insert Name
Insert Address
Insert City, State, Zip Code
Insert Telephone Number
Insert Fax/Email

SWPPP Preparation Date:

__/__/__

UPDES ID Permit Tracking Number*:

UTR_____

** This is the unique number assigned to your project after you have applied for coverage under the Utah Pollutant Discharge Elimination System (UPDES) Construction General Permit. If this template is filled out first, you can leave the tracking number blank until after you have applied for coverage.*

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SECTION 1: STORMWATER TEAM

Instructions (CGP Parts 6.1, 6.2, 6.3, 6.4 and 7.3.1):

- Identify the staff members that are part of the project's storm water team as well as their responsibilities. The storm water team is comprised of individuals who are responsible for the development of the SWPPP, any later modifications to it, installing and maintaining storm water controls, conducting site inspections, and making corrective actions where required.
- Provide documentation of the training received by all team members responsible for conducting site inspections in Appendix G of this template (CGP Parts 6.3 and 7.3.1).
- Each member of the storm water team must have ready access to either an electronic or paper copy of the 2024 CGP and the SWPPP (CGP Part 6.4).
- A SWPPP writer for a site greater than 5 acres, with a perennial surface water within 50 feet of the project, or with a steep slope (70% or 35 degrees or more) must complete a training program that demonstrates they are a "qualified person" per CGP Part 7.2. Sign the acknowledgement page in Section 10, if applicable.
- The following personnel, at a minimum, must receive training on their responsibilities (CGP Part 6.1/6.2):
  - ✓ Personnel who are responsible for the design, installation, maintenance, and/or repair of storm water controls (including pollution prevention measures);
  - ✓ Personnel responsible for the application and storage of treatment chemicals;
  - ✓ Personnel who are responsible for conducting inspections as required in Part 6.3.; and
  - ✓ Personnel who are responsible for taking corrective actions as required in Part 5.
- For more on training, see the *EPA SWPPP Guide*, Chapter 8.

Remove these instructions to create a cleaner document.

1.1 Storm Water Team

Name, Position, and Contact Info.	Responsibilities	I Have Completed Training Required by CGP Part 6.2	I Have Read the CGP and Understand the Applicable Requirements
Insert Name of Responsible Person Insert Position Insert Telephone Number Insert Email	Insert Responsibility (i.e., design, installation, maintenance, and/or repair of BMPs; taking corrective actions)	☐ Yes ☐ No	☐ Yes
Insert Name of Responsible Person Insert Position Insert Telephone Number Insert Email	Insert Responsibility	☐ Yes ☐ No	☐ Yes
Insert Name of Responsible Person Insert Position Insert Telephone Number Insert Email	Insert Responsibility	☐ Yes ☐ No	☐ Yes

[Insert or delete rows as necessary.]

1.2 Storm Water Inspection Team

Name, Position and Contact Info.	Training(s) Received	Date Training(s) Completed	Confirm that it Satisfies the Minimum Elements of CGP Part 6.3.b
Insert Name of Responsible Person Insert Position Insert Telephone Number Insert Email	Insert Title of Training Received	Date: Click here to enter a date.	☐ Principles and practices of erosion and sediment control and pollution prevention practices at construction sites ☐ Proper installation and maintenance of erosion and sediment controls and pollution prevention practices used at construction sites ☐ Performance of inspections, including the proper completion of required reports and documentation, consistent with the requirements of Part 4
Insert Name of Responsible Person Insert Position Insert Telephone Number Insert Email	Insert Title of Training Received	Date: Click here to enter a date.	☐ Principles and practices of erosion and sediment control and pollution prevention practices at construction sites ☐ Proper installation and maintenance of erosion and sediment controls and pollution prevention practices used at construction sites ☐ Performance of inspections, including the proper completion of required reports and documentation, consistent with the requirements of Part 4
Insert Name of Responsible Person Insert Position Insert Telephone Number Insert Email	Insert Title of Training Received	Date: Click here to enter a date.	☐ Principles and practices of erosion and sediment control and pollution prevention practices at construction sites ☐ Proper installation and maintenance of erosion and sediment controls and pollution prevention practices used at construction sites ☐ Performance of inspections, including the proper completion of required reports and documentation, consistent with the requirements of Part 4

[Insert or delete rows as necessary.]

SECTION 2: NATURE OF CONSTRUCTION ACTIVITIES

2.1 Construction Site Estimates

Instructions (CGP 7.3.2.b-c):

- State the property's total lot size.
- Estimate the total area that will be disturbed by construction activities (excavation, grading, staging, borrow and fill areas, etc.)

Remove these instructions to create a cleaner document.

The following are estimates for the construction site.

Total project area (parcel size): acres
Construction site area to be disturbed: acres

2.2 Construction Activity Descriptions

Instructions (CGP 7.3.2.a, d & g):

- Briefly describe the nature of the construction activity and support areas.
- Provide typical business days and hours of operation.
- For more information see CGP Part 7.3.2 and *EPA SWPPP Guide*, Chapter 3.A.

Remove these instructions to create a cleaner document.

Type of Construction Site *(check all that apply):*

☐ Single-Family Residential ☐ Multi-Family Residential ☐ Commercial
☐ Industrial ☐ Institutional ☐ Highway or Road ☐ Utility
☐ Other _____

Describe the general scope of work for the project, major phases of construction, etc.
INSERT TEXT HERE

Describe any on-site and off-site construction support activity areas (e.g., concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, borrow areas):
INSERT TEXT HERE

Typical site business days and times:
INSERT TEXT HERE

2.3 Description and Projected Schedule

Instructions (CGP 7.3.2.e):

- Provide a detailed construction schedule that includes: Start of work in each site area, any planned stoppages of work, stabilizations milestones, and site close-out dates (i.e., removal of temporary storm water controls, equipment and pollutant-generating activities).
- For more information, see *EPA SWPPP Guide*, Chapter 4, ESC Principle 2. It might be useful to develop a separate, detailed site map for each phase of construction.

Remove these instructions to create a cleaner document.

Phase I

Insert General Discription of Phase	
Estimated Start Date of Construction Activities for this Phase	Insert Estimated Date
Estimated End Date of Construction Activities for this Phase	Insert Estimated Date
Estimated Date(s) of Application of Stabilization Measures for Areas of the Site Required to be Stabilized	Insert Estimated Date *[Add additional dates as necessary]*
Estimated Date(s) when Stormwater Controls will be Removed	Insert Estimated Date *[Add additional dates as necessary]*

Phase II

Insert General Discription of Phase	
Estimated Start Date of Construction Activities for this Phase	Insert Estimated Date
Estimated End Date of Construction Activities for this Phase	Insert Estimated Date
Estimated Date(s) of Application of Stabilization Measures for Areas of the Site Required to be Stabilized	Insert Estimated Date *[Add additional dates as necessary]*
Estimated Date(s) when Stormwater Controls will be Removed	Insert Estimated Date *[Add additional dates as necessary]*

Phase III

Insert General Discription of Phase	
Estimated Start Date of Construction Activities for this Phase	Insert Estimated Date
Estimated End Date of Construction Activities for this Phase	Insert Estimated Date
Estimated Date(s) of Application of Stabilization Measures for Areas of the Site Required to be Stabilized	Insert Estimated Date *[Add additional dates as necessary]*
Estimated Date(s) when Stormwater Controls will be Removed	Insert Estimated Date *[Add additional dates as necessary]*

Phase IV

Insert General Discription of Phase	
Estimated Start Date of Construction Activities for this Phase	Insert Estimated Date
Estimated End Date of Construction Activities for this Phase	Insert Estimated Date
Estimated Date(s) of Application of Stabilization Measures for Areas of the Site Required to be Stabilized	Insert Estimated Date *[Add additional dates as necessary]*
Estimated Date(s) when Stormwater Controls will be Removed	Insert Estimated Date *[Add additional dates as necessary]*

[Repeat as needed]

2.4 Potential Sources of Pollution

Instructions (CGP 7.3.2.f):

- Identify and describe all potential sources of pollution or pollutant-generating activity (e.g., paving operations; concrete, paint, and stucco washout and waste disposal; solid waste storage and disposal), other than sediment, which could be exposed to rainfall or snowmelt, and may reasonably be expected to discharge from the construction site.
- For more information, see *EPA SWPPP Guide*, Chapter 3.A.

Remove these instructions to create a cleaner document.

Pollutant-Generating Activity (e.g., paving operations; concrete, paint, and stucco washout and waste disposal; solid waste storage and disposal; and dewatering operations)	**Pollutants or Pollutant Constituents** (e.g., sediment, fertilizers, pesticides, paints, caulks, sealants, fluorescent light ballasts, contaminated substrates, solvents, fuels)
Insert Pollutant-Generating Activity	Insert Pollutant(s)
Insert Pollutant-Generating Activity	Insert Pollutant(s)
Insert Pollutant-Generating Activity	Insert Pollutant(s)
Insert Pollutant-Generating Activity	Insert Pollutant(s)
Insert Pollutant-Generating Activity	Insert Pollutant(s)
Insert Pollutant-Generating Activity	Insert Pollutant(s)

[Include additional rows or delete as necessary.]

2.5 Non-Storm Water Discharges

Instructions (CGP 7.3.4):

- Identify all allowable sources of non-storm water discharges and how they will be controlled. A list of allowable non-storm water discharges is found in the CGP Part 1.2.2.
- For more information, see *EPA SWPPP Guide*, Chapter 3.A.

Remove these instructions to create a cleaner document.

List of Authorized Non-Stormwater Discharges Present at the Site

Authorized Non-Stormwater Discharge	**Will or May Occur at Your Site?**
Discharges from emergency fire-fighting activities	☐ Yes ☐ No
Fire hydrant flushings	☐ Yes ☐ No
Landscape irrigation	☐ Yes ☐ No

Authorized Non-Stormwater Discharge	Will or May Occur at Your Site?
Water used to wash vehicles and equipment	☐ Yes ☐ No
Water used to control dust	☐ Yes ☐ No
Potable water including uncontaminated water line flushings	☐ Yes ☐ No
External building washdown (soaps/solvents are not used and external surfaces do not contain hazardous substances)	☐ Yes ☐ No
Pavement wash waters	☐ Yes ☐ No
Uncontaminated air conditioning or compressor condensate	☐ Yes ☐ No
Uncontaminated, non-turbid discharges of ground water or spring water	☐ Yes ☐ No
Foundation or footing drains	☐ Yes ☐ No
Uncontaminated construction dewatering water	☐ Yes ☐ No

2.6 Site Maps

Instructions (CGP 7.3.3):

- Attach site maps to Appendix A. For most projects, a series of site maps is recommended. The first should show the undeveloped site and its current features. An additional map or maps should be created to show the developed site or for more complicated sites show the major phases of development.

These maps should include the following:

- Boundaries of the property
- Locations of earth-disturbing activities, including demolition, and note any phasing;
- Direction(s) of storm water flow and approximate slopes before and after major grading activities;
- Type and extent of pre-construction cover (vegetative cover, pavement, etc.);
- Locations of stockpiles and material storage;
- Water crossings and all water of the state within one mile downstream of the site's discharge point;
- Designated points where vehicles enter onto paved roads;
- Locations of structures and other impervious surfaces upon completion of construction;
- On-site and off-site construction support activity areas covered by the permit;
- Storm water and authorized non-storm water discharge locations to inlets or waters of the state;
- Locations of all potential pollutant-generating activities;
- Locations of storm water controls, including natural buffer areas; and
- Locations where polymers, flocculants, or other treatment chemicals will be used and stored.
- For more information, see *EPA SWPPP Guide*, Chapter 3.C.

Remove these instructions to create a cleaner document.

SECTION 3: WATER QUALITY

3.1 Discharge Information

Instructions:

- A Municipal Separate Storm Sewer System (MS4) is a publicly owned and operated storm water conveyance system that serves designated communities. Check the Utah Permitted MS4 Operator List; if your project falls within a regulated MS4's jurisdiction, name that MS4 here. If the municipality is not on the list, leave this field blank.

Remove these instructions to create a cleaner document.

Does your project/site discharge storm water into a Municipal Separate Storm Sewer System (MS4)? ☐ Yes ☐ No

List the MS4 that receives the discharge from the construction project: INSERT TEXT HERE

3.2 Receiving Waters

Instructions (CGP 1.1.6 and 3):

- In the table below, list the name of the first waters of the state receiving discharges from your site. Multiple rows are provided for sites with discharges at different locations flowing to distinct waters of the state. For discharges entering a storm sewer system, the first waters of the state is the water body receiving the stormwater discharge from that system. Contact the storm sewer system owner to confirm the discharge point if needed.
- Visit 2024 DWQ Beneficial Uses Map to locate the name of the receiving waters and check impairment, antidegradation category rank, TMDL status for completing the table below. Search for the waterbody in the upper left-hand corner or zoom to your area and click on the waterbody to view its antidegradation category status.
- For more information on approved TMDLs visit DWQ's State and Federally Approved Total Maximum Daily Load Studies webpage.
- If any of the waters of the state you listed are impaired, list the pollutant(s) causing the impairment in column 3 of the table below. Your SWPPP must include specific measures to prevent discharges of these pollutants.
- If any of the waters of the state you listed are identified as a Category 1 or 2 water (a Category 1 water is only found within Forest Service boundaries) provide the category in column 3 of the table below.
- For more information, see CGP Part 3.1 and 3.2 and *EPA SWPPP Guide*, Chapter 3.B.

Remove these instructions to create a cleaner document.

Name(s) of Receiving Waters: INSERT TEXT HERE		
Name of Receiving Water (first waters of the state that receives storm water or where storm system discharges to)	Is the water impaired or high quality?	**If high quality:** Is it Antidegradation Category 1 or 2? **If impaired:** List pollutants that the waterbody is impaired for
1.	☐ Not high quality or impaired ☐ Impaired, has approved TMDL ☐ Impaired, no TMDL ☐ High quality	
2.	☐ Not high quality or impaired ☐ Impaired, has approved TMDL ☐ Impaired, no TMDL ☐ High quality	

[Insert or delete rows as necessary.]

3.3 Impaired Waters

Instructions (CGP 3.2):

- If you discharge to an impaired water as listed in the above table, provide information on additional efforts that will be taken to control the release of impairment causing pollutants. This is especially important for projects discharging to a surface water with an EPA approved TMDL for sediment or nutrients and an extra effort must be provided to prevent sediment from leaving the site.
- If no impairments are identified, state: **"No impairment-causing pollutants are present on site."**

Remove these instructions to create a cleaner document.

Description of additional precautions taken if discharging to impaired waters of the state.
INSERT TEXT HERE

3.4 High-Quality Waters

Instructions (CGP 3.2):

- If you discharge to a high-quality water as listed in the above, provide information on additional efforts that will be taken to control the release of pollutants. Per CGP Part 1.1.6 you can discharge to a Category 1 water if your discharge is temporary and limited and where best management practices will be employed to minimize pollution effects. Discharge to Category 2 waters is allowed only if the discharge will not lower the water quality of the water body.
- If no discharges to high-quality waters, state: **"No discharges will impact high-quality waters."**

Remove these instructions to create a cleaner document.

Description of extra measures implemented to reduce pollution impacts when discharging to high-quality surface water:

INSERT TEXT HERE

SECTION 4: EROSION AND SEDIMENT CONTROLS – BMPS

4.1 List of Erosion and Sediment BMPs on Site

Instructions (CGP Part 2.2 and 7.3.5):

- Identify best management practices (BMPs) that will be implemented on site to control erosion and sediment transport from storm water.
- Use the below CGP requirements to determine where BMPs are necessary. Fill out the rightmost column with BMPs you are selecting. Some requirements may not apply to your site.
- For each BMP you must provide a description of the control, any design specifications, routine maintenance specifications, an approximate date for storm water control implementation/installation.. These details are listed in the BMP section below the table.
- BMPs are listed as examples, you may use BMPs not listed.
- Details and design specifications can be provided in this section or in Appendix H.
- Perimeter control maintenance must include removal of sediment before it has accumulated to one-half the above-ground height of the control.
- For more information, see *EPA SWPPP Guide*, Chapter 4.
- A preferred BMP list is available on your listed MS4's website, or if your project is outside an MS4, on the Utah DWQ website here: Utah DWQ Preferred Stormwater BMP List

Remove these instructions to create a cleaner document.

CGP Requirement	Example BMPs	EPA SWPPP Guide Section	BMPs Selected (Name and Reference Number from DWQ Preferred BMP List, if applicable)
Preserve vegetation where possible and direct storm water to vegetated areas when feasible (CGP 2.2.2.)	Phasing to minimize disturbance, signs/fences to protect areas not being disturbed.	Chapter 4, ESC Principle 1	
Install sediment controls along perimeter areas that receive pollutant discharges (CGP 2.2.3.).	Silt fence, fiber rolls, earth berms	Chapter 4, ESC Principle 7	
Minimize sediment track-out (CGP 2.2.4.)	Restrict access, stabilize exits, track-out pads, tire washing station, clean-up sediments	Chapter 4, ESC Principle 9	
Manage stockpiles with perimeter controls and locate away from storm water conveyances (CGP 2.2.5.)	Sediment barriers downgradient, proper location, covered stockpiles, diverting storm water from stockpiles	Chapter 4, ESC Principle 4	
Minimize dust (CGP 2.2.6.)	Water application, mulching, chemical dust suppression techniques		
Minimize steep slope disturbance (CGP 2.2.7.)	Erosion control blankets, tackifiers, protect slopes from disturbance	Chapter 4, ESC Principle 5	
Preserve topsoil (CGP 2.2.8.)	Stockpile topsoil	Chapter 4, ESC Principle 1	
Minimize soil compaction where final cover is vegetation (CGP 2.2.9.)	Restrict vehicle access, recondition soils before seeding		
Protect storm drain inlets (CGP 2.2.10.)	Inserts, rock-filled bags, covers	Chapter 4, ESC Principle 6	
Slow down runoff with erosion controls and velocity dissipation devices (CGP 2.2.11.)	Check dams, riprap	Chapter 4, ESC Principle 3	

Appropriately design any sediment basins or impoundments (CGP 2.2.12.)	Design to receive a 2-year 24-hour storm or 3,600 cubic feet per acre; include design specifications	Chapter 4, ESC Principle 8	
Follow requirements for any treatment chemicals (polymers, flocculants, coagulants, etc.) (2.2.13)	Store in leak proof containers and cover, proper training, minimize use		
Stabilize exposed portions of site with 14 days of inactivity (CGP 2.2.14).	Seeding, erosion control blankets, gravel, hydromulch	Chapter 9	

4.1.1: Place name of BMP here

BMP Description: Insert description of track-out control to be installed	
Installation Schedule:	Insert approximate date of installation
Maintenance Specifications:	***Reference to maintenance specifications in Appendix H if necessary***
Installation Specifications:	***Reference to installation specifications in Appendix H if necessary***

4.1.2: Place name of BMP here

BMP Description: Insert description of track-out control to be installed	
Installation Schedule:	Insert approximate date of installation
Maintenance Specifications:	***Reference to maintenance specifications in Appendix H if necessary***
Installation Specifications:	***Reference to installation specifications in Appendix H if necessary***

4.1.3: Place name of BMP here

BMP Description: Insert description of track-out control to be installed	
Installation Schedule:	Insert approximate date of installation
Maintenance Specifications:	***Reference to maintenance specifications in Appendix H if necessary***
Installation Specifications:	***Reference to installation specifications in Appendix H if necessary***

4.1.4: Place name of BMP here

BMP Description: Insert description of track-out control to be installed	
Installation Schedule:	Insert approximate date of installation

Maintenance Specifications:	***Reference to maintenance specifications in Appendix H if necessary***
Installation Specifications:	***Reference to installation specifications in Appendix H if necessary***

4.1.5: Place name of BMP here	
BMP Description: Insert description of track-out control to be installed	
Installation Schedule:	Insert approximate date of installation
Maintenance Specifications:	***Reference to maintenance specifications in Appendix H if necessary***
Installation Specifications:	***Reference to installation specifications in Appendix H if necessary***

4.1.6: Place name of BMP here	
BMP Description: Insert description of track-out control to be installed	
Installation Schedule:	Insert approximate date of installation
Maintenance Specifications:	***Reference to maintenance specifications in Appendix H if necessary***
Installation Specifications:	***Reference to installation specifications in Appendix H if necessary***

[Repeat as needed]

4.2 Natural Buffers or Equivalent Sediment Controls

Instructions (CGP Part 7.3.5.b (1), 2.2.1, and Appendix A):

- This section only applies if waters of the state are located within 50 feet of disturbed areas. If this is the case, review CGP Part 2.2.1 and Appendix A of the CGP for information on how to comply with the buffer requirements.
- Describe the compliance alternative that was chosen to meet the buffer requirements and include any required documentation supporting the alternative selected. The compliance alternative selected must be maintained throughout the duration of permit coverage. However, if you select a different compliance alternative during your period of permit coverage, you must modify your SWPPP to reflect this change.
- If you qualify for one of the exceptions in CGP Part A.2.2, include documentation related to your qualification for such exceptions.
- Review Appendix A of the CGP for step-by-step instructions and examples on how to comply with the different buffer alternatives.

Remove these instructions to create a cleaner document.

Buffer Compliance Alternatives

Are there any waters of the state within 50 feet of your project's earth disturbances?

☐ Yes ☐ No

(Note: If "no", no further documentation is required. Delete the rest of Section 4.3 below this point.)

List the water body: INSERT TEXT HERE

Check the compliance alternative that you have chosen:

☐ I will provide and maintain a 50-foot undisturbed natural buffer around waters of the state.

☐ It is infeasible to provide and maintain a full 50-foot undisturbed natural buffer. I will provide and implement erosion and sediment controls to achieve the required sediment load reduction for my conditions.

- Reason that a 50' buffer could not be maintained: INSERT TEXT HERE
- Width of buffer that will be retained: INSERT TEXT HERE
- Additional controls used to achieve equivalent sediment load reduction of a 50' buffer: INSERT TEXT HERE
- Description of the calculations and assumptions used to determine sediment load reductions: INSERT TEXT HERE

☐ The project qualifies as "small residential lot" disturbing less than an acre. The natural buffer is preserved in accordance with CGP A.2.3., storm water is treated by site erosion and sediment controls before discharge, natural buffers are shown on the site map, and buffer areas are marked on site. Select one of the 2 alternatives for small residential lots:

☐ Alternative 1: Using Table A-1 in CGP for requirements

- Width of buffer that will be retained: INSERT TEXT HERE
- Additional controls to be used: INSERT TEXT HERE

☐ Alternative 2: Using Tables A-2 through A-7 in CGP for requirements

- Width of buffer that will be retained: INSERT TEXT HERE
- Sediment Risk Level Determined: INSERT TEXT HERE
- Additional controls to be used: INSERT TEXT HERE

☐ I qualify for one of the exceptions in Part A.2.2. (If you have checked this box, provide information on the applicable buffer exception that applies, below.)

☐ There is no discharge of storm water through the area between the disturbed portions of the site and waters of the state that is located within 50 feet.

☐ No natural buffer exists due to preexisting development disturbances that occurred prior to the initiation of planning for this project.

☐ For a linear project, site constraints (e.g., limited right-of-way) make it infeasible for me to meet any of the compliance alternatives.

- Reason it is infeasible: INSERT TEXT HERE
- Buffer width retained or supplemental controls used: INSERT TEXT HERE

☐ Buffer disturbances are authorized under a CWA Section 404 permit.

- Describe earth disturbances in buffer area: INSERT TEXT HERE

(Note: This exception does not apply to portions upland of the Section 404 permitted work.)

☐ Buffer disturbances will occur for the construction of a water-dependent structure or water access area (e.g., pier, boat ramp, and trail).

- Describe earth disturbances in buffer area: INSERT TEXT HERE

4.3 Linear Site Perimeter Control Exemption

Instructions (CGP 7.3.5.b (2)):

- For areas where perimeter controls are not feasible on a linear construction site, include a description of why it is not feasible and other practices that will be implemented to minimize discharges of pollutants from the site.

Remove these instructions to create a cleaner document.

☐ Check box if section not applicable to this site (Note: If not applicable skip to next section)

If the site is linear and perimeter controls are not feasible, describe other practices in use: INSERT TEXT HERE

4.4 Final Stabilization

Instructions (CGP 7.3.5.b (6) and 2.2.14.b):

You must include the following information:

- The specific vegetative and/or non-vegetative practices that will be used; and
- The stabilization deadline that you will meet in accordance with part 2.2.14.
- You can amend or add to this section as areas of your project are finally stabilized.
- Update your site plans to indicate areas that have achieved final stabilization.
- For more on this topic, see *SWPPP Guide*, Chapter 9.

Remove these instructions to create a cleaner document.

Use this template box if you are <u>not</u> located in an arid, semi-arid, or drought-stricken area.

Insert name of site stabilization practice	
☐ *Vegetative* ☐ *Non-Vegetative* ☐ *Temporary* ☐ *Permanent*	
Description: ▪ Insert description of stabilization practice to be installed ▪ Note how design will meet requirements of Part 2.2.14.a	
Installation	Insert approximate date of installation

Insert name of site stabilization practice	
Completion	Insert approximate completion date
Maintenance Requirements	Insert maintenance requirements for the stabilization practice
Design Specifications	Reference to detailed specifications/instructions in Appendix H if necessary

[Repeat as needed for additional stabilization practices.]

Use this template box if you <u>are</u> located in an arid, semi-arid, or drought-stricken area. Seasonally Dry Period Locator Tool found here: Construction General Permit Resources, Tools, and Templates \| US EPA

Insert name of site stabilization practice	
☐ *Vegetative* ☐ *Non-Vegetative* ☐ *Temporary* ☐ *Permanent*	
Description: ▪ Insert description of stabilization practice to be installed ▪ Note how design will meet requirements of Part 2.2.14.b	
Dry Period	▪ Beginning month of seasonally dry period: Insert approximate date ▪ Ending month of seasonally dry period: Insert approximate date ▪ Site conditions during this period: Describe your site conditions during this period
Installation and Completion	Describe the schedule you will follow for initiating and completing vegetative stabilization ▪ Approximate installation date: Insert approximate date ▪ Approximate completion date: Insert approximate date
Maintenance Requirements	Insert maintenance requirements for the stabilization practice
Design Specifications	Reference to detailed specifications/instructions in Appendix H if necessary

[Repeat as needed for additional stabilization practices.]

4.5 Dewatering Practices

Instructions (CGP 1.2.4 and 2.3.7):

- If you will be discharging storm water that is removed from excavations, trenches, foundations, vaults, or other similar points of accumulation, it must be permitted by UPDES permit UTG070000 (Construction Dewatering and Hydrostatic Testing Permit) unless it can be managed onsite through percolation or evaporation.
- Refer to the Construction Dewatering And Hydrostatic Testing Permit or call the DWQ at 801-536-4300 for more information.
- Include schedule and general locations of dewatering. Dewatering locations must be on the site map.

Remove these instructions to create a cleaner document.

☐ Check box if section not applicable to this site (Note: If not applicable skip to next section)

Describe the general scope of dewatering practices for the project, approximate scheduled dates and any BMPs used to manage dewatering practices:

INSERT TEXT HERE

SECTION 5: BMPS - POLLUTION PREVENTION CONTROLS

5.1 Spill Prevention and Response

Instructions (CGP Part 7.3.5.b and 2.3.6):

- Describe the spill prevention and control plan. Include ways to reduce the chance of spills, stop the source of spills, contain and clean up spills, dispose of materials contaminated by spills, and train personnel responsible for spill prevention and control.
- Some projects/site may be required to develop a Spill Prevention Control and Countermeasure (SPCC) plan under a separate regulatory program (40 CFR 112). If you are required to develop an SPCC plan, or you already have one, you should include references to the relevant requirements from your plan.
- The plan must include the materials and method of containment and for flowing liquid, cleanup, disposal and follow the minimum spill controls below.
- For more information, see *EPA SWPPP Guide*, Chapter 5, P2 Principle 6.

Remove these instructions to create a cleaner document.

Describe spill procedures and materials available for expeditious containment, clean-up and disposal of spills:

INSERT TEXT HERE OR REFERENCE DOCUMENT

Identify the employee responsible for detection and response of spills and leaks:

INSERT TEXT HERE

Any discharges in 24 hours equal to or in excess of the reportable quantities listed in 40 CFR 117, 40 CFR 110, and 40 CFR 302 will be reported to the National Response Center and the Division of Water Quality (DWQ) as soon as practical after knowledge of the spill is known to the permittees. The permittee shall submit within 7 calendar days of knowledge of the release a written description of: the release (including the type and estimate of the amount of material released), the date that such release occurred, the circumstances leading to the release, and measures taken and/or planned to be taken to the Division of Water Quality (DWQ), 288 North 1460 West, P.O. Box 144870, Salt Lake City, Utah 84114-4870. The Storm Water Pollution Prevention Plan must be modified within 14 calendar days of knowledge of the release to provide a description of the release, the circumstances leading to the release, and the date of the release. In addition, the plan must be reviewed to identify measures to prevent the recurrence of such releases and to respond to such releases, and the plan must be modified where appropriate.

Agency	Phone Number
National Response Center	(800) 424-8802
Division of Water Quality (DWQ) 24-Hr Reporting	(801)-231-1769 (801) 536-4123
Utah Department of Health Emergency Response	(801) 580-6681

Material	Media Released To	Reportable Quantity
Engine oil, fuel, hydraulic & brake fluid	Land	25 gallons
Paints, solvents, thinners	Land	100 lbs (13 gallons)
Engine oil, fuel, hydraulic & brake fluid	Water	Visible Sheen
Antifreeze, battery acid, gasoline, engine degreasers	Air, Land, Water	100 lbs (13 gallons)
Refrigerant	Air	1 lb

5.2 Pollution Prevention Controls

Instructions (CGP Part 2.3 and 7.3.5):

- Describe the key pollution prevention BMPs that will be implemented to prevent the discharge of pollutants (CGP Part 2.3).
- Use the below CGP requirements, and the pollutant generating activates identified in SWPPP section 2.4, to determine where BMPs are necessary.
- For each BMP you must provide a description of the control, any design specifications, routine maintenance specifications, a schedule for storm water control implementation/installation, and the staff responsible for maintaining the BMP.
- BMPs are listed as examples, you may use BMPs not listed.
- Details and design specifications can be provided in this section or in Appendix H.
- For more information, see *EPA SWPPP Guide*, Chapter 5.
- A preferred BMP list is available on your listed MS4's website, or if your project is outside an MS4, on the Utah DWQ website here: Utah DWQ Preferred Stormwater BMP List

Remove these instructions to create a cleaner document.

CGP Requirements	Example BMPs	EPA SWPPP Guide Section	BMPs Selected (Name and Reference Number from DWQ Preferred BMP List, if applicable)
Equipment and vehicle fueling (CGP 2.3.1)	Spill kits, SPCCP, drip pans, locate activities away from conveyances, use secondary containment	Chapter 5, P2 Principle 4	
Equipment and vehicle washing (CGP 2.3.2)	Locating away from surface waters and storm water conveyances, directing wash waters to a sediment basin or sediment trap, using filtration devices	Chapter 5, P2 Principle 5	
Storage, handling, and disposal of building products and waste (CGP 2.3.3)	Cover (plastic sheeting / temporary roofs), secondary containment, leakproof containers, proper dumpsters, secured portable toilets, locate away from storm water conveyances	Chapter 5, P2 Principle 1 and 2	
Washing of stucco, paint, concrete, form release oils, curing compounds, etc. (CGP 2.3.4)	Leak proof containers, lined pits, locate away from storm water conveyances	Chapter 5, P2 Principle 3	
Properly apply fertilizer (CGP 2.3.5)	Follow manufacture specifications, document deviations in applications, avoid applications to frozen ground, before heavy rains, or storm water conveyances		

5.2.1.: Place name of BMP here	
BMP Description: Insert description of track-out control to be installed	
Installation Schedule:	Insert approximate date of installation
Maintenance Specifications:	***Reference to maintenance specifications in Appendix H if necessary***
Installation Specifications:	***Reference to installation specifications in Appendix H if necessary***

5.2.2.: Place name of BMP here	
BMP Description: Insert description of track-out control to be installed	
Installation Schedule:	Insert approximate date of installation
Maintenance Specifications:	***Reference to maintenance specifications in Appendix H if necessary***
Installation Specifications:	***Reference to installation specifications in Appendix H if necessary***

5.2.3.: Place name of BMP here	
BMP Description: Insert description of track-out control to be installed	
Installation Schedule:	Insert approximate date of installation
Maintenance Specifications:	***Reference to maintenance specifications in Appendix H if necessary***
Installation Specifications:	***Reference to installation specifications in Appendix H if necessary***

5.2.4: Place name of BMP here	
BMP Description: Insert description of track-out control to be installed	
Installation Schedule:	Insert approximate date of installation
Maintenance Specifications:	***Reference to maintenance specifications in Appendix H if necessary***
Installation Specifications:	***Reference to installation specifications in Appendix H if necessary***

5.2.5: Place name of BMP here	
BMP Description: Insert description of track-out control to be installed	
Installation Schedule:	Insert approximate date of installation
Maintenance Specifications:	***Reference to maintenance specifications in Appendix H if necessary***

Installation Specifications:	***Reference to installation specifications in Appendix H if necessary***

5.2.6: Place name of BMP here	
BMP Description: Insert description of track-out control to be installed	
Installation Schedule:	Insert approximate date of installation
Maintenance Specifications:	***Reference to maintenance specifications in Appendix H if necessary***
Installation Specifications:	***Reference to installation specifications in Appendix H if necessary***

[Repeat as needed]

SECTION 6: SPECIAL CONDITIONS

Instructions:

The conditions listed below require additional details or actions added to your SWPPP. If they do not apply you may delete them from this SWPPP.

Remove these instructions to create a cleaner document.

6.1 Emergency Related Projects

Instructions (CGP 1.4.1):

- For emergency activities that require immediate authorization but last longer than 30 days, a NOI may be submitted within 30 days of starting work.
- To be an emergency related project it must be considered a public emergency, and the cause must be documented along with the description of necessary construction to reestablish effected public services.

Emergency-Related Project? ☐ Yes ☐ No

DESCRIBE THE NATURE OF THE PUBLIC EMERGENCY AND WHY IMMEDIATE AUTHORIZATION WAS NECESSARY.

Instructions (CGP 7.3.7):

If you are using any of the following storm water controls at your site as they are described below, you must document any contact you have had with DWQ for implementing the requirements for underground injection wells in the Safe Drinking Water Act and DEQ's implementing regulation at UAC R317-7-2.

There may be additional local requirements related to such structures

For the State UIC Contact at DWQ call (801) 536-4300.

Remove these instructions to create a cleaner document.

6.2 UIC Class 5 Injection Wells

☐ Check box if section not applicable to this site (Note: If not applicable skip to next section)

Class V UIC Wells on site (all must be reported to DWQ for inventory):

☐ Infiltration trenches (if storm water is directed to any shaft or hole that is deeper than its widest surface dimension or has a subsurface fluid distribution system)

☐ Commercially manufactured pre-cast or pre-built subsurface detention vault/infiltration system

☐ Drywell, seepage pit, or improved sinkhole (if storm water is directed to any shaft or hole that is deeper than its widest surface dimension or has a subsurface fluid distribution system)

Description of your Class V Injection Well and any local requirements:

INSERT DESCRIPTION AND ANY DWQ OR LOCAL REQUIREMENTS

Description of any additional BMPs used in conjunction with the UIC well.

INSERT DESCRIPTION

6.2.1: Place name of BMP here	
BMP Description: Insert description of BMP to be installed	
Installation Schedule:	Insert approximate date of installation
Maintenance and Inspection:	*Reference to detailed specifications/instructions in Appendix H necessary*
Design Specifications and Drawings:	*Reference to detailed specifications/instructions in Appendix H necessary*

6.3 Chemical Treatment

Instructions (see CGP 2.2.13 and 7.3.5.b (5)):

- If you are using treatment chemicals at your site, provide details for each of the items below. This information is required as part of the SWPPP requirements in CGP Part 7.3.5.b.

☐ Check box if section not applicable to this site (Note: If not applicable skip to next section)

Soil Types
List all the soil types (including soil types expected to be found in fill material) that are expected to be exposed during construction and that will be discharged to locations where chemicals will be applied: INSERT TEXT HERE

Treatment Chemicals
List all treatment chemicals that will be used at the site and explain why these chemicals are suited to the soil characteristics: INSERT TEXT HERE

Describe the dosage of all treatment chemicals you will use at the site or the methodology you will use to determine dosage: INSERT TEXT HERE

Provide information from any applicable Safety Data Sheets (SDS): INSERT TEXT HERE

Describe how each of the chemicals will be stored: INSERT TEXT HERE

Include references to applicable state or local requirements affecting the use of treatment chemicals, and copies of applicable manufacturer's specifications regarding the use of your specific treatment chemicals and/or chemical treatment systems: INSERT TEXT HERE

Special Controls for Cationic Treatment Chemicals (if applicable)
If you have been authorized by DWQ to use cationic treatment chemicals, identify the specific controls and implementation procedures you are required to implement to ensure that your use of cationic treatment chemicals will not lead to a violation of water quality standards or harm aquatic life: INSERT TEXT HERE

Schematic Drawings of Storm Water Controls/Chemical Treatment Systems
Provide schematic drawings of any chemically enhanced storm water controls or chemical treatment systems to be used for application of treatment chemicals: INSERT TEXT HERE

Training
Describe the training that personnel who handle and apply chemicals have received prior to permit coverage, or will receive prior to the use of treatment chemicals: INSERT TEXT HERE

SECTION 7: INSPECTIONS & CORRECTIVE ACTIONS

7.1 Inspections

Instructions (CGP Part 7.3.6):

- Select an inspection schedule. These are minimum frequencies; you may inspect more frequently. If so, describe what your schedule would be.
- For more on this topic, see *EPA SWPPP Guide*, Chapters 6 and 8.
- Also, see suggested inspection form in Appendix B of the *EPA SWPPP Guide*.
- Inspection Reports can be filed in Appendix C.

Remove these instructions to create a cleaner document.

Minimum Inspection Schedule Requirements:

Standard Frequency:
☐ Once every 7 calendar days.
☐ Once every 14 calendar days and within 24 hours of the end of a storm event of 0.5 inches or greater. Rain gauge/weather station used: Gauge or station for rainfall depth
Increased Frequency (if applicable):
☐ *Sites discharging to impaired or high-quality waters:* Once every 7 calendar days and within 24 hours of the end of a storm event of 0.5 inches or greater.
Decreased Frequency (if applicable): ***Seasonally Dry Period Locator Tool found here:*** **Construction General Permit Resources, Tools, and Templates | US EPA**
☐ *Arid areas:* once a month and within 24 hours of a 0.5-inch storm event or greater.
☐ *Semi-arid areas*: once a month and within 24 hours of a 0.5-inch storm event or greater during the dry season: List months for dry season (also select the inspection schedule followed outside of the dry season).
☐ *Frozen conditions with work suspended – must have 3 months of continuous expected frozen conditions based on historical averages:* no inspections List months of suspended inspections(also select the inspection schedule followed when not frozen)
☐ *Frozen conditions with continued activities - must have 3 months of continuous expected frozen conditions based on historical averages*: once per month List months of frozen conditions (also select the inspection schedule followed when not frozen)
Other:
☐ Describe alternative frequency: List alternative schedule, must meet minimum requirements

7.2 Corrective Actions

Instructions (CGP 5.4.4):

- A sample corrective action log is provided in Appendix D.
- Whenever a storm water control requires repair or replacement (beyond routine maintenance), a control necessary for permit compliance was never installed or was installed incorrectly, your discharges cause an exceedance of applicable water quality standards, or a prohibitive discharge has occurred, you must log corrective actions taken.
- This log should describe actions taken, date completed, whether a SWPPP modification was required.
- In some cases, corrective actions may be documented on the inspection form. This is an acceptable alternative if corrective actions that occur outside of inspections are also documented.

Remove these instructions to create a cleaner document.

7.3 Delegation of Authority

Instructions (CGP 9.9.2):

- Identify the individual(s) or specifically describe the position where the construction site operator has delegated authority for the purposes of signing inspection reports, SWPPP documents, corrective action logs, or other information for reporting purposes.
- Each inspection report must be signed in accordance with CGP Part 9.9.2 of the permit.
- If a delegation letter is necessary, see Appendix E of this template and keep a signed copy with this SWPPP.
- For more on this topic, see *EPA SWPPP Guide*, Chapter 7.

Remove these instructions to create a cleaner document.

SECTION 8: SWPPP MODIFICATIONS

8.1 Log of Changes to the SWPPP

Instructions (CGP Part 7.5.2):

- Create a log here of changes and updates to the SWPPP. You should include additions of new BMPs, significant changes in the activities or their timing on the project, changes in personnel, changes in inspection and maintenance procedures, updates to site maps, and so on.
- Instead of using the table, SWPPPs can also be redlined to show changes if the redlines are initialed and dated.

Remove these instructions to create a cleaner document.

Description of the Amendment	Date of Amendment	Amendment Prepared by [Name(s) and Title]

SECTION 9: SWPPP CERTIFICATION

Instructions (CGP 7.3.8):

- The SWPPP should be signed by the responsible party listed in the NOI or the duly authorized representative in accordance with Part 9.9. 2.
- Attach a copy of the NOI and a copy of the General Storm Water Permit for Construction Activity. You can get a copy of the General Storm Water Permit for Construction Activity on the same web page that this template was obtained - https://deq.utah.gov/water-quality/general-construction-storm-water-updes-permits

Remove these instructions to create a cleaner document.

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

Name:	Title:
Signature:	Date:

SECTION 10: SWPPP PREPARER ACKNOWLEDGEMENT

Instructions:

- When a project disturbs greater than 5 acres, lies within 50 feet of a perennial waterbody, or includes a steep slope of 70% (35 degrees) or more, the SWPPP must be prepared by a "qualified person" as defined in CGP part 7.2. This individual must be knowledgeable in the principles and practices considered in the development of a SWPPP and hold a certification demonstrating completion of a training program.

Remove these instructions to create a cleaner document.

SWPPP Preparer

I acknowledge that I prepared this SWPPP and its attachments and have successfully completed the training required to be considered a "qualified person" under CGP Part 7.2.

Name:	Title:
Signature:	Date:

SWPPP APPENDICES

Include the following documentation with the SWPPP:

Appendix A – Site Maps

Appendix B – NOI

Appendix C – Inspection Reports

Appendix D – Corrective Action Log

Appendix E – Subcontractor Certifications/Agreements/Delegation of Authority (see CGP 9.9.2)

Appendix F – Documentation of Training (see CGP 6 and 7)

Appendix G – Additional Information (i.e., other permits such as dewatering, stream alteration, wetland; and out of date SWPPP documents)

Appendix H – BMP Instruction and Detail Specifications

Appendix I – Construction General Permit

Appendix A: Site Maps

Include any site maps in this appendix. For site map requirements review CGP Part 7.3.3.

Appendix B: NOI

Include a copy of your completed and signed NOI in this appendix.

Appendix C: Inspection Reports

Place all completed inspection reports in this appendix. You may also put blank inspection reports here to be completed.

You are encouraged to create your own inspection forms for each site. Inspection reports must have the following information (CGP Part 4.7):

1) The inspection date.
2) The UPDES ID number (UTRXXXXX).
3) Name and title of personnel making the inspections.
4) Summary of inspection findings and any necessary corrective actions:
    a. Are storm water controls properly installed and operational? If failed, then why?
    b. Presence of any conditions that could lead to spills or leaks.
    c. Locations where new or modified controls are necessary.
    d. Signs of visible erosion or sediment depositing related to your discharges.
    e. Any incidents of noncompliance.
    f. Visual quality of any discharges occurring.
5) Rainfall amount if the inspection was triggered by a precipitation event.
6) If it was unsafe to inspect any areas of the site, a description of the area and reason.

Appendix D: Corrective Action Log

An example of a corrective action log has been included in this appendix. Review the CGP Part 5.4 for corrective action log requirements. You can also create your own form or include corrective actions on your inspection form.

Sample Corrective Action Log (CGP Part 5.4)

Inspection Date	Inspector Name(s)	Description of BMP Deficiency	Corrective Action Needed	Date Action Taken

Appendix E: Sample Subcontractor Agreements

Project Number: _____

Project Title: _____

Operator(s): _____

As a subcontractor, you are required to comply with the Storm water Pollution Prevention Plan (SWPPP) for any work that you perform on-site. Any person or group who violates any condition of the SWPPP may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the SWPPP. A copy of the SWPPP is available for your review at request.

Each subcontractor engaged in activities at the construction site that could impact storm water must be identified and sign the following certification statement:

I certify under the penalty of the law that I have read and understand the terms and conditions of the SWPPP for the above designated project and agree to follow the BMPs and practices described in the SWPPP.

This certification is hereby signed in reference to the above-named project:

Company: _____

Address: _____

Telephone Number: _____

Type of construction service to be provided: _____

_____

_____

Signature: _____

Title: _____

Date: _____

Appendix F: Sample Delegation of Authority Form

Delegation of Authority

I, _____, hereby designate the person or specifically described position below to be a duly authorized representative for the purpose of overseeing compliance with environmental requirements, including the UPDES "General Permit for Storm Water Discharges Associated with Construction Activity" (CGP), at the construction site:

_____, Permit No. UTRC_____

The designee is authorized to sign all reports required by the Permit and other information requested by the Director of the Utah Division of Water Quality, or by an authorized representative of the Executive Secretary.

Name of Person or Position: _____

Owner/Operator: _____

Mailing Address: _____

City, State, Zip Code: _____

Phone Number: _____

By signing this authorization, I confirm that I meet the requirements to make such a designation as set forth in Part 9.9.2 of the CGP, and that the designee above meets the definition of a "duly authorized representative" as set forth in Part 9.2.2(b) of the CGP.

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

Name: _____

Title: _____

Signature: _____

Date: _____

Appendix G: Documentation of Training (see CGP 7.3.1)

Include documentation of completed training for SWPPP inspectors or writers in this appendix.

Appendix H: BMP Installation and Maintenance Specifications

Use this appendix if complete BMP specifications are not provided in Sections 4 and 5 of the SWPPP.

Appendix I: Additional Information

Use this appendix for additional information such as other permits (dewatering, stream alteration, etc.) or out of date SWPPP documents.

Appendix J: Construction General Permit

If all stormwater team members access the CGP online while on-site, providing this link to the Construction General Permit is sufficient:

http://construction.stormwater.utah.gov

Otherwise, include a printed copy of the Construction General Permit in this appendix.

(This SWPPP Template is for the **Common Plan Permit** Only, and

does **NOT** address SWPPP requirements found in the CGP.)

Common Plan Permit Storm Water Pollution Prevention Plan (SWPPP)

Facility Site/Project Name

Facility Site/Project Address

Facility Site/Project City, State, Zip

Owner/Contractor Street Address

Owner Street Address

Owner City, State, Zip

Telephone Number

Contractor Name (if not the same as Owner)

Contractor Street Address

Contractor City, State, Zip

Telephone Number

Date

SWPPP Preparation Date

Answering "True" to each of the following questions supports the use of the Common Plan Permit and this associated SWPPP template.

Qualification Checklist for Use of This Template			
1.	**My project is not located in Indian Country.**	☐ True	☐ False
2.	**My project is a residential building on an individual lot or parcel.**	☐ True	☐ False
3.	**My project area of disturbance is 1 acre or less, and the project is a part of a Common Plan of Development disturbing 1 acre or more.**	☐ True	☐ False

1. Project Information

Project Name: Click here to enter text.
Address: Click here to enter text.
City: Click here to enter text. **State:** UT **Zip:** Zip Code
Latitude: Degrees, Decimal Minutes
Longitude: Degrees, Decimal Minutes
UPDES Permit Tracking Number: Click here to enter text.

Owner: Click here to enter text.
Contact Person: Click here to enter text.
Address: Click here to enter text.
City: Click here to enter text. **State:** State **Zip:** Zip Code
Telephone Number: Contact Person Phone
Email Address: Contact Person Email

General Contractor: Click here to enter text.
Contact Person: Click here to enter text.
Address: Click here to enter text.
City: Click here to enter text. **State:** State **Zip:** Zip Code
Telephone Number: Contact Person Phone
Email Address: Contact Person Email

2. Pollution Prevention Best Management Practices

Answer yes or no whether the following features are located at your site. If yes, select the BMP(s) that will be used to protect each feature. If no, continue to the next question. Attach necessary illustrated details for proper installation in Appendix F, and show locations of all controls on Site Map in Appendix A.

2.1 **Is there a SWPPP sign on site?** (permit part 1.7) **Yes** ☐ **Required**

The sign must include the UPDES tracking number, the owner or general contractor name, phone number or email, and if the SWPPP is on-line, instructions on how to view it. The size requirement is to be readable from a publicly accessible point.

2.2 **Will there be construction dewatering on the site?** (permit part 1.2.3) **Yes** ☐ **No** ☐

BMP(s): ☐ Dewatering of the construction area is needed and a separate dewatering permit has been obtained to treat and discharge water. *Construction Dewatering (if discharged offsite) must be covered by UPDES Permit UTG070000*.
☐ Water from the dewatering of the construction area will be infiltrated on site.

2.3 **Will there be non-storm water discharges on the site?** (permit part 1.2.2) **Yes** ☐ **No** ☐

Allowable discharges include: Flushing of drinking water or irrigation water (not including wash or cleaning waters), water used for dust control, spring water or groundwater not exposed to construction activities, water from emergency fire-fighting activities, water from foot drains not exposed to construction activities and water used for washing vehicles, equipment, or building surfaces so long as water contains no soaps solvents or detergents . (see permit part 1.2.2 a-f).
Please list all anticipated non-storm water discharges: Click here to enter text.
What will you do to manage the non-storm water discharges? *Please list direct discharges, contained non-storm water discharges, and discharges that are treated separately.*

BMP(s): ☐ All non-storm water discharges are listed as allowable per permit part 1.2.2 and discharged
☐ All non-storm water discharges that are not allowed are properly contained (see question 2.11)
☐ Other: Click here to enter text.

2.4 **Is it possible for the total area of disturbance to be phased, minimizing the total exposure of disturbed soil at one time?** (permit part 2.1.5.a) **Yes** ☐ **No** ☐
If disturbance can be minimized, please show the locations on the site map and summarize (here) where disturbances will be delayed for some of the disturbed area: Click here to enter text.

2.5 **What perimeter controls will be used to prevent sediment from leaving the site?** (permit part 2.1.2)
BMP(s):
☐ Silt Fence ☐ Berms
☐ Vegetative Buffer ☐ Cut-Back-Curb
☐ Staked straw Wattles (Fiber Rolls) ☐ Weighted Wattles
☐ Other: Click here to enter text.

2.6 **Are surface waters located within 50 feet of your project's earth disturbances?** (permit part 2.1.6) **Yes** ☐ **No** ☐
Note: *A 50' natural vegetative buffer should be maintained by water bodies. If a buffer less than 50' is used, you shall demonstrate that the additional controls offer the same protection as a 50' natural vegetative buffer and select the reason for exemption below.*
BMP(s): ☐ 50' Natural Vegetative Buffer
If less than 50' Natural Vegetative Buffer select additional controls:
☐ Double Perimeter Controls (30-50ft. vegetative buffer retention)
☐ Double Perimeter Controls spaced at least 5ft. apart and stabilization within 7 days of ceasing earth disturbing activity (<30ft. vegetative buffer retention)
☐ Other: Click here to enter text.

2.7 **What track out control will be used to prevent dirt from being tracked on streets as vehicles leave the site?** (permit part 2.1.4)
BMP(s):
☐ Track Out Pad ☐ Cobble ☐ Gravel
☐ Rumble Strips ☐ Wash Down Pad ☐ Delivery Pad
☐ Restricted Site Access ☐ Selective Access During Dry Weather (Dry soil)
☐ Other: Click here to enter text.

2.8 **Do you have storm drain inlets on or down gradient of this site?** (permit part 2.1.3) **Yes** ☐ **No** ☐
Protection must address the curb inlet opening (throat) as well as the grate.
Where is/are the nearest downstream inlet(s) and how will you protect them: Click here to enter text.
BMP(s):
☐ Rock/Sand-filled Bags ☐ Drop Inlet Bags
☐ Filter Fabric ☐ Gravel or Sand filled Wattles
☐ Proprietary inlet devices
☐ Other: Click here to enter text.

2.9 **Will curb ramps be used at the site?** (permit part 2.1.4.a) **Yes** ☐ **No** ☐

If curb ramps are used it must be done with material [not dirt] that will not wash away in storm water.

BMP(s): ☐ Crushed Rock ☐ Wood/Steel Ramps
☐ Other: Click here to enter text.

2.10 **Will there be stockpiles or spoil piles on the site?** (permit part 2.1.1) **Yes** ☐ **No** ☐

Note: *Select "Contained by other BMP" if another BMP on your site will contain runoff from the stockpiles. Materials that can be transported by precipitation must not be placed in the street.*

BMP(s): ☐ Surrounded by Silt Fence ☐ Surrounded by Staked Straw Wattles
☐ Covered with Tarp ☐ Temporary – Removed same day
☐ Contained by other BMP. Explain: Click here to enter text.
☐ Other: Click here to enter text.

2.11 **Does the project include installation of concrete, masonry, stucco, and paint (water based) work in this project?** (permit part 2.2.6 & 1.3) **Yes** ☐ **No** ☐

Wash water must be contained, evaporated, and the solids dried and disposed of at a landfill.

BMP(s): ☐ Lined Depression ☐ Steel Dumpster
☐ Regional Washout (per development)
☐ Other: Click here to enter text.

2.12 **How will solid waste be dealt with on the site?** (permit part 2.2.4)

Provide sufficient waste containers (such as dumpsters or trash receptacles) to accommodate all construction and domestic waste. Light trash in uncovered dumpsters can blow out and scatter with wind and rain may fall on uncovered leachable material in the dumpster and leak out the bottom causing pollutants to escape.

BMP(s): ☐ Bag Lightweight Trash ☐ Leak Proof Dumpsters
☐ Receptacles with Lids ☐ Other: Click here to enter text.

2.13 **Will there be a need to dispose of solvents, oil, fuel, etc. liquid waste?** (permit part 1.3) **Yes** ☐ **No** ☐

BMP(s): ☐ Contained and Removed from the site ☐ Collected for Reuse
☐ Other: Click here to enter text.

2.14 **How will sanitary waste be handled on the site?** (permit part 2.2.5)

BMP(s): ☐ Portable Toilet(s) *(must be tied, staked down or otherwise secured)*
☐ Onsite or Adjacent Indoor Bathrooms
☐ Portable Toilet Secondary Containment (secured down with straps to heavy weights)
☐ Other: Click here to enter text.

2.15 **How will you minimize the discharge of pollutants from spills and leaks?** (permit part 2.2.3)

BMP(s): ☐ Use of drip pans ☐ Offsite fueling, and maintenance
☐ Spill kit ☐ Spill response plan.
☐ Other: Click here to enter text.

2.16 **Will there be a need to store construction materials on site?** (permit part 2.2.2) **Yes** ☐ **No** ☐

Minimize the exposure of materials with a pollution risk (certain building and landscaping materials, fertilizers, pesticides, herbicides, detergents) to precipitation and storm water runoff.

BMP(s): ☐ Covering Erodible or Liquid Materials ☐ Secondary Containment
☐ Strategic Storage and Staging ☐ Stored off-site
☐ Enclose them in a weather proof shed.
☐ Other: Click here to enter text.

2.17 **Does your site have steep slopes (greater than 70%)?** (permit part 2.1.5.c) **Yes** ☐ **No** ☐

BMP(s): ☐ Erosion Control Blanket ☐ Avoid Disturbance on slope
☐ Seeding ☐ Hydroseed
☐ Mulch ☐ Tackifiers
☐ Other: Click here to enter text.

2.18 **Are there site conditions that cause storm water flows with highly erosive velocities?** (permit parts 2.1.5.d and 2.1.6) **Yes** ☐ **No** ☐

Flows must be controlled to minimize sediment transport.

BMP(s): ☐ Gravel Check Dam ☐ Straw Wattles (Fiber Rolls) Check Dam
☐ Divert Flows around the Site ☐ Armored channel (riprap, geotextile, other)
☐ Other: Click here to enter text.

2.19 **How will you reduce storm water volume to minimize sediment transport, channel and stream bank erosion?** (permit part 2.1.5.d)

BMP(s): ☐ Utilize basin, depression storage of storm water, cut back curb, or other to hold and infiltrate.
☐ Prevent heavy equipment (as much as possible) from compacting soil so storm water will infiltrate easier.
☐ Rip soil after heavy equipment has caused compaction.
☐ Other: Click here to enter text.

2.20 **Is there a need for dust control on the site (regulatory or for practical reasons)?** **Yes** ☐ **No** ☐

BMP(s): ☐ Wetting with Water ☐ Cover dirt piles with a tarp
☐ Use Magchloride, Calcium Chloride or Lignan Sulfonate
☐ Stabilize surface with mulch, gravel or other surface cover
☐ Other: Click here to enter text.

2.21 **Will there be disturbed areas on the site that will need to be temporarily stabilized before the project is completed?** (permit part 2.1.7) **Yes** ☐ **No** ☐

Areas receiving greater than 20 in. of rainfall annually that are disturbed and then left for over 30 days with no activity, must have stabilization initiated within that timeframe, and completed within 30 days post initiation. Areas receiving less than 20 in. of rainfall annually must begin stabilization measures as soon as site conditions allow.

BMP(s): ☐ Bark or other mulch ☐ Hydro-mulch ☐ Seeding
☐ Tackifier ☐ Staked netting with straw mulch
☐ Other: Click here to enter text.

2.22 **Will the house be sold without any landscaping?** **Yes** ☐ **No** ☐

If so, what downslope perimeter controls will be installed, and stabilization measures will be implemented on slopes of 20% or more, until the homeowner completes landscaping? (permit part

1.6.7.b) *(the permit can be terminated when the owner occupies the house even though the site is not stabilized).*

BMP(s):
☐ Mulching/Hydro-mulching ☐ Swales ☐ Silt Fence
☐ Wattles ☐ Cut-Back-Curb ☐ Seeding
☐ Vegetated Buffer ☐ Grade Front-Yard Lower than Sidewalk
☐ Other: Click here to enter text.

3. Sequence of Construction Activity

Type of Construction Activity	Approximate Date Range
Start/End of the Project	
Excavation activities	
Foundation/Footings	
Backfill	
Erection of Building	
Any temporary or permanent cessations of earth disturbing activities.	
Landscaping (if done as part of the construction activity before the home is sold)	
Add in rows as needed. Utilities work, etc.	

4. Site Map

On a blank page (or include a page from the architectural drawings that show site layout and dimensions), please draw a map (and place this map in Appendix A) showing the layout of the site including locations of:

1. boundaries of project/property
2. boundaries of disturbance (including areas outside of property boundaries)
3. show slopes on site (if there are steep areas show steep areas)
4. location of structures/facilities
5. locations of:
    a. stockpiles for soils and materials
    b. construction supplies
    c. portable toilets

   d. garbage/trash containers
   e. egress points/track out pads
   f. concrete washout pits or containers
6. water bodies, wetlands, natural vegetative buffers
7. placement of all BMPs, perimeter, erosion control, sediment control, inlet protection, etc.
8. storm water inlets and storm water discharge points (where storm water drains off the site)
9. areas that will be temporarily or permanently stabilized on the site
10. areas where disturbances will be delayed minimizing total exposed surface at one time.

5. Potential Sources of Pollutants

Potential sources of sediment to storm water runoff:

- Clearing and grubbing operations
- Grading and site excavation operations
- Vehicle tracking
- Topsoil stripping and stockpiling
- Landscaping operations

Potential pollutants and sources, other than sediment, to storm water runoff:

- Combined Staging Area—small fueling activities, minor equipment maintenance, sanitary facilities, and hazardous waste storage.
- Materials Storage Area—general building materials, solvents, adhesives, paving materials, paints, aggregates, trash, and so on.
- Construction Activity—paving, curb/gutter installation, concrete pouring/mortar/stucco, and building construction
- Concrete Washout Area

For all potential construction site pollutants, see Table 2 below.

Table 2. Potential construction site pollutants. Circle all that applies to your site and in the last column identify pollution prevention measures to minimize their discharge.

Material/Chemical	Storm Water Pollutants	Common Location*	Pollution Prevention Methods
Pesticides (insecticides, fungicides, herbicides, rodenticide)	Chlorinated hydrocarbons, organophosphates, carbamates, arsenic	Herbicides used for noxious weed control	
Fertilizer	Nitrogen, phosphorous	Newly seeded areas	
Plaster	Calcium sulphate, calcium carbonate, sulfuric acid	Building construction	
Cleaning solvents	Perchloroethylene, methylene chloride, trichloroethylene, petroleum distillates	No equipment cleaning allowed in project limits	

Material/Chemical	Storm Water Pollutants	Common Location*	Pollution Prevention Methods
Asphalt	Oil, petroleum distillates	Streets and roofing	
Concrete	Limestone, sand, pH, chromium	Curb and gutter, building construction	
Glue, adhesives	Polymers, epoxies	Building construction	
Paints	Metal oxides, Stoddard solvent, talc, calcium carbonate, arsenic	Building construction	
Curing compounds	Naphtha	Curb and gutter	
Wood preservatives	Stoddard solvent, petroleum distillates, arsenic, copper, chromium	Timber pads and building construction	
Hydraulic oil/fluids	Mineral oil	Leaks or broken hoses from equipment	
Gasoline	Benzene, ethyl benzene, toluene, xylene, MTBE	Secondary containment/staging area	
Diesel Fuel	Petroleum distillate, oil & grease, naphthalene, xylenes	Secondary containment/staging area	
Kerosene	Coal oil, petroleum distillates	Secondary containment/staging area	
Antifreeze/coolant	Ethylene glycol, propylene glycol, heavy metals (copper, lead, zinc)	Leaks or broken hoses from equipment	
Sanitary toilets	Bacteria, parasites, and viruses	Staging area	

*(Area where material/chemical is used on-site)

6. Spill Prevention and Response Plan

Describe the spill prevention and control plan to include ways to reduce the chance of spills, stop the source of spills, contain and cleanup spills, dispose of materials contaminated by spills, and train personnel responsible for spill prevention and control. Additionally, fill in all **BLUE** fields below.

Spill Plan:

Click here to enter text.

Any discharges in 24 hours equal to or more than the reportable quantities listed in 40 CFR 117, 40 CFR 110, and 40 CFR 302 will be reported to the National Response Center and the Division of Water Quality (DWQ) as soon as practical after knowledge of the spill is known to the permittee. The permittee shall submit within 14 calendar days of knowledge of the release a written description of: the release (including the type and estimate of the amount of material released), the date that such release occurred, the circumstances leading to the release, and measures taken and/or planned to be taken to the Division of Water Quality (DWQ), 288 North 1460 West, P.O. Box 144870, Salt Lake City, Utah 84114-4870. The Storm Water Pollution Prevention Plan must be modified within14 calendar days of knowledge of the release to provide a description of the release, the circumstances leading to the release, and the date of the release. In addition, the plan must be reviewed to identify measures to prevent the reoccurrence of such releases and to respond to such releases, and the plan must be modified where appropriate.

Agency	Phone Number
National Response Center	(800) 424-8802
Division of Water Quality (DWQ) 24-Hr Reporting	(801) 538-6146; (801) 536-4123
Utah Department of Health Emergency Response	(801) 580-6681
Local Fire Department	(XXX) XXX-XXXX

Minimum spill quantities requiring reporting:

Material	Media Released To	Reportable Quantity
Engine oil, fuel, hydraulic & brake fluid	Land	25 gallons
Paints, solvents, thinners	Land	100 lbs. (13 gallons)
Engine oil, fuel, hydraulic & brake fluid	Water	Visible Sheen
Refrigerant	Air	1 lb.
Antifreeze, battery acid, gasoline, engine degreasers	Air, Land, Water	100 lbs. (13 gallons)

Emphasis to:

1st Priority: Protect all people (including onsite staff)
2nd Priority: Protect equipment and property
3rd Priority: Protect the environment

1. Make sure the spill area is safe to enter and that it does not pose an immediate threat to health or safety of any person.
2. Check for hazards (flammable material, noxious fumes, cause of spill) – if flammable liquid, turn off engines and nearby electrical equipment. If serious hazards are present leave area and call 911. LARGE SPILLS ARE LIKELY TO PRESENT A HAZARD.
3. Stop the spill source and contain flowing spills immediately with spill kits, dirt or other material that will achieve containment.
4. Call co-workers and supervisor for assistance and to make them aware of the spill and potential dangers
5. If spilled material has entered a storm sewer, regardless of containment; contact the City Storm Water Division.

6. Cleanup all spills (flowing or non-flowing) immediately following containment. Clean up spilled material according to manufacturer specifications, for liquid spills use absorbent materials AND DO NOT FLUSH AREA WITH WATER.
7. Properly dispose of cleaning materials and used absorbent material according to manufacturer specifications.
8. Report the reportable quantity to the XXXXXXXXXX City Storm Water Division.

Emergency Numbers

Utah Hazmat Response Officer 24 hrs.	(801)-538-3745
City Police Department	(XXX) XXX-XXXX
City Engineering Division	(XXX) XXX-XXXX

7. SWPPP, Inspections and Corrective Action Reports

Inspection Schedule and Procedures: The permit requires inspections once a week (see permit Part 3). You must list and provide details of your BMPs in Appendix F. Inspection reports require reporting on BMPs and how effective they are (download inspection reports from the DWQ construction storm water website under the Common Plan Permit). You may be required to maintain, modify, remove, or apply/install more or different BMPs to control pollutants on the site. You may number your BMPs in Appendix D, or F and refer to those numbers on your inspection reports and corrective action reports when you inspect or report on them.

Describe the general procedures for correcting problems when they are identified. Include responsible staff and time frames for making corrections:

Click here to enter text.

Inspections and Corrective Actions: All inspections and corrective actions must be logged using the "Inspection/Correction Action Log" attached in Appendix D. The log should be filled out completely for each BMP.

8. Training of Sub-Contractors

All sub-contractors, installers of utility connections, and others that perform activities that are affected by permit requirements will be informed about permit requirements that pertain to their scope of work.

Sub-Contractors that have been informed:

Contractor	Date	Topic(s) Covered	Initials of Trainer
Excavator			

Gas utilities			
Plumbing connection			
Electrical connection			
Concrete foundation walls			
Concrete flat work			
Landscaper			
Other: Click here to enter text.			
Other: Click here to enter text.			
Other: Click here to enter text.			
Other: Click here to enter text.			

9. Changes to the SWPPP

All changes to this SWPPP must be redlined, dated, and initialed in the SWPPP document and on the site map.

10. Record Keeping

The following items should be kept at the project site available for inspectors to review:

1. A copy of the Common Plan Permit (Appendix B)
2. The signed and certified NOI form (Appendix C)
3. Inspection reports (Appendix D)

11. Delegation of Authority (if any)

Duly Authorized Representatives or Positions:

Company/Organization: Company of Representative.
Name: Authorized Representative Name.
Position: Representative Title.
Address: Click here to enter text.
City: Click here to enter text. State: State Zip: Zip Code
Telephone: (XXX) XXX-XXXX Fax/Email: (XXX) XXX-XXXX

Owner/General Contractor Signature:_____ Date:_____

Additional Duly Authorized Representatives or Positions:

Company/Organization: Company of Representative.
Name: Authorized Representative Name.
Position: Representative Title.
Address: Click here to enter text.
City: Click here to enter text. State: State Zip: Zip Code
Telephone: (XXX) XXX-XXXX Fax/Email: (XXX) XXX-XXXX

Owner/General Contractor Signature:_____ Date:_____

12. Discharge Information

Does your project/site discharge storm water into a Municipal Separate Storm Sewer System (MS4)?

☐ Yes ☐ No

Municipal Storm Drain System receiving the discharge from the construction project: Click here to enter text.

Receiving Waters (look up https://deq.utah.gov/water-quality/water-quality-assessment-map to identify your receiving water body). If you discharge to a MS4 you may need to contact them to determine the receiving water that their system outfalls to.

Enter the name(s) of the first surface water(s) that receives storm water directly from your site and/or from the MS4 listed above. **Note:** *multiple rows provided in the case that your site has more than one point of discharge in which each flows to different surface waters.*

1. Click here to enter name of receiving waters.
2. Click here to enter name of receiving waters.

Impaired Waters (on https://deq.utah.gov/water-quality/water-quality-assessment-map click on the waterbody you are discharging to, and refer to Assessment Category, TMDL, and Impairment information).

Select any impaired surface water(s) that your site will discharge to, either directly or through the MS4 selected above.

Impaired Surface Water	Is this surface water impaired?	Pollutant(s) causing the impairment	Has a TMDL been completed?	Pollutant(s) for which there is a TMDL
Click here to enter text.	☐ Yes ☐ No	Click here to enter text.	☐ Yes ☐ No	Click here to enter text.
Click here to enter text.	☐ Yes ☐ No	Click here to enter text.	☐ Yes ☐ No	Click here to enter text.

13. Certification and Notification

I, Name of Authorized Construction Operator Representative, certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

X _____

Construction Operator:

This SWPPP should be signed and certified by the construction operator(s)

SWPPP Appendices

Ensure the following documentation is attached to the SWPPP:

Appendix A: SWPPP Site Maps

Appendix B: Common Plan Permit

Appendix C: Authorization to Discharge Letter.

Appendix D: Inspection Reports and Corrective Actions

Appendix E: Additional Information (i.e. permits such as local permits, dewatering, stream alteration, wetland, and out of date SWPPP documents, delegation of authority forms, etc.)

Appendix F: BMP Specifications and Details (label BMPs to match the sections identified in this document.)

APPENDIX A: SWPPP Site Maps

APPENDIX B: Common Plan Permit

Find the permit on https://deq.utah.gov/water-quality/general-construction-storm-water-updes-permits

APPENDIX C: Authorization to Discharge Letter

APPENDIX D: Inspection Reports

Tip: Number BMPs for quick reference in inspection reports.

(See template below)

Include BMPs inspected even if they are in good condition. Corrections must be completed before the next weekly inspection.

Weekly Inspection Form /Corrective Action Log							
Date & Time of Inspection	**Weather**	**BMP # and Name**	**Description of BMP Condition or Deficiency**	**Initial**	**Correction Date (MM/DD/YY)**	**How the BMP was Corrected**	**SWPPP Changed (Y/N)**

APPENDIX E: Additional Information

For permits such as local permits, dewatering, stream alteration, wetland, and out of date SWPPP documents, delegation of authority forms, etc.

Delegation of Authority

I, _____ (name), hereby designate the person or specifically described position below to be a duly authorized representative for the purpose of overseeing compliance with environmental requirements, including the Common Plan Permit, at the _____ construction site. The designee is authorized to sign any reports, stormwater pollution prevention plans and all other documents required by the permit.

_____ (name of person or position)

_____ (company)

_____ (address)

_____ (city, state, zip)

_____ (phone)

By signing this authorization, I confirm that I meet the requirements to make such a designation as set forth in _____ (Reference State Permit), and that the designee above meets the definition of a "duly authorized representative" as set forth in _____ (Reference State Permit).

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

Name:

Company:

Title:

Signature:

Date:

APPENDIX F: BMP Specifications and Details

Provide details regarding proper installation for implemented BMPs. Use resources provided on the next page as applicable.

Below are links to various Construction Storm Water BMP Manuals for reference.

State of Utah
https://lf-public.deq.utah.gov/WebLink/ElectronicFile.aspx?docid=559800&eqdocs=DWQ-2025-003821
Preferred List of Stormwater BMPs

Davis County
http://www.daviscountyutah.gov/docs/librariesprovider20/default-document-library/stormwater-best-management-practices.pdf?sfvrsn=c9cd4053_2
A Guide to Stormwater Best Management Practices

Nevada DOT
https://www.nevadadot.com/home/showdocument?id=9417
Stormwater Quality Manuals: Construction Site Best Management Practices (BMPs) Manual

Los Angeles
http://dpw.lacounty.gov/cons/specs/BMPManual.pdf
Construction Site Best Management Practices (BMPs) Manual

Maricopa County (Arizona)
https://www.maricopa.gov/DocumentCenter/View/2368/2015-03-Drainage-Design-Manual-for-Maricopa-County-Volume-III-Erosion-pdf
Drainage Design Manual for Maricopa County (Erosion Control)

Minnesota
https://www.pca.state.mn.us/sites/default/files/wq-strm2-09.pdf
Stormwater Compliance Assistance Toolkit for Small Construction Operators

Stormwater Pre-construction meeting agenda

Site UPDES number:_____

Site Name:_____

SWPPP review

- ☐ Review BMPs that will be used.
- ☐ Verify contact person in NOI and SWPPP is the preferred contact for SWPPP communication.
- ☐ Verify email address and phone number is correct in SWPPP.
- ☐ Discuss General expectations of CGP or CPP.
- ☐ Discuss where log of inspections completed by contractors will be kept and they will be accessible to city inspectors.
- ☐ Discuss importance of SWPPP and it's role in protecting waters of the state.

NOT review

- ☐ Verify they understand NOT submittal process
- ☐ Review site conditions needed for NOT to be certified
- ☐ Review, if needed, any needed long term maintenance plans and agreements
- ☐ Review BMPs needed for NOT certification
- ☐ Review inspection requirements of long term storm water controls

Pre Construction SWPPP Inspection

- ☐ Schedule inspection of site with BMPs installed before ground disturbance begins
- ☐ Verify BMPs are installed where they are needed
- ☐ If contractor is present (preferred) walk them through inspector looks for

Print Name: _____

Meeting Date:_____

Signature: _____

Electronic Site Inspection Guide for Operators

Last Reviewed: May 12, 2026

Construction Stormwater Inspections Overview

Construction stormwater inspections fall into two categories: operator site inspections and regulatory oversight inspections, each governed by different requirements.

Operator site inspections are required under Part 4 of the Utah Construction General Permit (CGP) and Part 3 of the Common Plan Permit (CPP). These require that a qualified person regularly inspects the site (typically once per week, or every 14 days and after a 0.5-inch or greater rainfall event) to ensure stormwater controls are properly installed, functioning, and maintained. These inspections are internal to the project team and are a condition of permit compliance.

In contrast, oversight inspections are conducted by the Utah Division of Water Quality (DWQ) or a regulated Municipal Separate Storm Sewer System (MS4) to evaluate whether a site is complying with its stormwater permit and developed Storm Water Pollution Prevention Plan (SWPPP). Under Utah Code § 19-5-108.3, these oversight inspections must now be conducted electronically using photographs and documentation submitted by the operator. If an operator opts out, routine on-site inspections from the DWQ or MS4 will continue.

Areas of the Site to Photograph

If you, the operator, choose to conduct electronic inspections in place of on-site inspections by Ogden Valley City, you are confirming your intent to submit all necessary documentation required for Ogden Valley City to perform a remote electronic inspection. This includes providing geo-located, time-stamped photos of the active construction site that clearly captures:

1. Site signage showing the UPDES permit tracking number, main SWPPP contact's name, phone number and email address, and how to obtain a copy of the SWPPP (Ex: QR code that directs to the SWPPP documents).
2. All cleared, graded, or excavated areas that have not yet achieved final stabilization, as required by CGP Part 2.2.14 or CPP Part 2.6;
3. All storm water controls, including erosion, sediment, and pollution prevention BMPs installed per specifications to comply with the CGP or CPP;
4. All material, waste, borrow, and equipment storage and maintenance areas covered under your storm water permit;
5. All areas where storm water typically flows within the site, including natural or constructed drainage features used to divert, convey, or treat runoff;

6. All discharge points (outfalls) from the construction site; and
7. All areas where you have implemented stabilization measures, but final stabilization has not been completed.

Photograph Quality and Considerations

Photographs must be of sufficient resolution, clarity, and scope to allow the regulatory authority to assess compliance with Permit requirements. For best results, submit photos in their original format, ensuring they clearly capture site conditions and all areas where BMPs are installed. Images should offer full, clear views that accurately represent the extent and effectiveness of BMP installation and overall site conditions. Per Utah Code § 19-5-108.3(11)(b), electronic site inspection photos shall include meta data verifying the date, time, and GPS location corresponding to the construction site. If operator submitted photos do not meet this standard, Ogden Valley City will have a documented reason for an on-site inspection.

Submission Deadline

This documentation **must** be submitted **within the first seven (7) calendar days** of each month, beginning after the first full month of active construction under permit coverage, and shall continue on a monthly basis until an adequate compliance history has been achieved. Once adequate compliance history has been established, submittals may transition to an annual basis. However, in the event of verified complaints, inspections and documentation shall revert to monthly submittals and continue at that frequency until an adequate inspection history has been re-established. For example, if your permit coverage begins on March 15, your first full month of coverage is April. You must submit your first electronic inspection by May 7.

Failure to provide complete or clear documentation may result in a request to submit additional documentation or a decision by Ogden Valley City to conduct an on-site inspection.

Procedures for Conducting Electronic Site Inspections

It is essential that all sediment, erosion, and pollution prevention controls are installed in accordance with:

- The locations shown on the site map; and
- The materials and installation methods specified for each BMP in the SWPPP.

To support a complete and accurate oversight inspection, operators should provide photos that clearly show all key site conditions and stormwater controls. These photos must demonstrate compliance with the CGP or CPP. Follow this guide to ensure your photos meet inspection standards and reflect current site conditions:

- **Permit Signage**

  Start with a photo of the site's stormwater permit sign, ensuring it includes all information required under CGP Part 1.5 (or CPP 1.9). The sign should be visibly posted in a safe and publicly accessible location near the primary site entrance. Ensure the photo clearly captures both the content of the sign and its placement.

- **Stormwater Controls (BMPs)**

  Provide clear, geo-located photos of all BMPs. Capture multiple angles as needed to show installation and functionality per the BMP detail. For follow-up inspections, repeat photos from the same locations to show progress and maintenance.

  Include photos of the following:

  - Unstabilized areas:
    - Cleared, graded, or excavated areas that have not yet reached final stabilization
    - Areas where interim stabilization measures are in place (e.g., mulch, seed, erosion control blankets)
  - Erosion and sediment controls:
    - Wattles, silt fence, check dams, slope protection, sediment basins
    - Show perimeter controls approximately every 200–400 feet and especially at low points where runoff collects and/or leaves the project site
  - Pollution prevention controls:
    - Spill kits, covered chemical storage, concrete/stucco washout stations, covered dumpsters, portable toilets (from multiple sides and with any tie-downs visible)
    - Fueling areas (show hoses, secondary containment, and/or berms)
  - Stormwater flow paths and drainage features:
    - Natural or constructed swales, ditches, and curbs
    - Linear drainage features (e.g., curb lines) approximately every 400 feet
  - Inlet protection:
    - Close-up of inlet protection devices and the area directly upstream
  - Discharge points (outfalls):
    - Include views of erosion, sediment deposits, and any signs of discharge (e.g., color changes, oil sheen, solids)
  - Exit/Track-out controls:
    - View of the full exit point from 90 degrees, showing effectiveness of stabilized construction entrance
  - Staging and storage areas:
    - Show equipment/vehicle parking and material/waste storage (e.g., for concrete, asphalt, topsoil, gravel)
  - Vehicles and equipment:
    - Document any leaks or signs of fluid drips, especially near maintenance areas

- **Photo Quality & Placement**
  - Photos must be clear, well-lit, and unaltered
  - Match photo locations to those on the site map

- Provide context where needed (e.g., zoomed out to show surroundings, close-ups for key features)
- Label photos clearly when submitting (e.g., “North Silt Fence – SE Corner,” “Concrete Washout – West Side”)

Justification for Conducting an Onsite Inspection

Pursuant to Utah Code § 19-5-108.3(11)(c) and (12), DWQ or Ogden Valley City may conduct an on-site oversight inspection if there is a documented justification, which may include:

1. The operator opted out of electronic inspections or requested an on-site inspection.
2. Submitted documentation is insufficient, including altered photos or missed submittal deadlines.
3. Immediate or imminent threat to water quality exists.
4. An illicit discharge or complaint requires an investigation.
5. The site is within one-half mile of a river, stream, or lake.

Pursuant to the Small MS4 General UPDES Permit No. UTR090000, Section 4.2.4.4.5, the MS4 may complete an on-site inspection if the MS4 has a documented and justified reason. The circumstances that may be considered documented reasons include, but are not limited to:

1. Inadequate characterization in electronic site inspections of site conditions or portions of a site
2. Verified complaints
3. Operator has opted-out of electronic inspections
4. Any other evidence of noncompliance with Permit conditions that warrants an on-site inspection

Additional Documentation

Additionally, permitted sites must maintain an up-to-date SWPPP throughout the duration of the project and ensure it is accessible to Ogden Valley City inspectors during an oversight inspection. The SWPPP must include all required elements as outlined in CGP Part 7.3 or CPP Part 4.2, including site map(s), inspection reports, corrective action logs, a copy of the NOI, and other relevant documentation.

How to Submit

If you choose to provide electronic site inspections, please compile all required photographs into a single compressed archive file (e.g., *.zip) and submit it by e-mail to amackliet@jub.com within the timeframe specified above.

For any questions and further assistance with submitting an electronic site inspection please contact the Ogden Valley City at amackliet@jub.com or at (801) 547-0393.

Electronic Site Inspection Opt-out Form:

I have reviewed and understood the Electronic Site Inspection Guide for Operators. I am formally opting out of electronic inspections, thereby authorizing Ogden Valley City to conduct routine on-site oversight inspections in accordance with established procedures.

Operator Name: _____

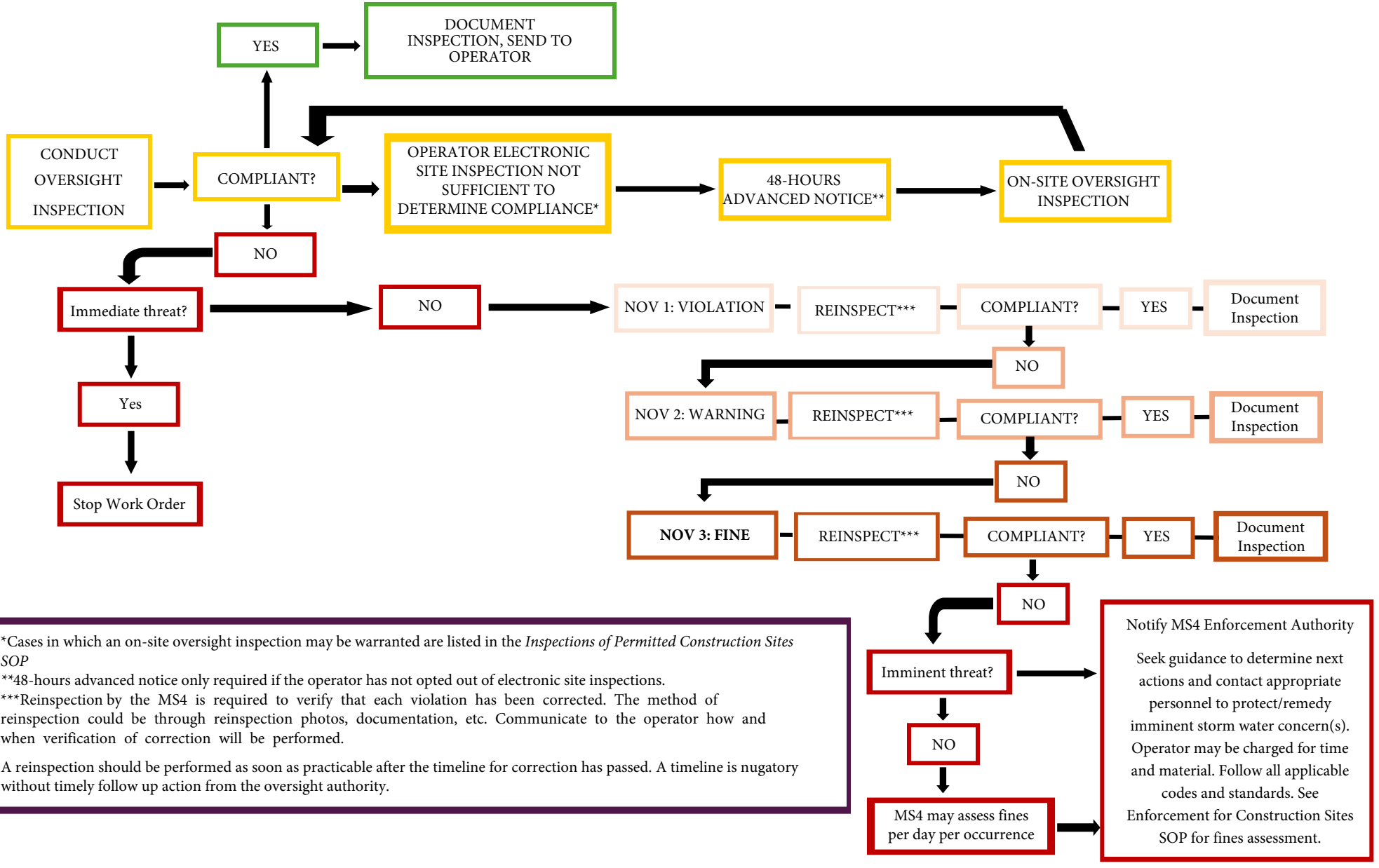
Operator Signature: _____

Today's Date: _____

Enforcement for Construction Sites

This Flow Chart is based on UAC 19-5-108.3

Flow Chart



*Cases in which an on-site oversight inspection may be warranted are listed in the *Inspections of Permitted Construction Sites SOP*

**48-hours advanced notice only required if the operator has not opted out of electronic site inspections.

***Reinspection by the MS4 is required to verify that each violation has been corrected. The method of reinspection could be through reinspection photos, documentation, etc. Communicate to the operator how and when verification of correction will be performed.

A reinspection should be performed as soon as practicable after the timeline for correction has passed. A timeline is nugatory without timely follow up action from the oversight authority.

APPENDIX B – LOW IMPACT DEVELOPMENT HANDBOOK

UTAH DEPARTMENT *of*
ENVIRONMENTAL QUALITY
WATER
QUALITY

A Guide to Low Impact Development within Utah

Prepared for:
Utah Department of Environmental Quality
Division of Water Quality

195 North 1950 West
Salt Lake City, UT 84116

December 2018

Revised: August 2020

Prepared by:
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Environmental Planning Group, LLC
208 E 800 S
Salt Lake City, UT 84111

epg Sustainable Solutions. Thriving Environments.

Summary of Changes

August 2020	
Description of Changes	**Impacted Sections**
Updated definition of Redevelopment	*The 80th Percentile Volume*
Updated V_{goal} calculations to reflect new definition of Redevelopment	*The 80th Percentile Volume*
Updated the Commercial land use example as an example of Redevelopment	*Land Use Examples*
Replaced 90th percentile NOAA storm depths with permittee-submitted 80th percentile storm depths	*Appendix A 80th Percentile Storm Depths*
Updated Storm Water Quality Report Template	*Appendix B Storm Water Quality Report Template*
Updated BMP drawing notes to indicate treatment options	*Appendix C LID BMP Fact Sheets*
Added a Minimize Impervious Area fact sheet	*Appendix C LID BMP Fact Sheets*
Replaced 90th percentile storm depth text and calculations with 80th percentile storm depth	Throughout manual
Replaced many uses of '90th percentile storm depth' with 'project volume retention goal' to allow for option of using the predevelopment hydrologic condition as the retention goal.	Throughout manual
Minor spelling, grammatical, and formatting updates	Throughout manual

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Introduction

Purpose

This manual is to be used as a reference and guide for incorporating low impact development (LID) storm water approaches into new development and redevelopment projects. It helps planners and designers in selecting appropriate practices to incorporate in their site design as well as municipal separate storm sewer system (MS4) program managers in evaluating LID practices and determining what is most appropriate for their storm water programs. The information contained in this guidance complies with the goals of the federal Clean Water Act (CWA) "to reduce the discharge of pollutants to the maximum extent practicable."

This manual provides background and technical information on LID best management practices (BMPs), maintenance practices, selection of appropriate plant materials, methods to retain the project volume retention goal (see *The 80th Percentile Volume*), and other relevant information needed to assist decision makers, planners, designers, and reviewers in making the best possible decisions for their storm water programs and developments while complying with Utah's Division of Water Quality (DWQ) storm water permit requirements.

Users of this manual are encouraged to seek out innovative and effective methods in addition to those discussed here to accommodate site-specific conditions and to achieve the key principles of LID and meet permit requirements. A wide array of LID approaches is presented; however, as with any environmental discipline for any development, site-specific decisions from qualified personnel will always be required. While the LID BMPs presented are widely used, local climate, soil conditions, vegetation, and other factors must be considered to determine what will work best within the project location.

Low Impact Development

LID refers to engineered systems, either structural or natural, that use or mimic natural processes to promote infiltration, evapotranspiration, and/or reuse of storm water as close to its source as possible to protect water quality and aquatic habitat. LID practices at the regional and site-specific level preserve, restore, and create green space using soils, vegetation, and rainwater harvesting techniques. These systems and practices are referred to as BMPs.

Green infrastructure (GI) includes LID practices but is a broader practice that also includes ecological services and approaches such as "filtering air pollutants, reducing energy demands, mitigating urban heat islands, sequestering and storing carbon, enhancing aesthetics and property values, and preserving and creating natural habitat functions." (United States Environmental Protection Agency, 2012)

Key LID Principles

- Mimic natural processes
- Promote infiltration, evapotranspiration, harvest/reuse
- Manage storm water close to source
- Site design planning at project conception

Urban development has historically resulted in increased impervious surfaces, vehicle use, and other human activities that introduce pollutants and create adverse hydrologic conditions detrimental to water quality. In the past, the goal of traditional storm water management was to convey these flows offsite as directly as possible (*Figure 1*), giving little to no consideration to preserving open spaces or creating pervious areas where rainfall could be managed on-site. Flood control infrastructure such as storm drains have been used to convey runoff and discharge it to a receiving surface water. Polluted runoff degrades the quality of the receiving water, impacting aquatic life and dependent ecosystems. Incorporating LID practices reduces the impact of development on natural waterways and watersheds and provides practical as well as aesthetic benefits. Other benefits include reduced construction costs by conveying runoff through vegetated swales instead of through pipes. Pavers or other pervious surfaces can reduce the size of an on-site basin by retaining runoff within a subsurface storage layer and

bioretention areas can provide retention and treatment to improve water quality before discharging. These types of designs also enhance the aesthetics of the development and are viewed favorably by the public.

LID practices are not limited to long-term post-construction controls. Site design practices such as preserving natural areas and reducing the size and connectivity of impervious surfaces are examples of LID practices at the site planning stage that will result in improved water quality. City leaders, engineers, developers, and other stakeholders are encouraged to incorporate LID practices into project planning to maximize the effectiveness of their LID strategy and minimize negative impacts on water quality.



Figure 1: Impervious parking lot with no pervious areas or storm water quality features

Extensive research and educational materials have been developed to assist in the understanding and implementation of LID practices. See the US Environmental Protection Agency (EPA) website on LID for an overview of LID concepts: https://www.epa.gov/nps/urban-runoff-low-impact-development.

Projects Covered by the Manual

The guidance provided in this manual is intended for all projects where the long-term management of storm water is required. New development and redevelopment projects within a permitted MS4 that disturb one acre or more, including projects less than one acre that are part of a larger common plan of development or sale which collectively disturbs land greater than or equal to one acre, have specific LID requirements that must be met as part of DWQ's storm water program. As of July 1, 2020, the following requirements apply for new development and redevelopment projects:

New Development: New development projects must manage rainfall on-site and prevent the off-site discharge of the precipitation from all rainfall events less than or equal to the 80th percentile rainfall event or a predevelopment hydrologic condition, whichever is less.

Redevelopment: If a redevelopment project increases the impervious surface by greater than 10%, the project shall manage rainfall on-site, and prevent the off-site discharge of the net increase in the volume associated with the precipitation from all rainfall events less than or equal to the 80th percentile rainfall event.

All projects are encouraged to consider LID practices including projects for permitted non-traditional MS4s such as universities, medical centers, and prisons.

Storm Water Integration

Long-Term Storm Water Management at the Jurisdictional Level

Successful integration of LID features and green infrastructure requires that jurisdictions be able to provide technical and planning guidance to stakeholders. Storm water master plans and technical guidance documents will assist stakeholders in developing their planning approach and design process

Organizational structures vary widely but implementation of long-term storm water quality requirements typically fall within the duties of the public works, utilities, engineering, maintenance, and/or land development groups. It may become necessary to have staff dedicated to storm water management as the jurisdiction develops ordinances, land development standards, storm water master plans, and review processes.

Familiarity with permit requirements is imperative to succeed at implementation. Dedication to achieve and maintain compliance with permit requirements is necessary for a successful and functioning storm water management program. Restraints to success; such as competing interests, budgetary constraints, lack of inter-departmental communication, and lack of support within the jurisdiction, must be addressed or they will jeopardize implementation at the program level, the planning level, and ultimately at the project level.

Impaired Waters

Permittees should be aware of receiving waters within their jurisdiction that have been listed as having impairments on the State's 303(d) list and those that have been identified as requiring or have an approved Total Maximum Daily Load (TMDL). Project sites near these waters may have additional restrictions and require more attention. An interactive map identifying such waters can be found at the DWQ website: https://enviro.deq.utah.gov/

Ordinances

Ordinances should be adopted or modified that promote or mandate LID principles and green infrastructure for development within the jurisdiction. Ordinances should be developed that:

- Promote and preserve open spaces
- Help meet density goals by specifying building footprint, height limits, and setbacks that allow for the proper placement of LID BMPs
- Include an LID analysis as part of the site plan review
- Allow for the use of pervious surfaces within parking lots within parking code
- Encourage clustering development to increase green space within developments
- Address any public safety concerns relating to LID practices
- Allow vegetation appropriate to the BMP being used (See *Vegetation Selection* for specific information relating to the goals and benefits of selecting appropriate vegetation)
- Address maintenance agreements that:
    - Determine final ownership of the BMP (if not the MS4)
    - Require a maintenance schedule, list of activities, and identify the responsible party
    - Allow the municipality to access BMPs for inspections and/or maintenance
    - Provide a method of resolution should violation of the maintenance agreement occur

Examples of ordinances related to storm water maintenance and maintenance agreements templates may be found at the following links:

- EPA – Urban Runoff: Model Ordinances for Stormwater Control: https://www.epa.gov/nps/urban-runoff-model-ordinances-stormwater-control
- Utah Storm Water Advisory Committee – Long-Term Stormwater Management Agreement: https://uswac.files.wordpress.com/2018/09/uswac-long-term-stormwater-management-agreement-template.docx

Creating zoning ordinances and providing incentives that promote LID will lay the groundwork for LID implementation. A gap analysis of existing codes will determine if existing codes are preventing LID principles from being implemented.

A gap analysis is a systematic approach to reviewing ordinances to determine how LID practices can be written into city codes. The results of the gap analysis will identify the objective, a reference to specific codes or standards, and give recommendations for how the code can be modified (*Table 1*).

Table 1: Example parking lot runoff gap analysis results.

Objective	Code	Summary of Impediment
Determine if rain gardens, bioretention cells, and other bioretention devices are permitted within parking areas.	*ORD 04-13.b* Vegetation within parking lots shall be within raised areas and protected by curbs.	The existing code does not permit storm water flows within parking lots to sheet flow into bioretention or vegetated areas.

An example of a gap analysis template for Small MS4s within California was based on a requirement for permittees to review local planning and permitting processes and identify gaps or impediments to effective implementation of post-construction requirements. Landscaping is directly identified as a priority in the permit. The gap analysis identifies five areas related to the conservation and creation of landscapes (AHBL, 2017):

1. Vegetation conservation
2. Open space management
3. Rooftop runoff
4. Open space/cluster development
5. Street and parking lot standards

The full gap analysis template can be found here: https://www.casqa.org/sites/default/files/downloads/20171109_gap_analysis_user_guide.pdf.

Ordinances within Utah

A review of current ordinances within Utah reveals that some cities have created or modified codes to address LID (*Table 2*). Ordinances range from general descriptions of implementation to entire sections dedicated to storm water ordinances and design criteria. Examples of some of these are provided in the following table.

Table 2: LID ordinances within Utah

City	Category	Ordinance
Spanish Fork	Land Use	15.4.16.085.F. Grades *"…The minimum grade allowed for any City street is zero-point forty-five (0.45) percent. The City Engineer or his/her designee may allow a minimum grade of zero-point thirty-five (0.35) percent if the roadway has incorporated Low Impact Development (LID) systems. The maximum grade allowed for any private driveway is 12%."*
Spanish Fork	Utilities	13.16.040.E. *"All site designs shall implement LID principles as defined in this Chapter and in the BMP Manual. Runoff rates from one lot to another may not exceed pre-existing conditions as defined by the City, nor in such a manner that may unreasonably and unnecessarily cause more harm than formerly."*
Spanish Fork	Utilities	13.16.080. Waivers "*Every applicant shall provide for post construction stormwater management as required by this Chapter, unless a written request to waive this requirement is filed and approved. Requests to waive the stormwater management plan requirements shall be submitted to the City SWMP Administrator for approval.* *For post construction, minimum requirements for stormwater management may be waived in whole or in part upon written request of the applicant, provided that at least one of the following conditions applies:* *1. It can be demonstrated that the proposed development is not likely to impair attainment of the objectives of this Chapter.* *2. Alternative minimum requirements for on-site management of stormwater discharges have been established in a stormwater management plan that has been approved by the City Engineer.* *3. Provisions are made to manage stormwater by an off-site facility. The off-site facility must be in place and designed to provide the level of stormwater control that is equal to or greater than that which would be afforded by on-site practices. Further, the facility must be operated and maintained by an entity that is legally obligated to continue the operation and maintenance of the facility.*

City	Category	Ordinance
Moab*	Zoning	17.80.050.10. *"Parking lots shall incorporate methods for storm water management utilizing low impact development (LID) techniques including, but not limited to:* *a. End-of-island bioretention cell(s) with underdrain(s) and landscaping;* *b. Bioretention cells or biofiltration swales located around the parking perimeter;* *c. Breached curb drainage inlets (or curb cuts) in the end-of-island bioretention cells and bioretention strips to collect runoff; or* *d. Bioretention cells installed between lines of parking stalls to increase the total treatment surface area of these systems."*
Salt Lake City	Public Services	Chapter 17.75 through 17.91 address storm water quality ordinances. 17.75.200.C. *"Purposes and Objectives: In view of the foregoing, the purposes and objectives of this chapter through chapter 17.91, inclusive, of this title are to:* *1. Provide for and maintain a stormwater sewer system for collecting and disposing of stormwater runoff;* *2. Establish the inspection, surveillance and monitoring procedures, and all related rules and regulations, necessary to regulate discharges into the stormwater sewer system, and to establish the legal authority to enforce compliance with such rules and regulations; and* *3. Provide fair, equitable and nondiscriminatory rates and charges which will generate sufficient revenues to construct, operate, improve, and maintain the stormwater sewer system at a level commensurate with stormwater sewer management needs. It shall be the policy of the city that present and future costs of operating the stormwater sewer system shall be fairly allocated among the various users of the stormwater sewer system through the establishment of rates and charges based upon such factors as the intensity of development of the parcel; the types of development on the parcel; the amount of impervious surface on the parcel; the cost of maintenance, operation, repair and improvements of the various parts of the system; the quantity and quality of the runoff generated; and other factors which present a reasonable basis for distinction, and which will allow for management of the stormwater sewer system in a manner that protects the public health, safety and welfare. (Ord. 53-07 § 5, 2007)"*

City	Category	Ordinance
Logan	Public Services	13.14.200.A. *"All site designs shall control the peak flow rates of storm water discharge associated with design storms specified in this chapter or in the BMP manual and reduce the generation of postconstruction storm water runoff volumes and water quality to preconstruction levels. These practices should seek to utilize pervious areas for storm water treatment and to infiltrate storm water runoff from driveways, sidewalks, rooftops, parking lots, and landscaped areas to the maximum extent practical to provide treatment for both water quality and quantity. Other low impact development (LID) methods are also encouraged."*

*Not a permitted MS4

Retrofitting Programs

A retrofit program is the structured evaluation of existing development to identify possible improvements to infrastructure with the goal of creating and improving the design of storm water practices and improving water quality. A retrofit program may require dedicated funding for development and implementation. Note that permitted MS4s are required to develop a ranking of control measures to determine those best suited for retrofits. Retrofits can be completed on both public and private properties. Retrofits on private property require coordination and approval from the property owner and may require encouragement through financial incentives to be accepted.



Figure 2: Potential curb cut location that could be retrofitted into a swale

Retrofit programs include activities such as adding curb cuts that allow runoff of impervious surfaces to enter vegetated areas. *Figure 2* shows an existing development that has a slightly depressed, curbed, vegetated area that is surrounded by impervious surfaces. If allowable after considering grading of the site, potential conflicts with the existing utilities, and the environmental sensitivity of receiving waters, a curb cut or multiple curb cuts at the upstream end of the swale to allow parking lot storm water runoff to be conveyed through it would be considered a retrofit. Project site parameters such as the contributing drainage area, imperviousness, 80th percentile volume, water quality flow, and the swale's geometry should be analyzed to determine the impact of the retrofit. Additional analysis would be needed to determine the potential contributing drainage area if a curb cut were to be made at the upstream end. *Figure 3* shows the curb of a parking lot island that has been retrofitted to allow storm water runoff to be retained within the island.



Figure 3: Retrofitted island curb within parking lot

A common need among all programs is prioritizing where retrofit efforts should be focused based on geography and environmental needs. The following factors identified in the Utah 2016 General Permit for Discharges from Small MS4s (UTR090000) must be considered in prioritizing:

- Proximity to waterbody
- Status of waterbody to improve impaired waterbodies and protect unimpaired waterbodies
- Hydrologic condition of the receiving waterbody
- Proximity to sensitive ecosystem or protected area
- Any upcoming sites that could be further enhanced by retrofitting storm water controls

The general steps below can be used in the development of a retrofit program:

1. Identify local need and capacity for storm water retrofitting. Include an evaluation of watersheds in the MS4 that are 303(d) listed or have TMDLs associated with them.
2. Identify potential locations within the MS4 including publicly owned properties, right-of-way, easements, culverts, and existing detention practices that lack adequate storm water practices or are undergoing modifications in the near future.
3. Visit potential project locations to verify current conditions and identify potential retrofit BMP options.
4. Create an inventory of potential locations with site sketches, photos, and basic hydraulic calculations.
5. Based on the permittee's developed ranking of control measures, evaluate retrofit options for factors like performance, cost, community support, property ownership, and feasibility.
6. Model water quality benefits for chosen retrofitting option to determine most cost-effective approach. Online models are available that give users multiple options and associated costs.
    a. Green Values Storm Water Management Calculator: http://greenvalues.cnt.org/calculator/calculator.php
    b. EPA's National Stormwater Calculator: https://www.epa.gov/water-research/national-stormwater-calculator
7. Once the most cost-effective and environmentally beneficial option is determined and funds are obtained, move the project to the design and construction phase. Allow time for sites surveys, permitting, bidding, and specifications.

The LID BMPs described in this manual can be used to retrofit existing sites in addition to the control measures described below.

Curb Cuts

Identify areas where introducing a curb cut will result in flows being diverted from gutters into vegetated areas. A curb cut detailing a depression within the curb may be needed to ensure that flows do not bypass the curb cut. Regrading of the vegetated receiving area and inlet protection may be necessary on the downstream side of the cut.

Dual-Purpose Basins

Retrofitting the outlet structure of a flood control basin creates a dual-purpose basin that accommodates flood control flows and the 80th percentile volume (*Figure 4*). Determine the 80th percentile volume of the contributing drainage area and provide an outlet near the bottom of the structure that releases the 80th percentile volume within an acceptable drawdown time. Modification of the outlet structure can be as simple as adding orifices to a pipe riser or could require design of a new outlet structure.

Perform infiltration testing (or obtain from project plans) within the basin to determine the infiltration rate of the soils within the basin. If infiltration rates are appropriate for retention, the detention basin will also function as an infiltration basin.



Figure 4: Multi-stage overflow outlet with trash screen

Trash Capture Devices

Trash collection devices are installed as in-line systems or end-of-pipe systems to prevent large solids from entering a receiving water or basin. In-line systems require more design effort and expense for retrofitting but end-of-pipe systems such as that seen in *Figure 5* are easier to install retroactively to a pipe end section depending on the end section configuration.

Linear radial devices are in-line or end-of-pipe trash collection devices that can be installed either within the pipe or at the end of a pipe prior to discharging to a basin or receiving water. The EPA provides additional information about the use of linear radial devices: https://www.epa.gov/trash-free-waters/clean-water-act-and-trash-free-waters.



Figure 5: End-of-pipe trash netting

Alternative Compliance and Credit Systems

Alternative Compliance Options

Municipalities may choose to adopt alternative options that provide water quality benefits either on-site or off-site. Off-site treatment is only considered when it is technically infeasible to retain the project volume retention goal within the project limits as required for permitted MS4s. This is done within the project limits, within the watershed or subwatershed of the project, or on a regional level. If retention of the project volume retention goal is technically infeasible for a project, possible alternative compliance measures include:

- Implementation of BMPs that provide water quality treatment such as bioswales, filter strips, etc.
- Proprietary water quality treatment devices.
- The creation of off-site retention areas within the original project's subwatershed that is sized for the volume unable to be captured.
- Establishment of a credit system that allows for the tracking of volume reduction and pollutant reduction throughout the municipality's jurisdiction.

Spanish Fork's Municipal Code (13.16.080) which is cited within the example ordinances (*Table 2*), allows requests to be submitted to waive post construction storm water requirements.

Credit Systems and Alternative Compliance Programs

In its simplest form, a credit system is a database of projects that documents project volume retention goals and the actual volume retained. This applies to pollutant reduction goals as well. Regional BMPs can be used within the credit system. Additional runoff at one project location can be retained to account for runoff that may have been technically infeasible to retain at other project locations.

A few examples of credit systems and other alternative compliance programs are briefly explained below. Links to additional credit systems in use throughout the country are found below the examples in *Table 3*.

Minnesota Pollution Control Agency

The state of Minnesota credit system quantifies storm water runoff volume and pollutant reduction. Every cubic foot of the design storm that is captured is counted as a credit. Pollutant removal is counted as 1 credit based on the unit of measurement for the pollutant. For example, if a BMP removes 10 pounds of phosphorus per year, it is counted as 10 credits. Multiple credits can be claimed for each BMP depending on its function. A bioretention area that removes multiple pollutants can claim credit for the volume reduction and the reduction of any pollutants (Kieser & Associates, LLC, 2009).

Credits can be used towards the following:

- To meet a TMDL waste load allocation
- To meet the Minimal Impact Design Standards performance goal
- To provide incentive to site developers to encourage the preservation of natural areas
- To reduce costs associated with BMPs
- To supplement the Minnesota Pollution Control Agency Construction General Permit or be used for projects not covered under the CGP
- As part of the financial evaluation under a local storm water utility program

San Diego County

San Diego County implements an Alternative Compliance program that is implemented in areas that are unable to retain 100% of the required retention volume on-site. There may be several reasons why the volume cannot be handled on-site including poorly infiltrating soils, high groundwater, and concerns with pollutant mobilization. San Diego County has identified the following measures for alternative compliance (California Regional Water Quality Control Board San Diego Region, 2015):

- Stream or riparian area rehabilitation
- Retrofitting existing infrastructure for storm water retention or treatment
- Groundwater recharge projects
- Regional BMPs
- Water supply augmentation projects
- Floodplain preservation through land purchase

Los Angeles County

Los Angeles County also implements an Alternative Compliance program. Los Angeles County has identified the following measures for alternative compliance (California Regional Water Quality Control Board Los Angeles Region, 2016):

- On-site biofiltration
- Offsite infiltration
- Groundwater replenishment projects
- Offsite retrofitting projects
- Regional storm water mitigation programs

If using biofiltration, the county requires the project to treat 1.5 times the volume retention goal that cannot be retained on-site. Offsite infiltration requires a project to retain the portion of the project's volume retention goal that is unable to be retained on-site as well as reduce pollutant loads from the runoff. Groundwater replenishment projects are required to intercept the volume retention goal not retained on-site through infiltration, bioretention, or groundwater replenishment BMPs. These projects are required to be located in the same sub-watershed as the development. For retrofitting projects, developers are required to retain the volume retention goal not retained on-site through BMP measures at a site with similar land uses. The regional storm water mitigation program option allows permittees to create a program for handling runoff on a regional or sub-regional scale.

Table 3: Nationwide storm water programs using credit systems.

State or Local Storm Water Guidance Document	Web Link
Vermont Storm Water Management Manual	https://dec.vermont.gov/sites/dec/files/wsm/stormwater/docs/Permitinformation/2017%20VSMM_Rule_and_Design_Guidance_04172017.pdf
Minnesota Stormwater Manual	https://www.pca.state.mn.us/water/minnesotas-stormwater-manual
Philadelphia Storm Water Management Guidance Manual	https://www.pwdplanreview.org/manual-info/guidance-manual
New Jersey Storm Water Best Management Practices Manual	https://www.njstormwater.org/bmp_manual2.htm
Maryland Storm Water Design Manual	https://mde.maryland.gov/programs/Water/StormwaterManagementProgram/Pages/index.aspx
Georgia Storm Water Management Manual	https://atlantaregional.org/natural-resources/water/georgia-stormwater-management-manual/
Pennsylvania Storm Water Best Management Practices Manual	http://www.depgreenport.state.pa.us/elibrary/GetFolder?FolderID=4673
Ontario Storm Water Management Planning and Design Manual	https://www.ontario.ca/document/stormwater-management-planning-and-design-manual-0
Storm Water Management Manual for Western Washington	https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/stormwater-permittee-guidance-resources/stormwater-manuals

Source: Center for Watershed Protection

Storm Water at the Project Level

Incorporating LID principles at the planning stages of a development will increase the likelihood that they will be able to be integrated into the site (*Figure 6*). If LID is considered late in the design, it becomes more expensive to implement due to costs associated with redesign of the site layout, additional geotechnical studies, or coordination with community councils, watershed management groups, or other state or federal agencies. Integration of LID principles should be done by qualified engineers who understand the goals of the project, the requirements within the municipality's jurisdiction, and the design criteria for the BMPs.

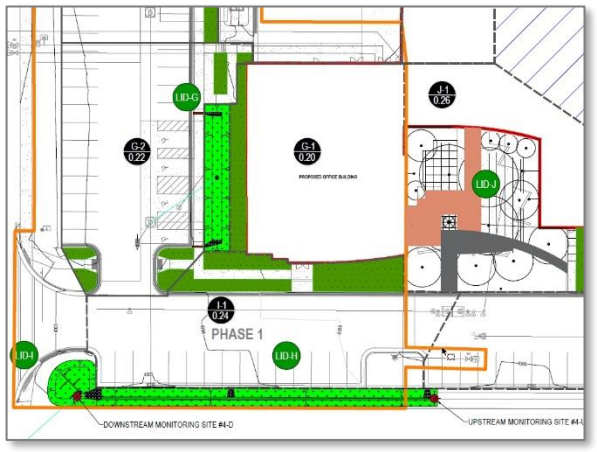


Figure 6: LID BMPs shown in site plans

Collaboration among a project's stakeholders for including LID principles should occur as part of the regular project development, as would be the case for other design elements like grading, utilities, and flood control. As the design progresses, project meetings should include discussion on the storm water elements of the project to ensure that water quality requirements are being met and that the LID approach is functional and compatible with the site's hydrologic and hydraulic design. Additional meetings and coordination to address design details and/or conflicts should be expected. A list of potential project team members who will be involved in the coordination and/or design of LID features is presented in *Table 4*.

Table 4: LID project team.

Jurisdiction/Permittee		**Site Designer/Developer/Architect**
MUNICIPALITY	NON-TRADITIONAL MS4s	Project Manager
Storm Water Coordinator	Storm Water Coordinator	Civil Engineers
Environmental Compliance	Environmental Compliance	Geotechnical Engineers
City Engineer	Facilities Director	Lead Architect
Public Works	Project Coordinator	Landscape Architects
Utilities	Utilities	Landscape Engineers
Planner	Planner	Environmental Engineers
Maintenance	Maintenance	
Landscaping	Landscaping	

Site Considerations

Gather subsurface, geotechnical, topographical, and any other technical information about the site to incorporate into the site design. Site conditions will dictate an appropriate LID approach by revealing opportunities and limitations.

Soils

Soil characteristics will determine if certain LID approaches are feasible. Soils that are classified as Hydrologic Soil Group 'A' are generally acceptable for bioretention and infiltration BMPs. 'B' soils may be marginal for

infiltration and bioretention. 'C' and 'D' soils generally have limited capacity for bioretention and infiltration. For a planning level analysis of the Hydrologic Soil Groups, the Web Soil Survey developed by the National Cooperative Soil Survey can be used: https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. For design, geotechnical reports should determine if the existing soils are acceptable.

Groundwater

Infiltration BMPs should not be utilized within areas of shallow groundwater as it may lead to flooding of the BMP or introduction of pollutants into the groundwater. Measurements should be taken at each BMP location to determine the depth to the historical high groundwater level. The following groundwater resources are available for planning level decision making:

Hydrogeology of Recharge Areas and Water Quality of the Principal Aquifers along the Wasatch Front and Adjacent Areas, Utah – A snapshot of the overall hydrogeology within the Wasatch Front area of Utah. https://pubs.usgs.gov/wri/1993/4221/report.pdf

Groundwater Conditions in Utah, Spring of 2017 – An annual report on groundwater conditions within Utah. https://ut.water.usgs.gov/publications/GW2017.pdf

Utah Active Water Level Network, USGS – Active monitoring of groundwater wells throughout the state. https://groundwaterwatch.usgs.gov/StateMap.asp?sa=UT&sc=49

Project sites with contaminated groundwater may not be appropriate for infiltration due to the potential for mobilizing the contamination into new areas. Coordinate with jurisdictions or watershed management groups to identify areas with contaminated groundwater to determine the level of concern it presents.

Existing drainage patterns

Drainage patterns will be readily evident for any redevelopment project either from visual observation or from plan sets. Determine the constraints introduced by the existing storm drain network such as pipe capacity and inlet and outlet elevations. For new development projects, determine the existing drainage patterns as determined by the site's topography. It is more likely that the site's pre-development hydrology can be mirrored if the design maintains the original drainage patterns and paths.

Existing pervious areas and vegetation

If existing pervious areas can support bioretention or already provide bioretention, maintain them or otherwise make them a part of the site design. Taking advantage of natural depressions or areas of vegetation is an ideal and cost-effective alternative to grading and design. Preserve existing trees and other vegetation on-site when possible.

Site Design Practices

Storm water treatment and retention is most effective when done close to its source. Site design practices accomplish this by taking advantage of approaches that are aimed at reducing the overall impact of the development. These approaches to reducing the impact of storm water should be considered during projects' planning phases and their use should be evaluated as design progresses. These practices should be prioritized because they will reduce the project's retention requirement by introducing pervious areas and they will reduce storm water pollutants.

Reduction of Impervious Surfaces

Reducing impervious surfaces, preserving pervious surfaces, or creating pervious surfaces provides multiple benefits to storm water quality. From a storm water quality standpoint, the potential for treatment is higher for runoff that lands on the pervious surface instead of on an impervious surface. Pervious surfaces with healthy soils will infiltrate more runoff from frequent storms. From a design standpoint, increasing the pervious area decreases the total runoff from the site. Pervious surfaces also provide the opportunity to add shade trees or other types of vegetation that will increase the aesthetic appeal of the site. For more information, see the Minimize Impervious Area fact sheet.

Disconnected Impervious Areas

The practice of connecting impervious areas to the storm drain network is ubiquitous as traditional designs encouraged the removal of runoff as quickly as possible. This practice leads to increased runoff volume from rain events and increased peak flows. Treatment of runoff is virtually nonexistent as it is conveyed from rooftop to sidewalk to parking lot to catch basin to receiving water, taking with it all the pollutants it encounters in its path. Disconnecting impervious areas by introducing pervious areas or rerouting flows from impervious surfaces (*Figure 7*) slows down flows and reduces the volume discharged to the downstream storm drain network or removes it entirely. Treatment is also provided through bioretention and biofiltration.



Figure 7: Downspout disconnected from parking lot

Curb Cuts

Curb cuts can be part of a site plan or be introduced as part of a retrofit program. Curb cuts are a simple way to convey flows from an impervious surface to a pervious surface (*Figure 8*). Roadways and parking lots are prime locations to investigate whether curb cuts can be used to divert flows from a traditional storm drain network to a pervious area or a bioswale, bioretention or infiltration area, or another type of BMP.



Figure 8: Curb cuts to a rock lined swale.

<u>Additional site design practices</u>

- Preserving natural areas
- Site reforestation
- Stream and shoreline buffers
- Open space design
- Disconnecting rooftop and impervious discharges and distributing runoff
- Soil compost amendments
- Grass channels
- Storm water landscaping
- Reducing impervious cover in site design
    - Narrower streets and sidewalks
    - Smaller cul-de-sacs
    - Shorter driveways
    - Smaller parking lots

Documentation

MS4s are required to review and document that a project's LID approach and design are consistent with the permittee's requirements and other project developers may wish to document design parameters. A template for documentation is provided in *Appendix B*. The storm water quality report template provides jurisdictions a sample of project documentation that ensures consistent design and verifies compliance with LID considerations and retention requirements. The report template may be used during a project's design and review process and be required as part of a project's submittal documents to ensure that water quality requirements have been met. The review process may differ between municipalities, and the template can be altered as needed by the user. Sample text is highlighted.

The 80th Percentile Volume

LID Impact on Hydrology

Storm water programs have focused on the goal of mimicking predevelopment hydrologic conditions over the last several decades as municipal and department of transportation (DOT) storm water programs have increased their efforts to comply with the Federal Clean Water Act of 1972 and their associated MS4 permits. LID BMPs, green infrastructure practices, and retention of the 80th percentile volume or of the predevelopment hydrologic condition are tools and requirements that are used to accomplish this goal.

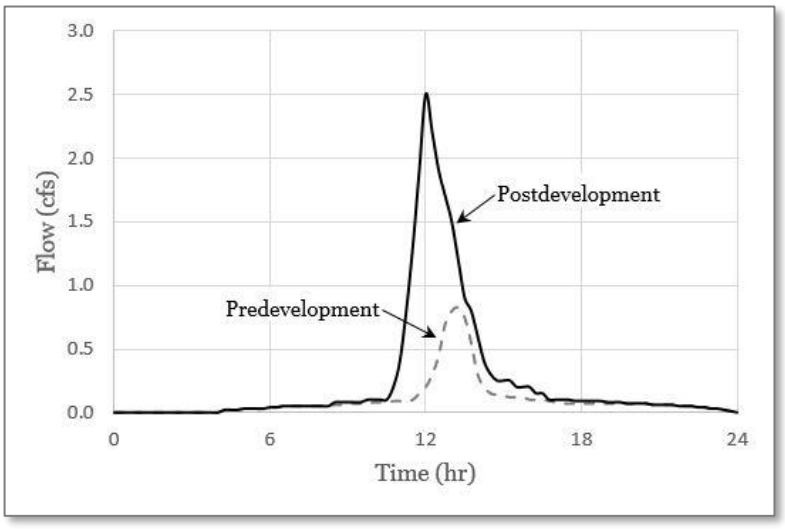


Figure 9: Typical hydrologic impact of development on-site hydrology.

More frequent peak flows, higher peak flows, and higher runoff volumes are well-documented hydrologic impacts of urbanization and development due to an increase in impervious surfaces (D.B. Booth, 1997; Konrad & Booth, 2002) (*Figure 9*).

Traditional approaches to storm water management that remove runoff from a site by quickly conveying flows to a storm drain network are also effective in protecting life and property and should be implemented in tandem with low impact design principles. Within Utah, discharges are typically limited to between 0.1 cfs and 0.2 cfs per acre.

An LID approach to site development produces a hydrologic condition that more closely mimics the pre-development hydrologic condition. Peak flows are reduced and are less frequent (*Figure 10*); runoff volume is also reduced (WEF Press, 2012).

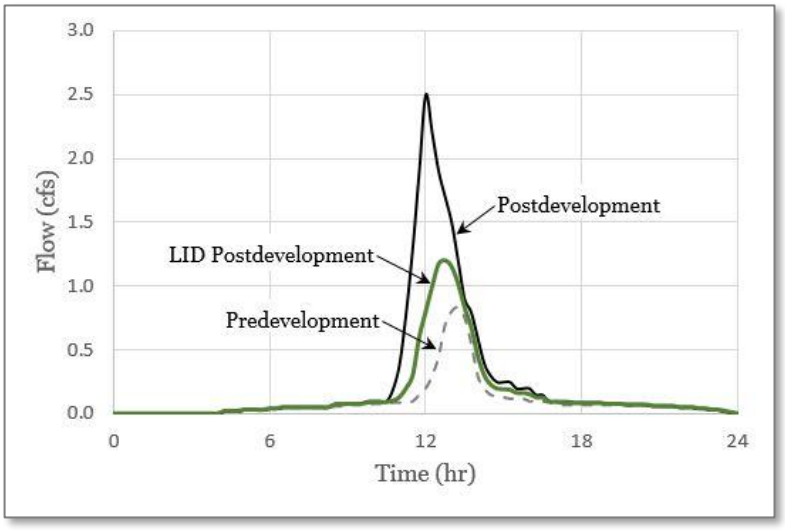


Figure 10: General post development hydrograph with LID.

Developing the 80th Percentile Volume

Project Volume Retention Goal, V_{goal}

V_{goal} for New Development: The volume of runoff generated within the project's limits of disturbance over a 24-hour period during the 80th percentile storm event or a predevelopment condition, whichever is less.

V_{goal} for Redevelopment: For a redevelopment project that results in a net increase in impervious surface greater than 10%, V_{goal} is the net increase in volume between the existing condition and the proposed condition generated by the 80th percentile storm event over a 24-hour period.

Water Quality Volume, WQV – The volume of runoff generated within a BMP's drainage area over a 24-hour period during the 80th percentile storm event.

The following steps may be used to determine the project volume retention goal and the water quality volume.

Step 1: 80th Percentile Depth

Method 1

A table of 80th percentile storm depths can be found in *Appendix A*. These values have been determined by the permittees.

Method 2

Planners and developers should verify with the MS4 before determining an 80th percentile with this method.

Determine the 80th percentile precipitation depth.

1. Obtain long-term daily rainfall data from the following sources:
    a. National Oceanic and Atmospheric Administration (NOAA): https://www.ncdc.noaa.gov/cdo-web/datatools/selectlocation; or
    b. Reliable historical local data; or
    c. Any other reliable data source.
2. Sort data low to high.
3. Remove snowfall and small precipitation events (≤0.1 inch).
4. Use the Excel PERCENTILE function to calculate the 80th percentile rainfall depth.

A more in-depth discussion on determining the 80th percentile precipitation depth is found here: https://documents.deq.utah.gov/water-quality/stormwater/DWQ-2019-004584.pdf.

A reliable record of historical precipitation data should meet the following conditions:

1. Come from an active rain gage;
2. Have at least 30 years of data;
3. Have 90% data coverage for the period of record.

Step 2: Imperviousness

To determine the project's volume retention goal, determine the imperviousness within the disturbance limits of the project. To determine the water quality volume of a BMP's drainage area, determine the imperviousness of the drainage area. The imperviousness of the BMP drainage area will include any off-site impervious areas that are part of the BMP's drainage area.

Project imperviousness = Post-development impervious area / Project's disturbance limits

BMP imperviousness = Post-development impervious area within BMP drainage area / BMP drainage area

Step 3: Volumetric Runoff Coefficient

Determine the volumetric runoff coefficient (R_V).

The volumetric runoff coefficient (also referred to as just the 'runoff coefficient') is a calculation of the percentage of rainfall that results in surface runoff. Runoff coefficients for small, frequent storms, such as for the 80th percentile, are not equivalent to runoff coefficients for large, less-frequent storms such as the 10-yr event and greater that are used with the Rational Method. The effects of infiltration, retention, and interception are increased for the smaller storm events compared to the larger events. Because of this, runoff coefficients for smaller storms are numerically smaller than for larger storms.

In 1983 data from over 50 sites nationwide was evaluated as part of the Nationwide Urban Runoff Program (NURP) (Driscoll, 1983). From these sites, mean and median R_V values were calculated and compared to the site's imperviousness. This research led to the following conclusions that are also discussed by Schueler who did additional analysis of the NURP sites:

1. "Most of the variation in mean R_V among sites can be attributed to differences in the level of urbanization, and in particular, to the site imperviousness."
2. "R_V's were found to be relatively consistent at individual sites and were only weakly correlated with storm-related variables such as precipitation volume, intensity, and duration."
3. "The runoff coefficient could serve as a reliable estimator of runoff volumes, given an initial estimate of rainfall volume." (Schueler, Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs, 1987)

Various coefficients for smaller storms have also been developed using national datasets and through local research. Municipalities are encouraged to research these and other runoff coefficients or develop their own in determining which method to use within their jurisdiction for use with the 80th percentile storm. Deciding on a single runoff coefficient methodology for a jurisdiction will simplify the design and review process.

Development of a runoff coefficient is done by monitoring the runoff volume produced from a storm event. The runoff coefficient is the ratio between the monitored runoff volume and the total precipitation volume expressed in the following equation and will vary depending on land use and imperviousness of the measured area:

$$R_V = \frac{V_R}{V_P}$$

Where:

R_V = Volumetric runoff coefficient, unitless

V_R = Monitored runoff volume, cf

V_P = Total precipitation volume, cf

The total precipitation volume can be determined using the following equation:

$$V_P = \frac{dA}{12}$$

Where:

d = Precipitation depth, in.

A = Drainage area, sf

It is not the intent of this manual or the Division of Water Quality to recommend specific methodologies. An in-depth summary of runoff coefficients used throughout the country by municipalities and DOTs was developed by the California Department of Transportation (Caltrans) and published as a Technical White Paper titled *Runoff Coefficient Evaluation for Volumetric BMP Sizing*. It can be found here: http://www.dot.ca.gov/design/hsd/guidance/CTSW-TM-15-312_03_01-Runoff_Coeff_for_Vol_BMP_Sizing.pdf. This white paper specifically discusses Method 1 in more detail.

For all the equations presented below, i represents the percent of imperviousness of the drainage area in decimal format (0.0 – 1.0).

Method 1 – Reese method

Comparing the imperviousness of 44 nationwide sites to their respective calculated volumetric runoff coefficient, a simple linear regression equation was created to estimate the volumetric runoff coefficient for small urban catchments. Land uses for these sites were classified as residential, mixed, commercial, industrial, and urban open and nonurban (Schueler, Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs, 1987). Outliers were removed from this dataset by Reese to derive the equation below. Removing outliers from the dataset reduces the impact of erroneous measurements (Reese, 2006).

$R_V = 0.91i - 0.0204$

Method 2 – Hydrologic soil groups

Regression equations for runoff coefficient equations were derived based on imperviousness and the NRCS hydrologic soil groups for the 2-year event as presented in *Table 5* (Guo, 2013).

Table 5: Runoff coefficient equations based on the NRCS Soil Group.

NRCS Soil Group		
A	B	C/D
$R_{V\text{-}A} = 0.84i^{1.302}$	$R_{V\text{-}B} = 0.84i^{1.169}$	$R_{V\text{-}C/D} = 0.83i^{1.122}$

Method 3 – Granato method

This runoff coefficient is calculated based on a two-line regression model of the runoff coefficient developed by the United States Geological Survey (USGS). This method of developing the runoff coefficient was developed to assist DOTs and contractors to estimate long-term volume reduction for highway projects and has been adopted for use by UDOT. Additional information relating to this runoff coefficient and its applicability can be found in NCHRP Report 792.

$R_V = 0.225i + 0.05$; when $i < 0.55$

$R_V = 1.14i - 0.371$; when $i \geq 0.55$

Step 4: 80th Percentile Volume

Calculate the 80th percentile volume using the following equations for V_{goal} or WQV.

$$V_{goal} = R_V dA \quad \text{or} \quad WQV = R_V dA$$

Where:

V_{goal} and WQV = 80th percentile volume, cf

R_V = Volumetric runoff coefficient, unitless

d = 80th percentile storm depth, ft (convert from inches to feet if required)

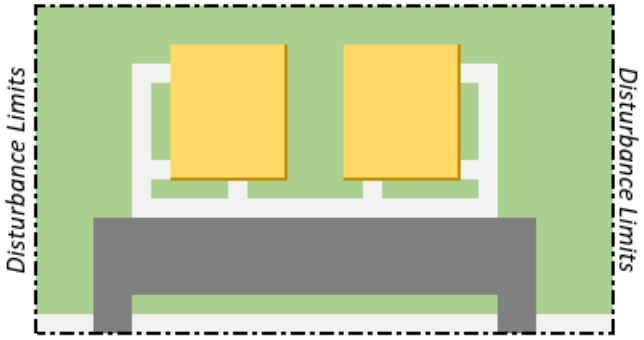
A = Project area or BMP drainage area, sf

The images on the following page show how V_{goal} and WQV are related. Examples from local case studies and different land uses further demonstrate the usage of these equations. See *Land Use Examples* and *Local Case Studies*.

V_{goal}

New Development

V_{goal} is the volume generated from the 80th percentile storm event over the entire project site or a predevelopment hydrologic condition, whichever is less.



$V_{goal} = R_V dA$

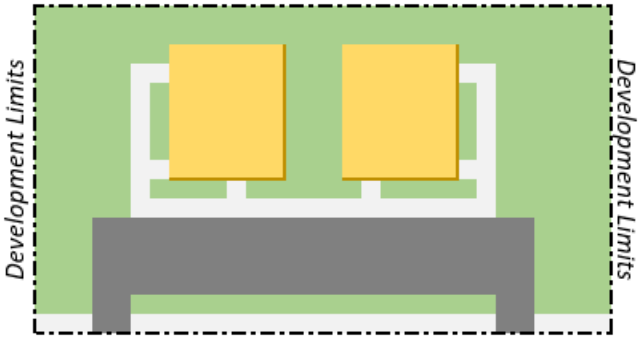
R_V = Volumetric runoff coefficient (based on the project's total area)

d = 80th percentile storm depth, ft

A = Project area, sf

Redevelopment

V_{goal} is the net volume increase generated from the 80th percentile storm event over the project area when the increase in impervious surface is greater than 10%.



Proposed Redevelopment
(Impervious surface increase > 10%)



$V_{goal} = V2 - V1$

$V_2 = R_V dA$

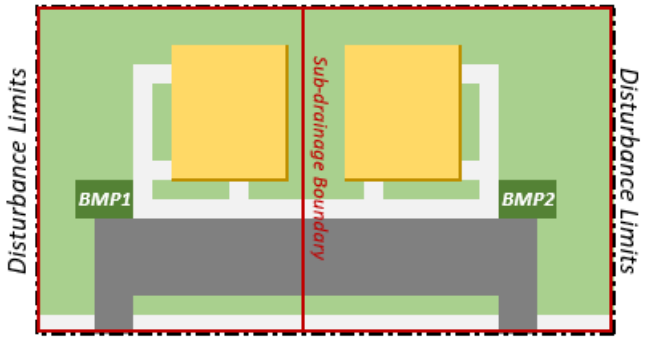
- Volume generated by the 80th percentile storm depth for the proposed project condition.

$V_1 = R_V dA$

- Volume generated by the 80th percentile storm depth for the existing project condition.

Water Quality Volume, WQV

The WQV is the 80th percentile volume of the sub-drainage area for each BMP.



Within the sub-drainage area boundaries, WQV is the 80th percentile volume based on the BMP's drainage area, the imperviousness of the BMP's drainage area, and the 80th percentile storm depth.

$WQV = R_V dA$

R_V = Volumetric runoff coefficient (based on the sub-drainage area's imperviousness)

d = 80th percentile storm depth, ft

A = Sub-drainage area, sf

LID BMPs

Introduction

LID BMPs are long-term structures, graded features, or practices that are designed to retain and/or treat runoff close to its origin after construction is complete. Guidance is given in the following areas:

- **Fact Sheets:** The preface and fact sheets contain information on: pollutant removal effectiveness, design criteria, calculation methods, sample calculations, evaluating BMP effectiveness, technical infeasibilities, water quality concerns, a designer checklist, vegetation selection, installation, installation costs, maintenance, maintenance activities, maintenance costs, and a cross-sectional figure.
- **Treatment Trains:** A description of the use and benefits of treatment trains.
- **Proprietary Devices:** A discussion on manufactured devices that have been designed specifically for storm water quality.
- **LID BMP Selection:** How 303(d) listed impairments, TMDLs, and existing and planned land uses should be used to inform the selection of BMPs. Three flow charts are shown for BMP selection based on site conditions and design criteria.
- **Vegetation Selection:** Description of the role of vegetation and guidance on plant selection for BMPs.
- **Land Use Examples:** Hypothetical developments showing a site plan for residential, commercial, and industrial land uses and how an LID approach improves storm water quality.
- **Local Case Studies:** Examples of existing sites within Utah that have implemented LID practices.
- **Additional Local LID Implementation:** An overview four additional LID sites that investigated pollutant removal, vegetation performance, and the relationship between observed runoff coefficients and rain depth, storm duration, and intensity.

LID BMP Fact Sheets

DWQ has developed fact sheets for 12 LID BMPs. These provide guidance for the more common BMPs; however, BMP selection should not be limited to those on this list. They can be found in *Appendix C*.

LID BMP Type	Fact Sheet ID	LID BMP Category
Minimize Impervious Area	SD-1	Site Design
Rain Garden	BR-1	Bioretention
Bioretention Cell	BR-2	
Bioswale	BR-3	
Vegetated Strip	BR-4	
Tree Box Filter	BR-5	

LID BMP Type	Fact Sheet ID	LID BMP Category
Green Roof	BR-6	
Pervious Surfaces	PS-1	Pervious Surfaces
Infiltration Basin	ID-1	Infiltration Devices
Infiltration Trench	ID-2	
Dry Well	ID-3	
Underground Infiltration Galleries	ID-4	
Harvest and Reuse	HR-1	Harvest and Reuse

Where possible, information that is relevant to all BMPs has been summarized below in this preface instead of repeating identical information in each fact sheet.

Preface to Fact Sheets

Pollutant Removal Effectiveness

Pollutant removal effectiveness is determined from various sources and provides general guidance (Taylor & Barrett, 2014; Filterra Bioretention, 2018; Minnesota Pollution Control Agency, 2018; WERF, 2016; Charlesworth, Beddow, & Nnadi, 2017; APWA, 2012). Many factors contribute to a BMP's pollutant removal effectiveness such as infiltration capacity, climate, vegetation selection, and maintenance practices. Careful collection and analysis of monitoring data is the only definitive method of determining actual pollutant removal for any BMP.

Primary Functions

The BMP's primary functions are listed as a quick reference. Bioretention is the process by which soils and plants remove pollutants from runoff after it has entered the soil. Volume retention describes the BMP's ability to retain runoff and contribute to groundwater recharge. Biofiltration is the process by which pollutants are removed as surface flows interact with grasses, and other vegetation.

Design Criteria

The design criteria for each BMP are based on generally accepted designs. The maximum and minimum ranges are meant to provide a starting point for jurisdictions to develop their own standards, details, and designs. They are not prescriptive. Deviation from the design criteria in these fact sheets is acceptable and encouraged if alternative designs are supported by sound engineering practice, research, or have been shown through past experience to be effective.

Calculation Methods

BMPs are sized for the water quality volume and/or the water quality flow of the BMP's contributing drainage area. The following equations are used for the BMPs in the fact sheets.

Manning's Equation

Applicable BMPs: *Bioswale*, and *Vegetated Strip*

$$Q = \frac{1.49}{n} A R^{\frac{2}{3}} \sqrt{S}$$

Where:

Q = Flow rate, cfs

n = Manning's roughness coefficient, unitless

A = Cross-sectional area of flow, sf

R = Hydraulic radius, sf/ft

S = Longitudinal slope, ft/ft

Continuity Equation

Applicable BMPs: *Bioswale*, and *Vegetated Strip*

$$Q = AV$$

Where:

Q = Flow rate, cfs

A = Cross-sectional area of flow, sf

V = Flow velocity, ft/s

Storage volume within a media with a known porosity

Applicable BMPs: *Rain Garden*, *Bioretention Cell*, *Pervious Surfaces*, *Infiltration Basin*, and *Infiltration Trench*

$$V_{storage} = nV$$

Where:

$V_{storage}$ = Volume of runoff available for storage within media, cf

n = Media porosity, unitless

V = Volume of media layer, cf

Drawdown time

Applicable BMPs: *Rain Garden*, *Bioretention Cell*, *Pervious Surfaces*, *Infiltration Basin*, and *Infiltration Trench*

$$t = \frac{(D_T n_W + d)}{k}$$

Where:

t = Drawdown time, hrs

D_T = Total depth of soil matrix, in

n_W = Weighted average porosity of soil matrix based on soil layer depth

d = Ponding depth, in

k = Design infiltration rate of existing soil or soil matrix, in/hr

---

Minimum footprint area

Applicable BMPs: *Rain Garden*, *Bioretention Cell*, *Infiltration Basin*, and *Infiltration Trench*

$$A_{min} = \frac{12xSFxWQV}{kt}$$

Where:

12 = Conversion factor (inches to feet)

SF = Safety factor

WQV = Water quality volume, cf

k = Design infiltration rate of existing soil or soil matrix, in/hr

t = Drawdown time, hr

Water quality outlet elevation

Applicable BMPs: *Rain Garden*, *Bioretention Cell*, and *Infiltration Basin*

$$Ele_{WQ} = \frac{WQV}{A_{bottom}}$$

Where:

Ele_{WQ} = Elevation of the water quality volume above basin bottom where overflow is provided, ft

WQV = Water quality volume, cf

A_{bottom} = Area of basin bottom, sf*

*Although stage storage calculations may determine the water quality elevation, using the basin bottom will yield a conservative value.

Volume Reduction

For retention BMPs, the volume reduction is inherent in the sizing of the BMP. For example, a rain garden that is designed to retain 1,000 cf is said to have a volume reduction of 1,000 cf. Volume reduction calculations for bioswales and vegetated strips, however, may not be as simple to quantify due to the variable design considerations such as longitudinal slope, flow rate, and infiltrating capacity of the soils. The information below summarizes a few tools that have been developed by either national research groups or municipalities that may be considered for use.

It is not the intent of this manual to give guidance on the use of these tools or to discuss their applicability at length. Jurisdictions are encouraged to review and apply these tools as deemed appropriate or to develop their own. Jurisdictions are also encouraged to monitor the volume reduction of their own bioswales and vegetated

strips to gain a more precise understanding of performance within their jurisdiction to be able to make better informed design level and planning level decisions.

Urban Drainage Flood Control District, Colorado – UD-BMP v3.07

An Excel spreadsheet developed by the Urban Drainage Flood Control District. A multivariable Storm Water Management Model (SWMMM) analysis determines volume reduction based on the user's input of the BMP's drainage area characteristics such as imperviousness and soil type.

The tool can be found by clicking on the link for UD-BMP v3.0 here: https://udfcd.org/software.

City of Stockton, California – Stormwater Quality Control Criteria Plan Volume Reduction Calculator

An Excel spreadsheet developed by the City of Stockton and the County of San Joaquin. User input determines pre- and post-project volume runoff to determine the expected volume reduction.

The spreadsheet can be downloaded by clicking on the link for the Stormwater Quality Control Criteria Plan Volume Reduction Calculator found here:
http://www.stocktongov.com/government/departments/municipalUtilities/utilStorm.html.

NCHRP 25-41 – Volume Performance Tool V.1.0 for Windows

An Excel spreadsheet developed by the National Cooperative Highway Research Program (NCHRP) that allows users to define site characteristics and drainage area characteristics and determine an estimate of the volume reduction percentage for various BMP types. Applicability of this tool is limited to projects within urban highway environments.

The tool can be downloaded by clicking on the link for the .ISO CD-ROM Image found here:
http://www.trb.org/Main/Blurbs/172415.aspx.

Sample Calculations

The sample calculations provide one working configuration of a planning level design for each type of BMP. For example, the sample calculations in the rain garden fact sheet assume that the soils infiltrate and that there are no subsurface constraints. However, if a rain garden is required to be lined, an underdrain design and detention time may need to be considered. Different approaches beyond what is shown in the examples might be required and alternate calculation methods are acceptable if they are supported by sound engineering practice, research, or have been shown through experience to be effective.

Consider the following assumptions when reviewing the sample calculations:

- The examples use hypothetical jurisdictional requirements and design criteria to show their role in BMP design. An example may state that the jurisdiction requires 6 inches of freeboard for a BMP, but jurisdictions are encouraged to develop and implement their own design standards.
- The examples have been prepared with the assumption that the BMPs are for water quality purposes only. It is assumed that upstream bypasses have been provided for larger storm events or that overflow structures within the BMP are provided.
- The examples state which method of determining the volumetric runoff coefficient is used for the sole purpose of showing the calculations for the methods discussed in this manual. It is not intended to be an endorsement of a methodology for each BMP type. The appropriate use of runoff coefficients will be determined by jurisdictions.

See *Step 3: Volumetric Runoff Coefficient* in *Developing the 80th Percentile Volume* for additional information.

Evaluating BMP Effectiveness

To evaluate the performance of a BMP, it is necessary to know its purpose for the developed site and to understand the goals for the BMP's watershed. Visiting BMPs during storm events is a highly valuable method for determining if the BMP is functioning as expected. If the BMP is part of a monitoring program, analysis of monitoring data will reveal if it is performing as designed.

To gain a basic understanding of whether the BMP is functioning properly, performing as expected, and meeting regulatory goals several general questions should be asked that can be applied to all BMPs. Answers to these questions may provide guidance on how to remedy any functionality or treatment issues that arise. The below questions, along with additional considerations specific to each BMP that can be found within the fact sheets, can be used during BMP inspections.

Site-Specific Considerations

1. Are flows reaching the BMP?
    a. If not, flows have been interrupted and runoff is not being retained or treated by the BMP.
2. Is standing water present at or upstream of the BMP?
    a. If yes, the BMP may be clogged, groundwater may be entering the BMP, or the storm drain network may be backing up. Standing water can cause mosquito problems.
3. Is sediment collecting at the upstream end before entering the BMP?
    a. Sediments will ideally be captured in pretreatment (forebay, sump, bioswale, etc.). If significant amounts of sediment are visibly accumulating prior to entering the BMP (either along a curb or within a vegetated area), they should be removed to prevent them from eventually entering the BMP.
4. Does the BMP overflow during large storm events?
    a. If yes, this could indicate that the designated overflow point is clogged, and it should be immediately corrected.
5. Have changes to the site altered the quantity or quality of runoff that drains to the BMP?
    a. If yes, the drainage area to the BMP may be larger than the original design, and the BMP will be undersized for its new drainage area.
6. Is the BMP within a jurisdiction's database and is it being regularly maintained by the responsible party?
    a. If no, the BMP will likely fail. See the individual BMP fact sheets for specific maintenance activities that will prolong the lifespan of the BMP.
7. Has the public raised concerns about the BMP?
    a. If yes, address concerns or, if no modification is necessary, provide education on BMP functions and protective measures that are in place.

Watershed Specific Considerations

1. Is the BMP located within a 303(d) listed watershed, and does the watershed have an approved TMDL?
    - If yes, prioritizing the BMP for monitoring should be considered.
2. Was the BMP designed to address specific TMDL approved impairments?

    - If yes, monitoring will provide data to support the BMP's performance.
3. Has upstream and downstream monitoring equipment been set up for the BMP, and is it functioning?
    - If yes, analyze data of the monitored parameters to determine the BMP's effectiveness.
4. Does monitoring data show that targeted pollutants are being removed?
    - If no, investigate further to determine causes for the BMP's inability to remove the targeted pollutants.

Technical Infeasibilities

It may be technically infeasible to install BMPs at the project site. When this is the case, the site is not required to retain the full project volume retention goal; however, an MS4 may require that an alternative compliance option be utilized (See *Alternative Compliance and Credit Systems*). Technical infeasibilities will be related to depth to the historical high groundwater, soil conditions, project boundaries, economic factors, or other reasons. Possible technical infeasibilities have been categorized below by BMP type.

General Infeasibilities

- Insufficient project space
- Inadequate maintenance access
- Public safety concerns or BMP is unable to be designed in a way that is compatible with jurisdiction's safety standards
- Insufficient head to allow for proper BMP drainage
- Utility conflicts that cannot be resolved

Bioretention/Infiltration/Detention

- High groundwater that does not allow for the minimum separation between the bottom of the BMP and the water table. Infiltration may also exacerbate existing downstream groundwater concerns.
- Poorly infiltrating soils
- Proximity to structures that may result in compromising geotechnical, foundation, or structural integrity (though detention may still be an option with an impermeable liner)
- Steep slopes that may be compromised by infiltration

Pervious Surfaces

- Pervious surface would not provide sufficient load bearing strength for heavy loads
- Storage beneath pervious surface would threaten the stability of adjacent subgrades

Harvest and Reuse

- There are no opportunities for reuse within the contributing drainage area
- A harvest and reuse system cannot be practically designed without significant impact on the project

Water Quality Concerns

General Concerns

Negative impacts on water quality from the construction and maintenance of LID BMPs can generally be avoided in the development's design phases. On the planning level, water quality degradation can be avoided by considering the proximity of BMPs to environmentally sensitive areas such as landfills, areas with known groundwater contamination, and wellhead protection areas. Retention at these locations is not advised, as it has the potential to mobilize contaminated groundwater and degrade down-gradient groundwater or drinking water quality. Pollutants can become concentrated within the soils at BMP locations, which may further exacerbate existing groundwater contamination. Installing BMPs without consideration to geotechnical conditions such as high groundwater and poor soils can lead to a failed BMP that results in degraded water quality that in turn interacts with groundwater and receiving waters. Compaction of soils at the bottom of a BMP or within a soil matrix that is meant to infiltrate will likely result in standing water, vector issues, or algae. Poorly maintained BMPs will result in many possible modes of failure such as standing water, vector issues, algae, flooding, failed soils, or other issues which will compromise the integrity of groundwater or adjacent receiving waters.

Designer Checklist

The designer checklist provided on each BMP fact sheet may be used by those who are designing or reviewing the design decisions that were made for each BMP. Engineering judgment should be used for all design decisions and LID approaches. Consider including information from the designer checklist in the Storm Water Quality Report.

Vegetation

Ensuring that vegetation remains healthy will increase the likelihood that the BMP remains aesthetically pleasing and performs as expected. See *Vegetation Guidance by BMP Type* for additional information.

Installation

LID BMPs should be taken offline during construction so that flows within its drainage area do not enter the BMP until construction is complete. They should not be used as construction BMPs. Use as a construction BMP can compromise functionality and decrease lifespan. They should not be allowed to become compacted during construction.

Typical installation activities for each BMP can be found within each BMP fact sheet.

Installation Costs

Refer to each BMP fact sheet for a general list of construction items. The Green Values National Stormwater Calculator summarizes BMP construction costs and can be found here: http://greenvalues.cnt.org/national/cost_detail.php. Costs will vary.

Maintenance

Proper maintenance will significantly improve the functionality of the BMP and increase its life span. Maintenance activities typically include semiannual (Spring and Fall) inspections but may be required more often such as shortly after construction or after significant storm events. Documentation of maintenance activities is encouraged to provide a record of inspection frequency, maintenance activities, and associated costs.

Maintenance agreements between the municipalities and the final owner of the BMP (if not the MS4) should identify key maintenance elements such as: transfer of BMP ownership; a description of maintenance activities and who is expected to perform them (owner, municipality, other); and, a method of resolution should violation of the maintenance agreement occur.

A description of typical maintenance considerations for each BMP type is given below.

Bioretention/Infiltration/Detention/Harvest and Reuse

- Inspect for sediment buildup or pollutant accumulation within or upstream of BMP and remove if present. Inspection of underground systems may require an access port such as a manhole.

- Inspect for and remove trash and debris.
- Determine cause of any standing water within BMP and remediate.
- Ensure that vegetation is established and maintained.
- If underdrains have been installed, ensure that they are functioning properly.
- If irrigation system has been installed, ensure that it is functioning properly.
- For green roofs, additional inspection of the roof structure may be required.

Pervious Surfaces

- Inspect for clogging of pervious surfaces
    - Vacuum or sweep the pavement to remove sediment and debris.
    - Power wash if necessary. Prior to power washing, downgradient inlets (if present) need to be protected to prevent sediments from entering storm drain system.
- Inspect for depressions. Depressions will indicate that the subsurface layers are failing or have failed. Regrading may be required.

Maintenance Activities

Detailed descriptions of maintenance activities, inspection frequencies, actions that can be taken to resolve maintenance issues, and the general level of effort associated with maintenance activities can be found in each BMP fact sheet.

In determining the inspection effort, the following descriptions were used:

Low – Visual inspection only required to make determination of possible required maintenance activity.

Medium – Visual inspection and other physical activity is required, such as opening an observation or a manhole lid; or, visual inspection and training is required, such as identifying invasive species, to make determination of possible required maintenance activity.

High – Visual inspection, physical activity, and training is required to make determination of possible required maintenance activity.

Maintenance Costs

Maintenance costs are tied to maintenance activities. Inspection of BMPs requires either an on-site presence that is tasked with performing the inspections or a designated person or persons who must visit the BMP to perform the inspection. In either case, the inspector(s) will need to be trained to make correct determinations of the next maintenance activity (if any) for any given maintenance issue that is required to remedy a failing or poorly maintained BMP (*Figure 11*). Permittees are required and private owners are encouraged to track operations and maintenance activities and associated costs.

In general, the following items are considered when considering maintenance costs: inspection frequency, inspection duration, crew size, machinery costs, and remediation. Remediation costs will vary widely based on the action required.



Figure 11: Standing water after a rain event at a bioretention BMP.

The Green Values National Stormwater Calculator summarizes a range of BMP maintenance costs and can be found here: http://greenvalues.cnt.org/national/cost_detail.php.

Figures

The figures for each BMP show a general cross-section that is a starting point for site-specific design. Use of these figures is appropriate for planning level design. For project design, the level of detail, the layout, and cross-sections for the selected BMPs should meet the municipality's CAD and design standards and include all information required for construction.

Treatment Trains

Treatment trains are a configuration of BMPs in series designed to achieve a pollutant reduction goal or a volume retention goal. Treatment trains are commonly used when a BMP can provide pretreatment to a downstream BMP. An example of this is shown in *Figure 12* at a site that is under development where a swale will provide pretreatment for the downstream dry well. Another scenario where a treatment train may be appropriate is when additional BMPs are needed to adequately provide volume retention. A scenario where this applies is where a rain garden has insufficient space to retain the entire water quality volume, but there is available space for an upstream bioswale that can provide additional retention. Site design practices can also be part of a treatment train (WEF Press, 2012).



Figure 12: A vegetated swale that will provide pretreatment for a dry well.

Treatment trains that keep runoff on-site have been found to be more effective. For this reason, BMPs that provide physical, chemical, and biological treatment are good candidates as these processes occur within BMPs that are designed to capture runoff. Pollutant reduction primarily occurs within the most upstream BMP. This is due to the theory of irreducible pollutant concentrations. Irreducible pollutant concentrations occur because of the BMP's inability to adsorb and degrade pollutants beyond a certain concentration (Schueler, Irreducible Pollutant Concentrations Discharged from Stormwater Practices: The Practice of Watershed Protection, 2000). Treatment train configuration should be considered carefully based on the water quality goals and targeted pollutants at the site.

Proprietary Devices

Proprietary devices, such as tree box filters (*Figure 13*), media filters, and underground chambers use proprietary designs, soil mixes, aggregates, and other technologies to accomplish volume retention and storm water treatment.

Consideration of proprietary devices, as with other LID BMPs, should occur at the planning level. These devices function well in highly urbanized areas where there is limited room for other treatment options. Drainage areas with high imperviousness will require that the device have a larger footprint. A common design criterion for the size of the proprietary devices is the flow-through rate and are often referred to as flow-through devices.



Figure 13: Proprietary tree box filter

These devices and technologies are typically designed with the help of the manufacturer. An approved list of vendors, devices, or other technologies may be written into a municipality's storm water management plan. Manufacturers will also be able to provide maintenance activities and inspection frequencies associated with the device. Discussion of specific proprietary devices within this manual does not constitute an endorsement of the device; nor does exclusion of a device constitute a lack of endorsement. Municipalities are responsible for determining which devices and technologies to use within their jurisdiction at the planning or project level.

Tree Box Filters

Tree box filters are typically contained within a concrete vault if being designed as a flow-through device. The vault bottom is removed if it is decided that infiltration is an appropriate function of the filter. See the *Tree Box Filter* fact sheet for additional information.

Underground Detention or Retention

Underground systems, such as chambers, are installed beneath project surfaces that already serve a function, such as parking, when there is limited space within the project limits to provide above ground detention or retention. These systems can be designed for flood control volumes or for the project volume retention goal. See the *Underground Infiltration Galleries* fact sheet for additional information.

Engineered Soils

Engineered soils can be manufactured soil mixes or mixes that are known by a jurisdiction to perform as desired. They can be used to achieve various water quality goals such as pollutant removal, volume storage, or supporting vegetation when existing soils may not be adequate. They are composed of proprietary and non-proprietary materials such as crushed stone, soil, clay, rock, sand, or other proprietary materials developed by the manufacturer.

Others

Aggregate composition, concrete pavers, grass pavers, pervious concrete mixes, permeable asphalt mixes, hydrodynamic separators, and snouts are all examples of types of proprietary devices and technologies. Jurisdictions are encouraged to seek out and determine which devices are appropriate for their projects.

LID BMP Selection

Selection of BMPs is based on many factors. At the planning level, receiving waters, 303(d) impairments, TMDLs, land use, and watershed management plans will play a role in determining which BMPs are most appropriate. At the project level, project limits, groundwater, contaminated soils or groundwater, poorly draining soils, and connections to the storm drain network are all variables that will guide the project team toward BMP selection. The following sections provide tables and charts that can be used to assist in the selection of appropriate BMPs.

BMPs Categorized by 303(d)/TMDL

Table 6 summarizes pollutants that are included on the 303(d) list of impairments or that have approved TMDLs within at least one watershed in Utah along with BMPs that are effective at addressing the pollutant. In general, all BMPs are effective at addressing one or more pollutant impairments but special considerations should be taken into account as shown by footnotes provided at the end of the table. Specific BMPs are not identified for categories in which pollutant removal effectiveness is not rated.

Table 6: BMP types rated for the removal of pollutants that are either 303(d) listed or have approved TMDLs within Utah.

Pollutant	Category	BMP Type
E. coli	Bacteria	All
Total Coliform		
Dissolved Oxygen	Dissolved Oxygen	All[1]
Total Dissolved Solids	Dissolved Solids	BMPs that prevent erosion of sediments
Cadmium	Metals	All
Zinc		
Aluminum, Dissolved	Metals (Dissolved)	All
Arsenic, Dissolved		
Cadmium, Dissolved		
Copper, Dissolved		
Iron, Dissolved		
Lead, Dissolved		
Mercury, Dissolved		
Zinc, Dissolved		
Ammonia	Nutrients	All[2]
Boron		
Boron, Total		
Nitrate as N, Total		
Selenium		
Selenium, Dissolved		
Total Ammonia		
Total Phosphorus		
Observed/Expected (OE) Species Bioassessment	OE Bioassessment	All
pH	pH	All[1]
Gross Alpha	Radioactivity	BMPs that prevent erosion of sediments
Radium		
Sediments/TSS	Sediment	All
Temperature	Temperature	BMPs that incorporate shading and promote infiltration

[1]Improving dissolved oxygen levels and pH values are tied to nutrient reduction.
[2]BMPs may increase nutrients in the effluent if fertilizer is used.

BMPs Categorized by Land Use

Residential, commercial, industrial, and agricultural land uses produce unique assemblages of pollutants. Sediments, pet waste, fertilizers and pesticides are common pollutants in residential areas. Pollutants in commercial and industrial land uses vary depending on site activities. Landscaping, outdoor storage, metal roofs, food, and animal waste products will determine which pollutants may be expected. *Table 7* summarizes expected pollutants by land use.

Table 7: Expected pollutants by common land uses.

Land Uses	Expected Pollutants				
	Sediment	Nutrients	Metals	Bacteria	Oil/Grease
Residential	Y	Y	N	Y	Y
Commercial	Y	Y	N	N	Y
Industrial	Y	N	Y	N	Y
Transportation	Y	Y	Y	Y	Y
Landscaped Areas	Y	Y	N	N	N
Agriculture	Y	Y	N	Y	N

BMP Selection Flow Charts

Selection of LID BMPs is determined by site constraints. There may be geotechnical constraints that govern BMP selection such as shallow groundwater or poor soils, which could rule out the possibility of retention. When retention is not feasible, treatment of runoff can still be accomplished. Treatment can be achieved by creating soil layers or adding amendments to existing soils through which runoff will travel to remove pollutants. Impermeable liners may need to surround the soil layers to prevent groundwater intrusion or to protect adjacent structures. Underdrains should also be considered to allow the BMP subsurface to drain. An example of this would be a rain garden used at a project with high groundwater that has been designed with soil layers, underdrains, and an impermeable liner. Treatment is still achieved but retention does not occur.

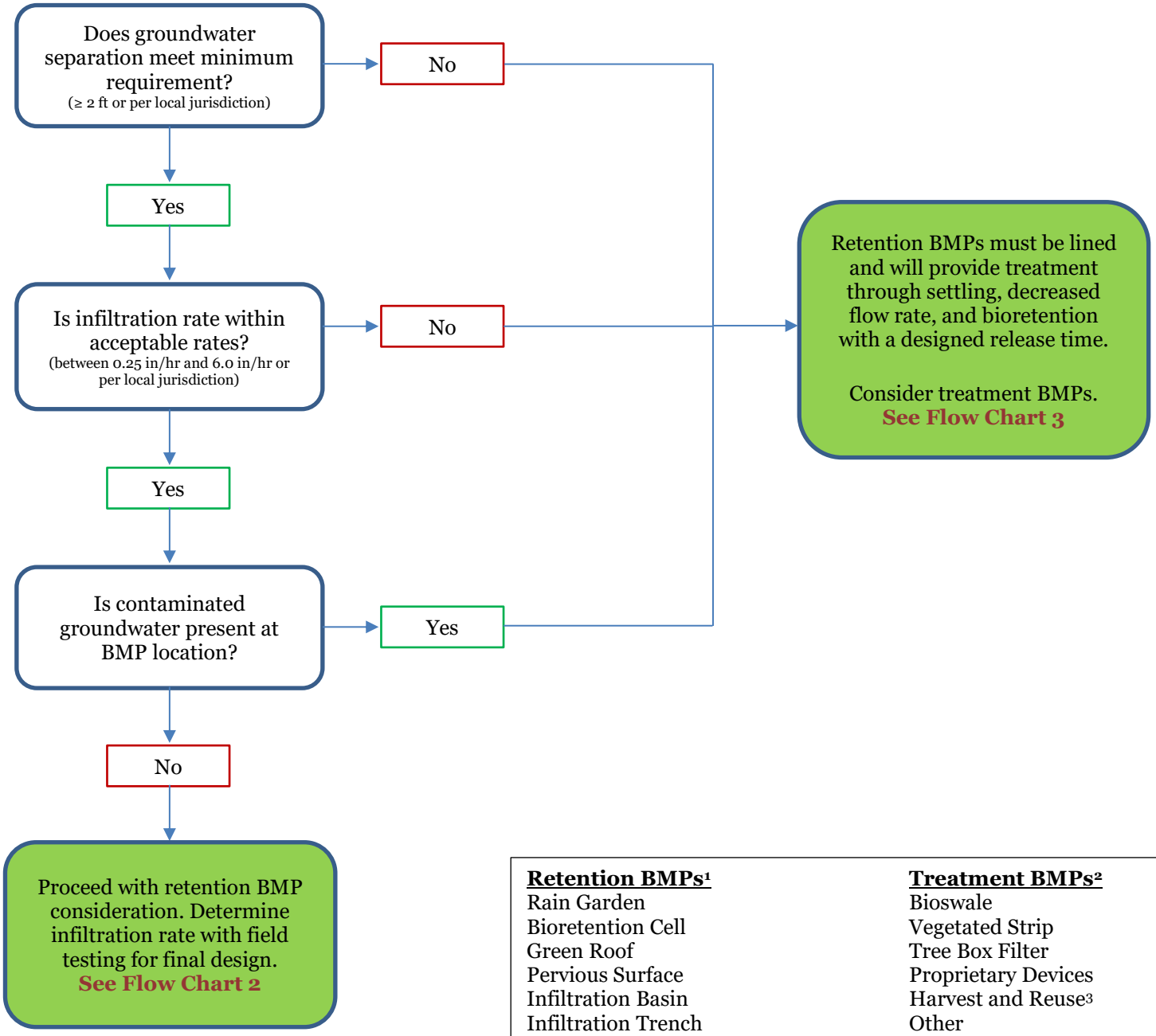
Three flow charts have been developed to assist in the selection of appropriate BMPs. The flow charts guide the user through the general BMP evaluation and selection process. Ultimately, BMP selection will be site-specific; BMP recommendations contained within the flow chart do not necessarily rule out consideration of other BMPs.

Flow Chart 1: Retention vs Treatment
Based on site conditions, determine if retention or treatment will be used.

Flow Chart 2: Retention BMP Selection
Determine which BMPs will provide retention based on the design criteria and technical criteria of each BMP.

Flow Chart 3: Treatment BMP Selection
Determine which BMPs will provide treatment based on the design criteria and technical criteria of each BMP.

Flow Chart 1: Retention vs Treatment

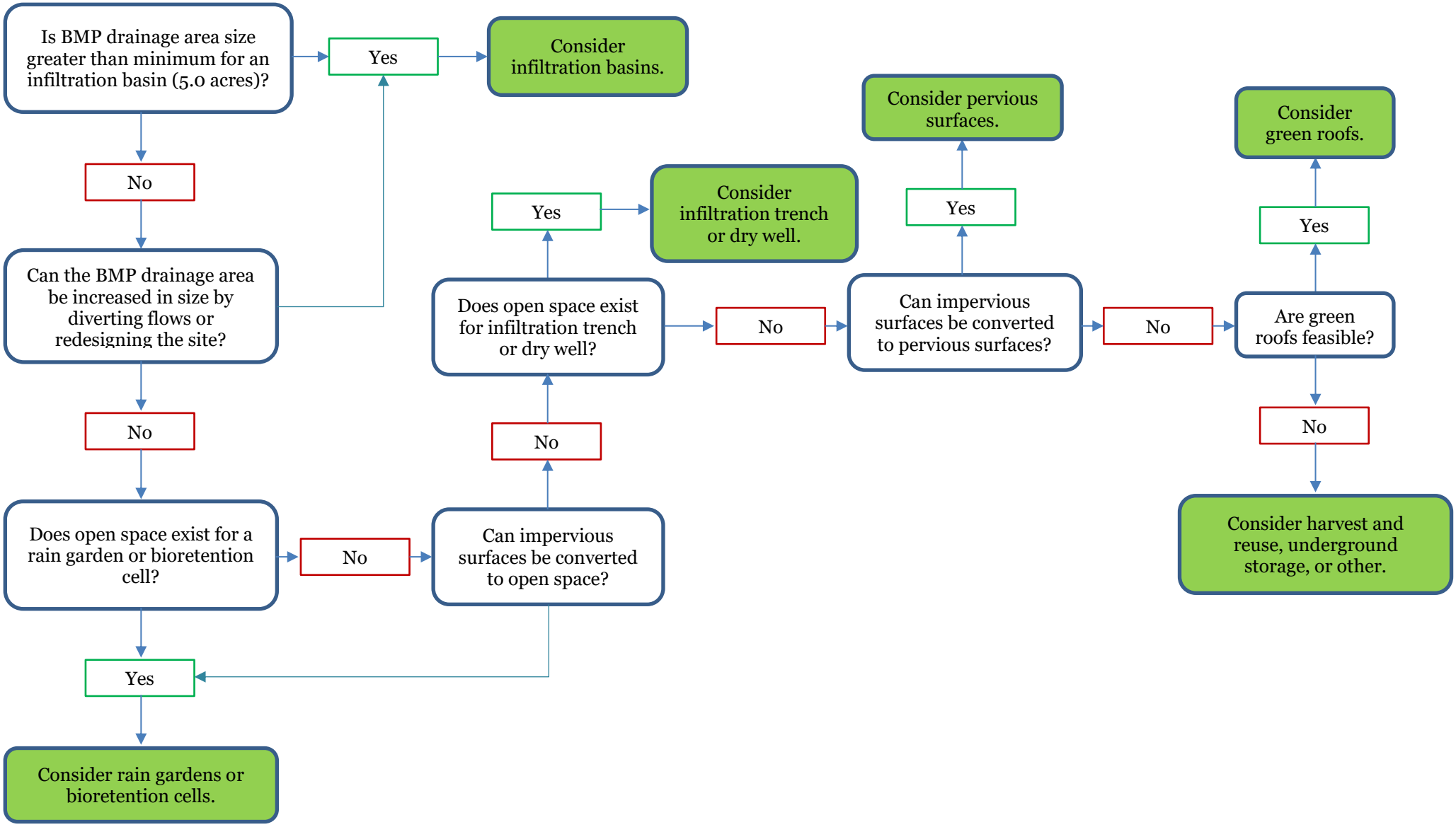


Retention BMPs[1]	**Treatment BMPs[2]**
Rain Garden	Bioswale
Bioretention Cell	Vegetated Strip
Green Roof	Tree Box Filter
Pervious Surface	Proprietary Devices
Infiltration Basin	Harvest and Reuse[3]
Infiltration Trench	Other
Underground Infiltration Galleries	
Dry Well	
Proprietary Devices	
Harvest and Reuse[3]	
Other	

[1]When retention BMPs are infeasible, they may still provide treatment by using impermeable liners and underdrains.
[2]Bioswales may function as retention devices if soils permit and if a raised outlet is provided.
[3]Harvest and Reuse may be considered a retention BMP or a treatment BMP depending on the application.

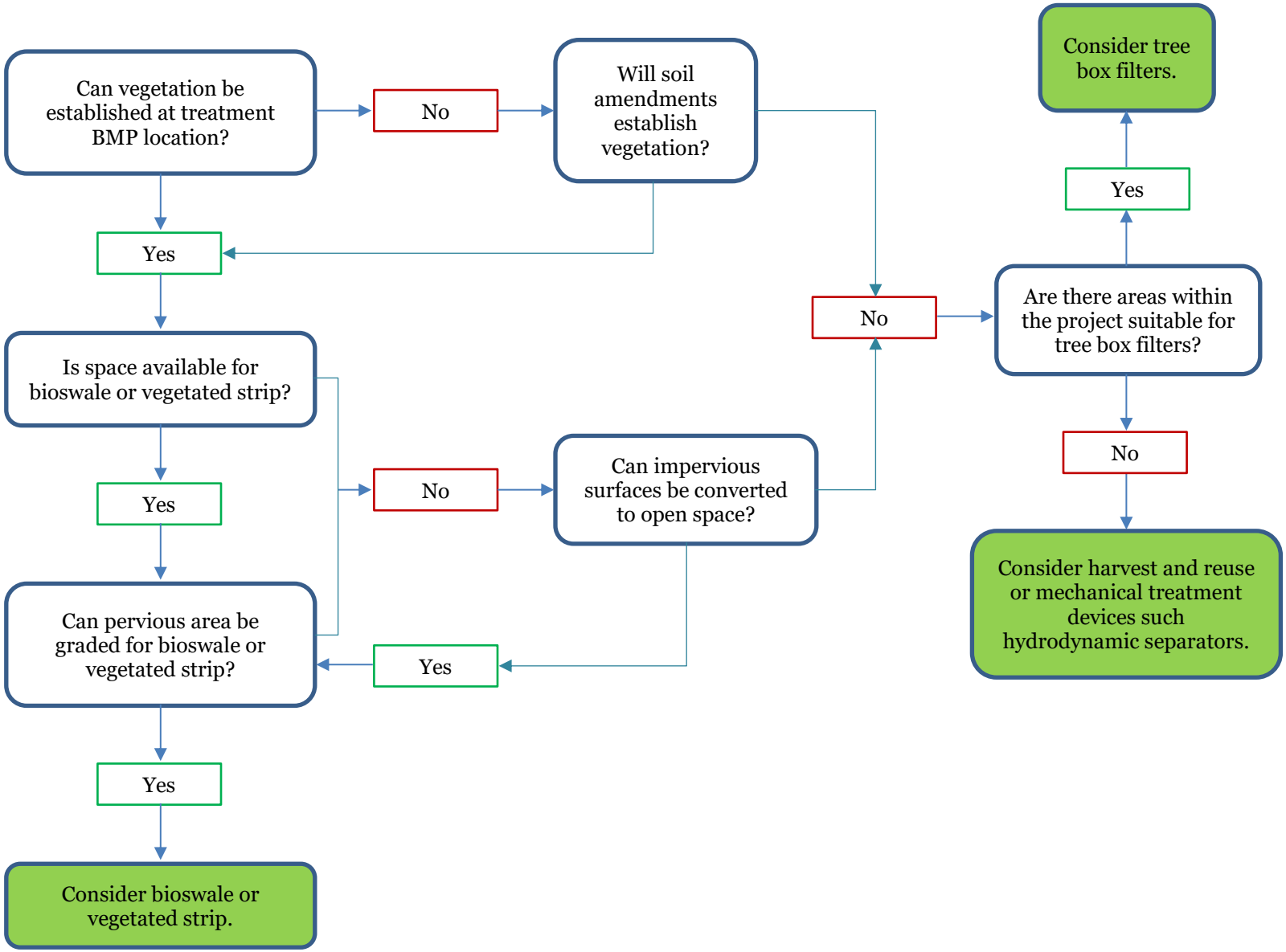
Flow Chart 2: Retention BMP Selection

Note: BMP recommendations contained within this flow chart does not necessarily rule out consideration of other BMPs.



Flow Chart 3: Treatment BMP Selection

Note: BMP recommendations contained within this flow chart does not necessarily rule out consideration of other BMPs.



Vegetation Selection

Benefits of Using Vegetation in BMPs

Vegetation plays a vital role in the viability of BMPs. In conjunction with engineered systems, they reduce pollutants through plant uptake, protect soils from further erosion, increase percolation rates, provide habitat for wildlife, increase aesthetic appeal of BMPs, contribute to mental health, and reduce heat retention.

Pollutant Reduction

Phytoremediation is another benefit of plant use in BMPs. Plants, can uptake pollutants through their root systems and utilize the contaminants to promote vegetative growth above ground, thereby removing the pollutants from soils and water. Generally, this method is more cost effective than other engineered approaches, which may create secondary contaminated waste that must be treated and disposed of in special landfills and through expensive treatment systems. Furthermore, when appropriate plants are selected, it does not have a negative impact on the plant itself as the nutrients are utilized for proper growth and functions of the plant. In conjunction with microbes, they break down otherwise harmful pollutants and either minimize pollutants to acceptable levels or reduce them altogether.

The percent of vegetative coverage has a direct impact on the pollutant reduction performance of the BMP. During a 2-year monitoring study of roadside vegetation by the Caltrans Division of Environmental Analysis, it was found that a minimum coverage of at least 65% was needed for pollutant reduction to occur, but that there was a significant decrease in pollutant reduction below 80% (Caltrans Division of Environmental Analysis, 2003). This result is consistent with similar studies that have led to minimum vegetative requirements for various permittees nationwide that range from 65% to 80%.

Protect Soils from Erosion

Soil erosion occurs when soil is removed through the action of wind and water at a greater rate than it is formed. Plants prevent soil erosion by providing protective cover, slowing down runoff and holding the soil in place. As raindrops fall directly on the soil the impact displaces small particles of soil causing erosion. Plants and plant litter protect the soil from the effects of raindrop impact. Vegetation that completely covers the soil and intercepts all falling raindrops on or close to the surface are the most effective in controlling soil erosion. Additionally, by slowing down runoff, fewer soil particles are carried downstream and surface water can soak into the soil. Plant cover also protects soil against wind erosion. A lack of wind breaks, such as trees, shrubs, and groundcovers, allows the wind to further displace soil particles for longer distances, increasing abrasion and erosion. Furthermore, plant roots help to bind the soil, reducing wind and water displacement. Roots also help to stabilize embankments and slopes, limiting the risk of landslides.

Mulch also adds additional protection from erosion, especially in newly seeded areas. Like vegetation, mulch protects the ground from wind and water erosion while seeds germinate and reduces the loss of soil moisture which, if not maintained, makes the soil more susceptible to wind erosion.

Increase Percolation Rates

Plant litter, root systems, and the microbes associated with the soil environment increase percolation rates through soils. This occurs due to increased air pockets within the soil created as roots expand and contract and decomposed vegetative material is incorporated into the soil. Additionally, the use of water by the plants as they grow draws water through the soil to the roots and increases the permeability of soil over time through constant microscopic movement within the soil itself. Together, these processes create voids in the soil structure allowing water to freely move through the soil either into plant roots for uptake or down into the groundwater below.

Provide Habitat for Wildlife

Vegetation plays a vital role in the quality of wildlife habitat. Plants offer wildlife food, shelter, water, and space needed to exist. Edge areas, especially where water occurs, offers secluded places for wildlife to forage without disturbing the BMPs. When wider habitat areas are provided, especially along edges, they provide a haven for wildlife. Furthermore, when wildlife occupies the area they contribute to vegetation distribution and help to control growth.

Increase Aesthetics

Form, line, color, and texture are the basic visual components of art, and their combination provides visual interest and aesthetic appeal. A good mix of plants with their varied physical characteristics adds beauty and aesthetics to the landscape. Some plants may have more value as a visual element in the landscape based on their physical characteristics. Some characteristics are more visually dominant and have a higher visual value, some are more functionally dominant, and some dominate simply by size. Upright forms, bright colors and coarse textures are dramatic and have high visual impact. Low or prostrate forms, dull colors and fine textures are calm and have low visual impact. The visual value of all plants is dependent on the distance from which they are viewed, the time of year, the quality of light, the adjacent plants, and the plants' health.

Creatively using vegetation within BMPs reduces negative visual impacts of the BMP, makes them more visually pleasing, and increases acceptance of BMP practices within urbanized areas, especially where residential areas are involved. Each plant must be considered individually when selecting plants for a composition, but the entire composition takes on greater importance than the individual plants. For this reason, it is important to think about how the characteristics of each plant will relate to the plant or hardscape next to it.

Contribute to Mental Health

Plants generally have a positive influence on mental health. In increasingly urbanized and developed areas, they provide respite and a sense of connectivity to nature.

Reduce Heat Retention

Vegetation also can mitigate the effect of heat islands created by development. By increasing areas for plants to grow, including within BMPs, increased shade is provided. The added shade combined with evapotranspiration naturally occurring from plants creates a cooling effect. Furthermore, trees and vines planted near buildings help to provide shade and insulation to existing buildings which provide a cooling effect and helps to mitigate cooling costs associated with urban living. One study that analyzed cost savings in Ft Collins, CO, Cheyenne, WY, Bismarck, ND, Berkeley, CA, and Glendale, AZ showed that a net savings of $30-$90 per tree ($40-$120 when adjusted for inflation) was achieved by planting trees in urban environments. (McPherson, Simpson, Peper, Maco, & Xiao, 2005).

Coordinating with a local Utah State University extension or a local nursery can help ensure appropriate plants are chosen for a project.

Vegetation Considerations

In choosing plant species for LID, several considerations need to be made to ensure establishment and long-term plant health. Factors that should be considered include: adaptability of plants to the site conditions, water consumption requirements, soil types, the ability to withstand air and soil pollutants, and heat and cold tolerances.

Site Conditions

When selecting vegetation for LID sites, it is critical to consider the needs of the plants and match them to the current and future site conditions. As the landscape transforms into a built environment, it is important to understand that the minimum and maximum temperatures will change, and microclimates will be created. As the

heat index increases, evapotranspiration rates will also increase. Reflected heat off pavement, concrete, and glass can also burn plants. Furthermore, natural drainage patterns are altered as buildings and infrastructure are developed changing the soil structure and porosity, nutrient availability, and availability of water. Therefore, plants selected must be adaptable to and be tolerant of the changing site conditions. Their ability to improve water, soil and air quality and reduce the heat island effect caused by development should also be considered. Species native to the project area are often better suited to current site conditions; however, plant materials adapted to the changing site conditions may also be a good choice.

Water Requirements

In the arid environment of Utah, it is critical that plants are drought tolerant. This not only helps reduce plant stress, but conserves water. Plants that are not well adapted to the region will tend to be more stressed and therefore, require more water, nutrient supplements, and overall management. The use of additional fertilizer to aid stressed plants can contribute to water pollution. Plants that are not suitable to more arid environments are generally not a good choice for Utah landscapes.

Many municipalities have landscape ordinances that require minimum vegetative cover or percentages of trees and shrubs. In most cases, these landscape ordinances do not preclude the use of native or water wise vegetation. Additional planning and careful selection may be needed to meet these and any other aesthetic requirements.

Fluctuation in soil moisture conditions is also a critical consideration. Typically, plants that can tolerate wide fluctuations in soil moisture, including saturated conditions with standing water, are good choices for basins, swales, bioretention cells, rain gardens, and tree box filters while plants needing good drainage are better suited to basin slopes and upland areas.

Soil

Some plants prefer growing in consistently moist soils while others prefer dry soil with only intermittent changes in moisture levels. Also, the soil's alkalinity, salinity and soil structure are important factors. For example, plants that tend to do well in dry, shallow, rocky soils with a higher tolerance for salt buildup will tend to do better in rooftop gardens compared to plants that prefer acidic bog-like conditions that are better suited to a bioretention cell or rain garden.

Another factor to consider is the soil's structure as it impacts the root system of plants. Plants with shallow surface roots would not be an appropriate choice for areas that may be inundated with heavy flows of surface water, while those with deep taproots would be a better choice.

Plants that have a proven ability to tolerate soil compaction, increased heat, and reduced air flow are best suited for landscape strips. Parking lots along streets require plants that can produce strong tap roots, especially for trees which may otherwise blow over in wind gusts.

It is also important to consider the soil in relation to microbes and plant material, especially for tree box filters and bioretention cells. Plants, soil, and microbes work symbiotically in these situations to alter or reduce the quantity of pollutants collected in storm water and rain water. Some of the nutrients are utilized directly by the plants and soil microbes reducing them to acceptable levels. Selecting plants that are effective at pollutant reduction will ensure that the pollutants are not toxic to the plants.

Air Quality

Plant tolerance to air pollution is another important consideration. Some plants thrive in higher carbon pollutant environments, for example, while others may experience stunted growth. Air pollutants to consider include: carbon monoxide, ground-level ozone, lead, sulfur dioxide, particulate matter, and nitrogen dioxide.

Heat and Cold Tolerance

In addition to soil and water considerations, heat and cold tolerances of plants should be considered. The map of plant hardiness zones in *Appendix D* identifies areas by the lowest annual minimum temperature. Plants associated with each zone are identified in *Appendix E* and are generally tolerant of the coldest temperatures in the area. The other consideration is heat tolerance of plants, which in drier and hotter desert regions is equally important and can be detrimental to plant health. This information can be found using the American Horticultural Society Heat Zone Map for the United States (http://www.ahsgardening.org/gardening-resources/gardening-maps/heat-zone-map). The map identifies the average number of days a specific area experiences extreme heat. Also, it is important to consider the reflectivity of surfaces such as buildings and sidewalks on leaves and bark. Highly reflective surfaces tend to increase the ambient temperature around plants and can injure them to the point of plant death.

A plant selection matrix containing appropriate trees, grasses, shrubs, and groundcover for the LID BMPs covered in this manual is provided in *Appendix E*.

If applicable to the site, vegetation for BMPs should meet the following conditions:

- Vegetation is adapted to the local climate, considering seasonal temperature ranges and average rainfall, exposure to direct sun, frost, wind, and desired irrigation practices.
- Plants selected are tolerant of weather conditions at the specific site such as extreme high and low temperatures, strong winds, sun, and snow. (*Appendix E* contains a matrix of example plants identified by climate zones within Utah and BMPs for each.)
- Vegetation is tolerant of varied moisture conditions (wet and dry).
- Plants are adaptable to varying soil types and conditions.
- Species are non-invasive for the area and site conditions (will not readily spread by air, seed transport, or root invasion).
- Flora is resistant to wildlife foraging such as deer, elk, and rabbits and local pests and diseases.
- Vegetation provides habitat value and linkages to larger open spaces on the fringe of urban developments.
- Site maintenance requirements (e.g., invasive root growth, pruning, thinning, dead-heading), site accessibility, and the ability of the property owner to maintain the specific vegetation is feasible.
- Vegetation adheres to local design criteria such as height limitations and approved plant lists.
- Plants are readily available in local or regional nurseries.
- Flora has an attractive appearance and aesthetic value.
- Vegetation is appropriate for the type of pollution present and desired pollutant removal.

Vegetation Guidance by BMP Type

Bioretention/Bioswales/Infiltration/Detention

Typically, bioretention BMPs receive greater pollution due to storm runoff from streets and roadways; and these BMPs receive water after every storm event. As a result, they require plants that:

- Have a greater ability for nutrient uptake and pollutant neutralization.
- Can survive in boggy and moist soils.
- Tolerate salt or other de-icing agents.

Infiltration Basins

Infiltration basins generally hold water for longer periods of time; however, only the bottom of the basins hold the standing water. Plants located in the bottom of the basin must be able to tolerate standing water for several days, while plants located on the side slopes must be able to tolerate drier conditions. Select plants in infiltration basins that:

- Withstand being covered with water for up to 72 hours.
- Reduce the need for supplemental irrigation and maintenance.
- Do not require additional fertilization and thereby reduce polluted runoff potential.

Vegetated Strips

Vegetated strips are typically small and have limited planting space, so selection must consider the overall size in conjunction with safety requirements. Select plants that:

- Do not require additional fertilization and thereby reduce polluted runoff potential.
- Tolerate environmental factors such as reflective pavements and building materials, salt or other de-icing agents, and air pollution at the site.
- Withstand trampling and vandalism in urban conditions.

Green Roofs

Plant material selection should be based on factors determined by the type of green roof desired, structure itself, as well as the long-term maintenance the owner is able to provide. Typical green roof vegetation ranges from low-growing succulent plants (e.g., Sedums) or groundcovers (characteristic of extensive green roofs) to an assortment of native grasses, shrubs, and trees (more typical of intensive green roofs). Plants of the genus Sedum (family Crassulaceae), which are low-growing succulents, are often used for green roofs because of their resistance to wind, frost, drought, and fire. A mix of Sedum and other succulent plants is recommended because they possess many of the recommended attributes. Herbs, forbs, grasses, and other low groundcovers may also be used but typically require more irrigation and maintenance. Use of native vegetation is preferred though some natives may not thrive in the rooftop environment; thus, a mix of approximately 80% Sedum/succulent plants and 20% native plants generally recognized for their hardiness is recommended, particularly for extensive green roofs (Velazquez, 2005). Select plants that:

- Grow in a shallow and porous substrate (i.e., grasses, perennials and groundcovers are suited to roofs with a substrate of 3-7 inches minimum).
- Root system depth requirements matches depth of substrate (i.e., plants with a deeper and more extensive root system such as shrubs and some trees require 48 inches of substrate minimum depth).
- Drought tolerant and able to exist with minimal and infrequent watering, especially once established.
- Able to withstand higher wind speeds.
- Tolerant of full-sun conditions.
- Fire resistant.
- High salinity tolerance.
- Lower maintenance requirements since access is limited.

- Are primarily non-deciduous to provide adequate foliage cover year-round and reduce erosion potential.
- Have good regenerative qualities (i.e., perennial or self-sowing).
- Are low maintenance (i.e., no fertilizers, pesticides, or herbicides, little or no mowing or trimming).
- Have growth patterns allowing vegetation to thoroughly cover the soil (at least 90% surface area coverage should be achieved within 2 years).
- Are compatible with the aesthetic preferences of the owner and future building occupants who may utilize the roof as a green space.

Steps to Selecting Vegetation for BMPs

To identify vegetation for specific sites and BMPs, consider the following steps:

1. Consider consulting with a landscape architect and/or horticulturalist to assist in the appropriate selection and design for each BMP in conjunction with other professionals such as engineers and architects.
2. Identify the hardiness zone(s) at the site.
3. Identify which BMPs will be used.
4. Determine if there are any microclimates within the site that need to be considered.
5. Identify plants that will best work for the BMP based on the hardiness zone and site's microclimates (See *Appendix E Utah Plant Selection Matrix by Climate Zone and BMP* for more information.)
6. Develop a landscape plan that considers site conditions, erosion protection, pollutant mitigation, human use of and interaction with the site, creation of wildlife habitat, aesthetics, and site and BMP maintenance.

Land Use Examples

The following examples show possible implementations of LID BMPs for three land use types: residential, commercial, and industrial. Figures in the examples are conceptual and as such are not to scale and do not show details for final design. New development is shown for the residential and industrial examples; redevelopment is shown for the commercial example.

Residential LID (New Development) **Residential Development**

Development size: 6.61 ac

Imperviousness: 0.51

Volumetric runoff coefficient: 0.38

80th percentile storm depth: 0.50 in

Hydrologic soil group: B

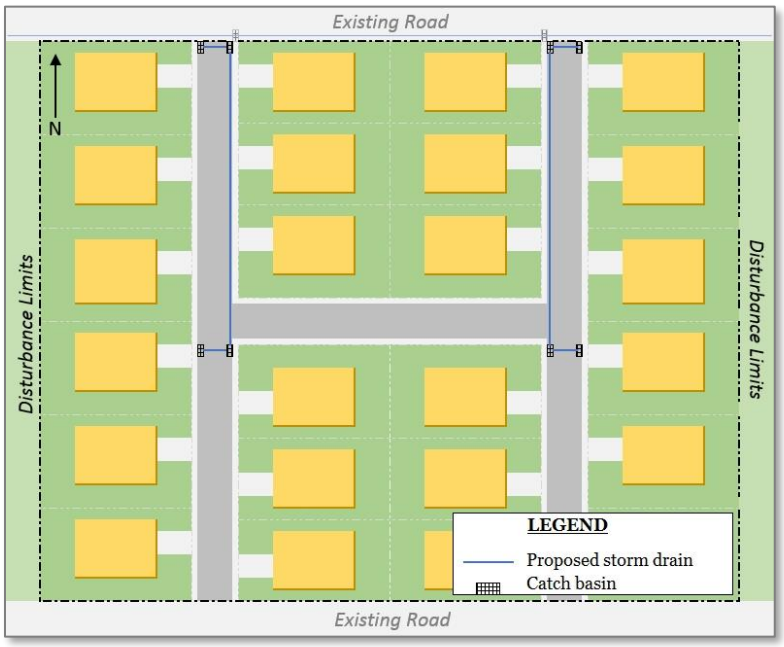


Figure 14: Proposed residential development.

A 6.61-acre residential development (*Figure 14*) is proposed. The development includes 24 homes, three new 30-foot wide roads, and sidewalks. The site is graded such that runoff will flow to the north. Catch basins and pipes are proposed as shown to connect to the existing storm drain network that runs east to west on the south side of the existing road north of the development.

With the given plan, the site's imperviousness is 51%. Assuming the jurisdiction of this development determines the volumetric runoff coefficient based on the hydrologic soil group and the site's imperviousness (See *Step 3: Volumetric Runoff Coefficient*), R_V is calculated to be 0.38. Using the 80th percentile storm depth of 0.50 inches, the volume retention goal of the site is 4,600 cf.

To manage this volume, the design team decided to implement several LID strategies. First, the total impervious surface was reduced by narrowing all roads by 10 feet, which was the minimum roadway width per city guidelines. This resulted in a reduction of impervious area by 0.28 acres, which reduced the site's total imperviousness to 48%. The volume retention goal was recalculated to be 4,254 cf.

To retain the 4,254 cf, rain gardens, bioswales, pervious surfaces, and a dry well were strategically placed to capture the volume retention goal (*Figure 15*).

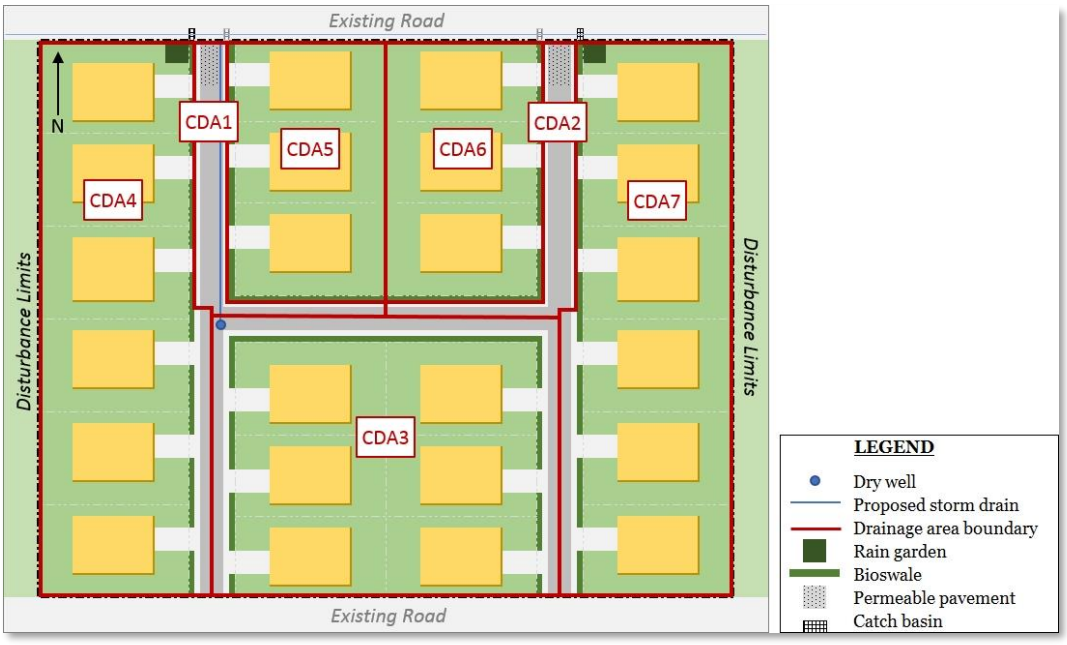


Figure 15: LID approach to residential development.

Contributing Drainage Area	LID BMP Type	Water Quality Volume, WQV (cf)	Runoff Captured (cf)	Percent of WQV Captured	Equivalent Storage Depth (in)	Notes
CDA1	Permeable Pavement	317	320	100%	6	-
CDA2	Permeable Pavement	317	320	100%	6	-
CDA3	Bioswale/Dry Well	1130	703* (bioswale) 452 (dry well)	100%	12 (bioswale)	6 ft x 16 ft dry well
CDA4	Bioswale/Rain Garden	870	238* (bioswale) 638 (rain garden)	100%	6 (bioswale) 24 (rain garden)	-
CDA5	Bioswale	375	410*	100%	14	-
CDA6	Bioswale	375	410*	100%	14	-
CDA7	Bioswale/Rain Garden	870	238* (bioswale) 638 (rain garden)	100%	6 (bioswale) 24 (rain garden)	-
	Total	4254	4367	100%		

*33% of water quality volume is assumed to infiltrate into bioswales. See *Volume Reduction* for further discussion on swale infiltration.

By narrowing the roads and introducing LID BMPs, the design team was able to capture 100% of the project's volume retention goal. This approach has also reduced the number of catch basins and linear feet of pipe required for the storm drain network (provided flood control consideration has also been incorporated into the design).

Commercial LID (Redevelopment) **Commercial Development**

Development size: 1.84 ac

Existing Impervious Area: 1.56 ac

Volumetric runoff coefficient: 0.75

80th percentile storm depth: 0.50 in

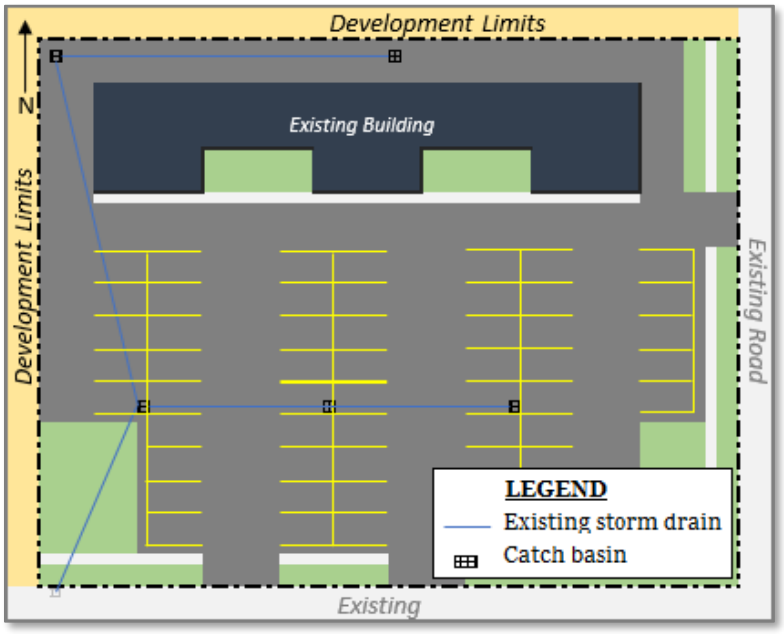


Figure 16: Existing commercial development.

An existing 1.84-acre commercial development (*Figure 16*) will be redeveloped to increase the size of the commercial building and the parking lot footprint. The development currently includes a 0.24-acre building, 1.32 acres of parking and sidewalk (1.56 total impervious acres), and 0.27 acres of pervious area. The imperviousness of the site is 85%. The storm drain network conveys flows to a catch basin at the southwest corner of the site.

The developer plans to increase the footprint of the building and increase parking capacity (*Figure 17*). This will increase the site's impervious area by 16% to 1.81 acres. Because this increase is greater than 10%, the project is required to prevent the off-site discharge of the net increase in the volume associated with the precipitation from all rainfall events less than or equal to the 80th percentile rainfall event. This net volume increase is the project's volume retention goal.

These calculations assume the jurisdiction permitted the project to use the Reese method of determining the runoff coefficient due to its applicability for urban development (see *Step 3: Volumetric Runoff Coefficient*). Using the 80th percentile storm depth of 0.50 inches, the net volume increase is summarized below:

Reese method of determining the runoff coefficient: $R_V = 0.91i - 0.0204$

Existing 80th percentile volume

$R_V = 0.91\ (0.85) - 0.0204 = 0.75$

80th percentile volume = $R_V dA = (0.75)\ (0.50"/12)\ (1.84\ ac)\ (43{,}560\ sf/ac) = 2{,}516\ cf$

Proposed 80th percentile volume

$R_V = 0.91\ (0.98) - 0.0204 = 0.87$

80th percentile volume = $R_V dA = (0.87)\ (0.50"/12)\ (1.84\ ac)\ (43{,}560\ sf/ac) = 2{,}905\ cf$

Volume Retention Goal, V_{goal}

V_{goal} is the net volume increase: V_{goal} = 389 cf

To retain this volume, the design team added a bioretention cell to one of the parking lot's drainage areas (*Figure 16*).

Water Quality Volume within the bioretention cell's drainage area based on the 80th percentile storm event:

Contributing drainage area: 0.37 ac

Impervious area: 0.36 ac

Imperviousness: 0.97

R_V = 0.91 (0.97) – 0.0204 = 0.86

WQV = R_VdA = (0.86) (0.50"/12) (0.37 ac) (43,560 sf/ac) = 584 cf

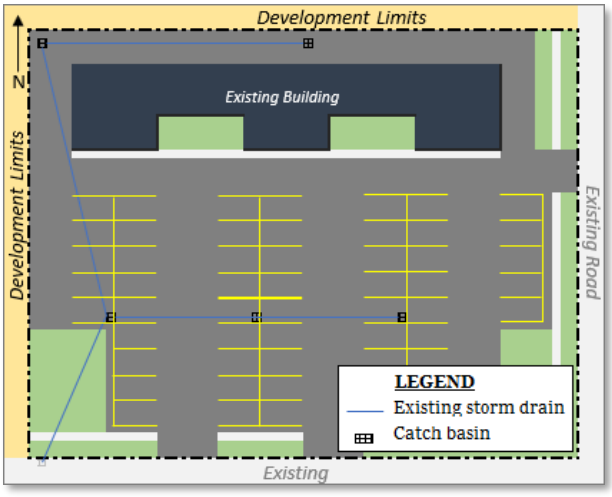
The water quality volume of this drainage area is greater than V_{goal}. The bioretention cell only needs to be sized for V_{goal}. In *Figure 16*, the bioretention area is 5' x 135'. The calculations below show that the storage depth of the bioretention cell needs to be at least 7" (0.58 ft) to retain V_{goal}.

Bioretention cell storage depth:

Bioretention cell footprint: 5' x 135' = 675 sf

V_{goal} = 389 cf

Storage depth = 389 cf / 675 sf = 0.58 ft



(Figure 16. Shown for comparison.)

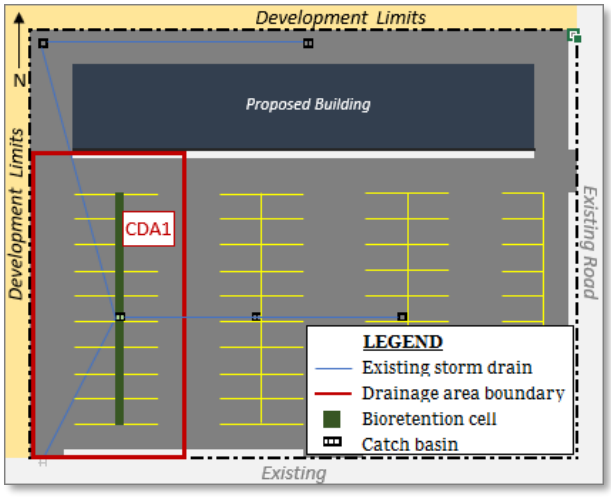


Figure 17: Bioretention cell within the redevelopment's project limits.

Industrial LID (New Development) **Industrial Development**

Development Size: 2.64 ac

Imperviousness: 94%

Volumetric runoff coefficient: 0.83

80th percentile storm depth: 0.50 in

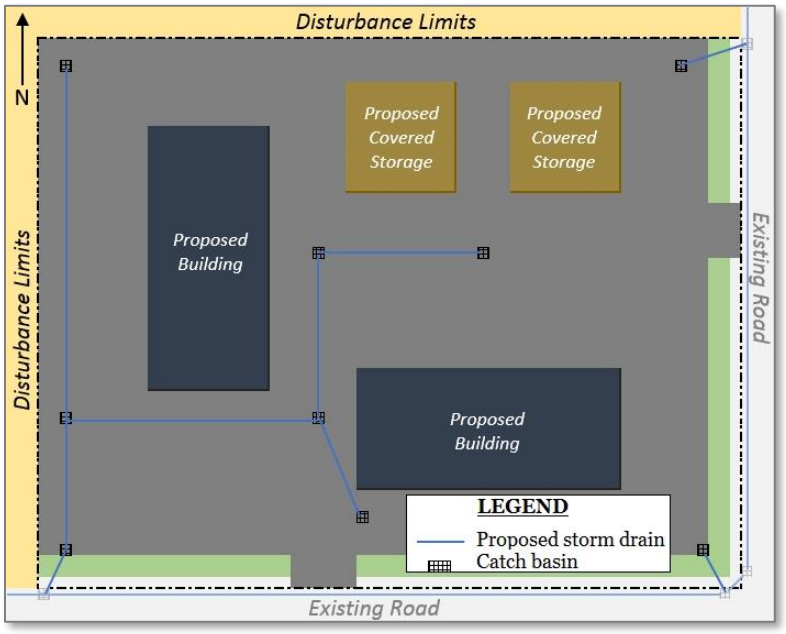


Figure 18: Proposed industrial development.

A 2.64-acre industrial development (*Figure 18*) is proposed. Two new buildings and two covered storage areas are also proposed. The current site will have 0.32 acres of pervious area adjacent to the new sidewalk. There are three connection points to the storm drain network.

With the given plan, the site's imperviousness is 94%. Assuming the jurisdiction of this development adopted the Reese method of determining the runoff coefficient due its applicability for urban development, R_V is calculated to be 0.83 (see *Step 3: Volumetric Runoff Coefficient*). Using the 80th percentile storm depth of 0.50 inches, the volume retention goal of the site is 4,000 cf.

Upon reevaluating the design of the site and subsurface site conditions, two LID features were determined to be appropriate: two infiltration basins and two infiltration trenches (*Figure 19*). Altering the grading design created four contributing drainage areas to the basins and trenches which have overflow connections to the existing catch basins. Pervious areas were also increased. Inclusion of these features results in a reduction of impervious area by 0.18 acres, which reduced the site's total imperviousness to 87%. The volume retention goal was recalculated to be 3,705 cf.

The LID features proposed will capture the volume retention goal.

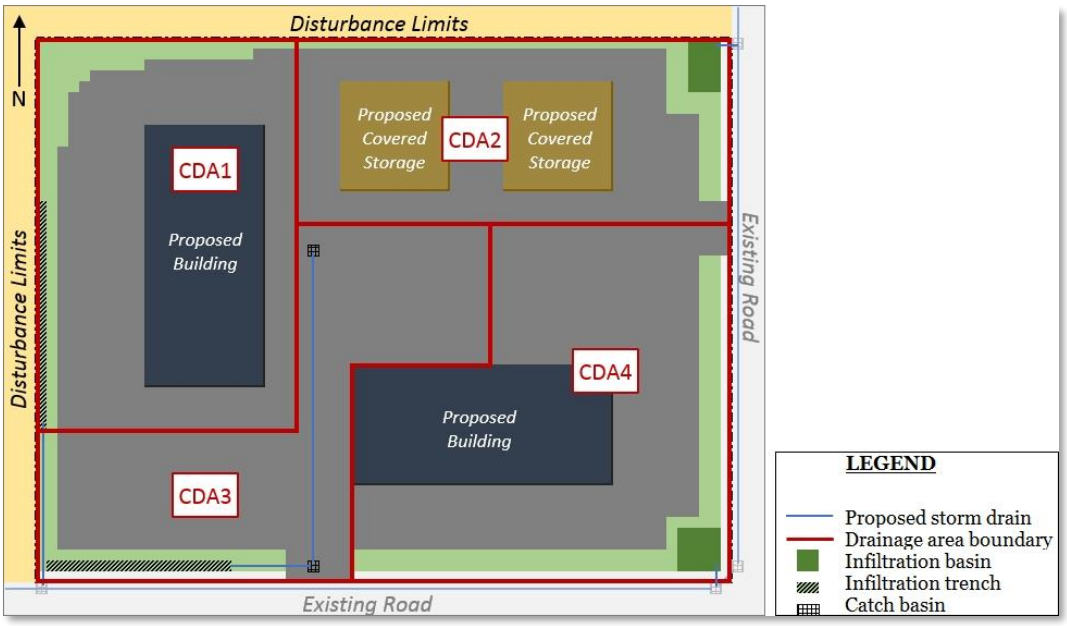


Figure 19: LID approach to industrial development.

Contributing Drainage Area	LID BMP Type	Water Quality Volume, WQV (cf)	Runoff Captured (cf)	Percent of WQV Captured	Equivalent Storage Depth (in)	Notes
CDA1	Infiltration Trench	975	975	100%	18	4 ft width
CDA2	Infiltration Basin	791	791	100%	-	Infiltration rate = 2 in/hr Safety factor = 1.33 Drawdown time = 24 hrs Footprint = 263 sf
CDA3	Infiltration Trench	801	801	100%	18	4 ft width
CDA4	Infiltration Basin	1129	1053	93%	-	Infiltration rate = 2 in/hr Safety factor = 1.33 Drawdown time = 24 hrs Footprint = 375 sf
	Total	3696	3620	98%		

Due to utility conflicts at the southeast corner of this site, the infiltration basin within CDA4 was not able to be sized for the full project volume retention goal. This is still an acceptable implementation of the 80th percentile retention requirement because retention of 100% of the 80th percentile volume was not possible. LID practices were still successful at this site such as the removal of pipe. Additional water quality measures appropriate for an industrial site such as an oil/water separator are not shown in this example but must be used if necessary. Flood control considerations should be considered for final design.

Local Case Studies

Preface to Case Studies

The following case studies are examples of LID features that were designed with the purpose of collecting urban storm water. They are significant because they demonstrate that within Utah's semiarid climate, bioretention and LID approaches can be successfully implemented. Two of the sites are within Salt Lake County and one is in Grand County.

The sites discussed are:

- Bioretention Area at Mountview Park in Cottonwood Heights

  A bioretention area within a large park captures runoff from parking lots within the park and from a nearby residential area.

- Various LID BMPs at the Sandy City Public Works facility

  Rain gardens, bioswales, vegetated swales, concrete pavers, and permeable asphalt detain and treat runoff from a public works facility.

- Permaculture Garden at Utah State University Moab

  As part of a landscaping renovation at the campus, impervious areas are converted to infiltrating swales and increased pervious surfaces that sustains various plant life.

Note that each of these projects was designed and constructed prior to adoption of the 80th percentile storm water retention requirement. As part of the evaluation of these sites, calculations using methods from the previous section were performed to determine whether the sites would be able to successfully retain the 80th percentile storm depth for the BMPs' drainage areas. The bioretention area at Mountview is undersized for the 80th percentile storm depth. The BMPs at the Sandy City Public Works were designed with the 90th percentile storm volume in mind and four of the nine BMPs were able to be sized for the full water quality volume. Approximate calculations for the 80th percentile storm volume for the Utah State University Moab site were also made.

Location: 40.6274°, -111.8449°

Contributing Drainage Area: 18.86 ac

Imperviousness: 65% (approx.)

Bioretention Footprint: 2,470 sf

Soil Type: A (Web Soil Survey)

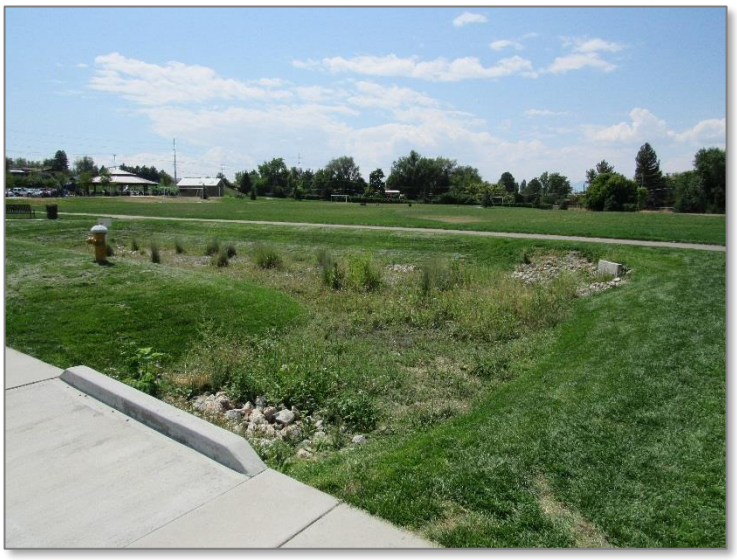


Figure 20: Bioretention area at Mountview Park.

This bioretention area is one of two constructed by The University of Utah for research purposes in the Spring of 2012 to determine if bioretention is a feasible option in Utah's semiarid climate (Heiberger, 2013). The bioretention area at Mountview Park remains intact (*Figure 20*); however, the other bioretention site that was constructed on The University of Utah campus has been removed.

The bioretention area is approximately 2,470 sf and has a depth of 4 ft. There are two layers within the bioretention area: the top layer is 2 feet of native backfill soil; the bottom layer is 2 feet of a subsurface reservoir layer composed of Utelite 3/4" medium grade aggregate with a porosity of 53%. Utelite aggregate was selected due to its filtering and planting applications. The porosity of the top layer is 0.25, resulting in a storage capacity of 1,235 cf. The reservoir layer allows for storage of up to 2,620 cubic feet. The total storage capacity is 3,853 cf.

The nearest rain gage with reliable historical data is the Cottonwood Weir rain gage. Its 80th percentile storm depth is 0.65 inches. The drainage area's total imperviousness is approximately 65%. The runoff coefficient was determined to be 0.57. The water quality volume for this drainage area would be 25,360 cf. which means that the existing bioretention area is undersized for the water quality volume.

Bioswales/Rain Gardens/Pervious Surfaces **Sandy City Public Works – Sandy City**

Location: 40.5924, -111.9091

Contributing Drainage Area: 7.98 ac

Imperviousness: 93.9%

Soil Types: C & D (Web Soil Survey)

80th Percentile Storm Depth: 0.77 in



Figure 21: Proposed rain garden location.

In the winter of 2017, 60% of the Sandy City Public Works facility was destroyed by a large fire. Sandy City decided to do a full redesign and take a multi-phased approach to rebuilding the entire site. Construction is currently ongoing (*Figure 21*).

An LID approach to the site was incorporated into the design and several LID features such as bioswales, rain gardens, and bioretention cells were designed. The Granato method of determining the runoff coefficient (R_V = 1.14*i*-0.371 when $i \geq 55\%$) was used (Taylor & Barrett, 2014) due to the heavy transportation use at a public works site. The project's total volume retention goal was 15,600 cf. Due to various infeasibilities and to maintain the functional purpose of the site, it was not possible for the proposed BMPs to capture the full retention volume. Some drainage areas within the site were unable to retain or treat any storm water.

Shallow groundwater and poor soils limited infiltration opportunities, and it was decided that all BMP areas would have impermeable liners and underdrain systems. For this reason, all BMPs except for the bioswales were designed as detention devices that provided treatment of runoff instead of retaining it on-site. Outlet structures connecting to the storm drain network were designed to release within an acceptable drawdown time. Treatment at the various BMPs was accomplished through a combination of settling, filtration through vegetation, and bioretention through the BMPs' soil layers. Some retention will be accomplished through the bioswales and could be quantified through monitoring.

A full list of the site's BMPs and a few characteristics of each are given in *Table 8* below.

Table 8: LID BMP characteristics designed for the Sandy City Public Works facility.

LID BMP Type	Subsurface Sections	Underdrain	Drainage Area (ac)	WQV (cf)	BMP's Treated Volume (cf)
Rain Garden 1 (lined)	Engineered Soil Coarse Sand Pea Gravel Open Graded Stone	Yes	0.34	737	737
Bioswale 1	Engineered Soil	Yes	0.07	141	27
Bioswale 2	Engineered Soil	Yes	1.23	2309	1469
Rain Garden 2 (lined)	Engineered Soil Coarse Sand Pea Gravel Open Graded Stone	Yes	0.15	280	280
Bioswale 3	Engineered Soil	Yes	0.42	800	366
Rain Garden 3 (lined)	Engineered Soil Coarse Sand Pea Gravel Open Graded Stone	Yes	0.41	885	541
Vegetated Swale	Native backfill	No	0.65	1291	140
Concrete Pavers	AASHTO No. 8 AASHTO No. 57 Drain Rock	Yes	0.13	55	55
Permeable Asphalt	AASHTO No. 8 AASHTO No. 57	Yes	0.13	55	55
			Total Volume (cf)	6553	3670

Four of the nine BMPs were able to be sized for their water quality volume. Treatment was provided for 56% of the total water quality volume of all BMPs. Although the volume retention goal for the entire site was 15,600 cf and all drainage areas were evaluated for their retention potential, many of the drainage areas were deemed to be infeasible for various reasons. Lack of available open space, constraints imposed by the downstream storm drain network, and groundwater restricted five of the BMPs from being able to be sized for the full water quality volume. This site would meet the 80th percentile requirement by retaining runoff to the maximum extent practicable.



Figure 22: Construction progress of permaculture garden.

Location: 38.5700°, -109.5526°

Soil Type: C

In 2014, as part of a campus-wide landscaping redesign, it was decided that portions of the parking areas of Utah State University Moab would undergo a renovation to capture rainfall and create a thriving, productive micro-riparian area. With the removal of a few parking spaces and the conversion of previously unused impervious areas, two permaculture gardens were created that now support vegetation and are aesthetically pleasing areas that benefits the public while retaining rainfall that is reintroduced to the soil instead of conveying directly to catch basins. Each garden contains bioretention systems and bioswales (*Figure 22*) that collect runoff from the adjacent parking lots and down drains from nearby buildings.

Although the permaculture garden was not specifically designed for targeted pollutants, it is worth noting that the garden is located just over one mile away from the Colorado River at the confluence of Mill Creek and Pack Creek. Both creeks are listed for 303(d) impairments including dissolved oxygen, E. coli, dissolved selenium, temperature and total dissolved solids. A monitoring program would reveal the effectiveness of the bioretention and bioswales at removing these pollutants.

The nearest rain gage with a reliable historical record is Arches National Park HQS, which has an 80th percentile storm depth of 0.43 inches. With an estimated contributing drainage area of 1.0 acre and a runoff coefficient determined to be 0.89, the volume retention goal for the permaculture garden would be 1,389 cf.

Additional Local LID Implementation

Daybreak, South Jordan

Daybreak is a mixed-use development located in South Jordan, Utah in the southwest corner of Salt Lake County. The area for the development is planned to contain more than 20,000 residential units.

A variety of techniques were used to mitigate the effects of urbanization on storm water runoff quality. Among the LID techniques used in the community are bioswales, dry wells, constructed wetlands, infiltration trenches, infiltration basins, and detention basins. The community also stipulates that 40% of residential lots and 68% of common open spaces consist of native, drought resistant plants. This strategy is designed to be able to retain the 100-year storm event.

Researchers conducted a water quality monitoring study on the development to determine the effectiveness of the green infrastructure design. One sub-watershed utilized a series of bioswales while the other sub-watershed deployed traditional storm water management techniques. Several constituents were monitored for water quality including nitrogen, phosphorus, suspended solids, and heavy metals. The sub-watershed with bioswales showed significantly reduced runoff volumes as well as large reductions in constituent and heavy metal concentrations when compared to the traditional storm water sub-watershed. A promising finding of the study was that first flush concentrations of copper were reduced, which is significant due to its removal difficulty and the proximity of copper mines in the area. Reductions of other metals during the first flush are listed below. (Yang, Li, Wall, Blackmore, & Wang, 2015)

Total suspended solids, TSS: 92% reduction

Total Nitrogen, TN: 87% reduction

Total Phosphorus, TP: 92% reduction

Zinc, Zn: 96% reduction

Lead, Pb: 96% reduction

Copper, Cu: 82% reduction

Utah State University Research Sites

Utah State University is currently conducting research on the effectiveness of LID techniques on storm water pollutant removal and nutrient uptake. Several LID techniques are being monitored including bioswales, planter boxes, dry wells, bioretention, vegetated filter strips, and membrane roofs at two sites in Logan and one site in Salt Lake City (Dupont, McLean, Peralta, Null, & Jackson-Smith, 2017). The following pollutants are being monitored:

Total Nitrogen, TN	Dissolved Organic Carbon, DOC	Nickel, Ni
Total Dissolved Nitrogen, TDN	Electrical Conductivity, EC	Copper, Cu
Total Phosphorus, TP	pH	Zinc, Zn
Total Dissolved Phosphorus, TDP	Aluminum, Al	Arsenic, As
Nitrate, NO3-N	Chromium, Cr	Cadmium, Cd
Ammonia, NH3-N	Iron, Fe	Lead, Pb

A summary of whether the monitored constituent levels decreased (D) or increased (I) is provided in *Table 9*. Reasons for the increases in pollutant concentrations are uncertain and are currently being investigated. Of particular concern to the researchers is the mobilization of arsenic, although levels are still significantly lower than drinking water standards. In general, the use of organic matter and fertilizer to establish a BMP's vegetation

is a typical reason for increases in nitrogen and phosphorus concentrations. BMP sites that are experiencing increases in pollutant concentrations should be inspected or further analyzed to eliminate the introduction of pollutants.

Site 1: Bioswale (Logan). Lysimeter measurements taken at depths of 6 inches and 24 inches depths.

Site 2: Bioswale (Logan). Lysimeter measurements taken at depths of 12 inches and 20 inches.

Site 3: Media Filter Layer below Bioretention Cell (Salt Lake City).

Site 4: Dry Well (Logan).

Site 5: Vegetated Parking Strip (Logan).

Table 9: Summary of monitored constituents at five sites.

Monitored Constituent	Site 1	Site 2	Site 3		Site 4	Site 5	
			UteLite Expanded Shale	Pea Gravel		4 ft Sump Sample	6 ft Sump Sample
TN	I	D	D	D	D	I	I
TDN	I	I	D	I	D	D	NC
TP	I	I	NC	NC	D	D	D
TDP	I	I	D	I	D	I	D
NO3-N	D	D	I	I	D	I	D
NH3-N	D	I	D	D	D	I	I
DOC	NM	NM	D	D	D	I	D
EC	I	I	I	I	D	D	D
pH	I	I	I	I	I	D	NC
Al	NM	D	I	I	D	D	I
Cr	NM	D	I	I	D	I	D
Fe	NM	D	I	I	D	I	I
Ni	NM	I	I	I	D	I	I
Cu	NM	D	I	D	D	I	D
Zn	NM	I	D	D	D	I	D
As	NM	I	I	I	D	I	D
Cd	NM	I	I	I	D	D	D
Pb	NM	D	D	I	D	I	D

D = decrease; I = increase; NC = no change; NM = not monitored

Green Meadows, Logan

The Green Meadows subdivision in Logan, Utah is one of Utah State University's research sites. The subdivision is a relatively new settlement with houses first being constructed in the early 2000s. The western end of the subdivision borders the Logan River which is in the Bear River watershed. A water quality management plan was established for the watershed in 1995 and found that the Logan River had relatively good water quality. As of 2016 it was listed on the 303d report by the Utah DWQ as having impairment for total phosphorus with a TMDL approved by the EPA.

Utah State University used the subdivision for a case study on the effectiveness of vegetative species within bioretention cells. The study focused on biomass production and water quality improvement to measure the effectiveness of the vegetation. Laboratory tests were conducted with simulated frequency and duration rainfall events to measure biomass production and pollutant removal. Field tests were conducted at the site to generate water quality improvement effectiveness data. Citric acid was added at the field site to simulate a possible increase in nutrient and metal uptake.

The USU study found that common reed and sedges were optimal plants for the area to improve storm water quality. The field site showed significant retention and infiltration capacities throughout the study and 100% pollutant removal from storm water runoff. Maximum nutrient and metal removal was shown to be possible at the site if there was no discharge from the bioretention cells. In tests with added citric acid, metal solubility was increased in the runoff but no enhanced metal uptake was observed. (Dupont & McLean, Optimizing Stormwater BMP Performance, 2018)

Northern Utah Runoff Coefficients

Additional research at Utah State University evaluated runoff coefficients at four sites in northern Utah. Monitoring of dozens of rain events took place from 2015 to 2017. Runoff coefficients were derived by dividing the cumulative rainfall by the cumulative runoff values for the rain events at each site. The sites are identified as 1400 N, 1300 N, 1000 N, and 800 N.

Data from the sites was statistically analyzed to determine relationships between the observed runoff coefficients and rain depth, storm intensity, and storm duration. Statistical significance (p values) and R squared values (the strength of the relationship between the runoff coefficient and the other parameters) were calculated. At the 1400 N site and 1300 N sites, the relationships between the runoff coefficient and all three parameters were found to be insignificant. The 1000 N site showed no statistical significance between the runoff coefficient and the storm intensity but did show significance between the runoff coefficient and storm duration. The 800 N site showed statistical significance between the runoff coefficient and both the storm duration and the storm intensity. Although general trends do come out in the data (increased rain depth results in higher runoff coefficients) R squared values were generally low due to the scattered nature of the data (Velásquez, 2018).

The range of imperviousness from these four sites is limited. The 1400 N and 1300 N sites were approximately 90% impervious and the 1000 N and 800 N sites were both approximately 65%. Jurisdictions will encounter a wider variation of imperviousness for their developments. Developing regression equations for runoff coefficients based on the 80th percentile storm depth that use the imperviousness as the control variable may be simpler to apply jurisdiction-wide to projects since imperviousness will be the parameter with the greatest variability. See *Step 3: Volumetric Runoff Coefficient* for more information on runoff coefficient equations that may be appropriate for use on a jurisdictional level.

Appendix A 80th Percentile Storm Depths

Facility Operator Name (MS4)	80th Percentile Storm Depth (in)	Facility Operator Name (MS4)	80th Percentile Storm Depth (in)
Cache County	0.47	Bluffdale	0.49
Hyde Park City Corp	0.50	Cottonwood Heights	0.58
Hyrum City Corporation	0.50	Draper	0.43
Logan	0.50	Herriman	0.50
Millville City Corp	0.47	Holladay	0.52
Nibley City Corporation	0.47	Midvale	0.50
North Logan City Corporation	0.60	Millcreek	0.55
Providence City Corporation	0.47	Municipal Service District (MSD)	0.55
River Heights City Corporation	0.50	Murray	0.46
Smithfield City Corporation	0.50	Riverton City	0.50
Utah State University (USU)	0.48	Salt Lake City	
Wellsville City Corporation	0.48	Salt Lake County	0.55
Bountiful City	0.60	Sandy	0.50
Centerville City Corporation	0.50	South Jordan	0.46
Clearfield City Corporation	0.50	South Salt Lake	0.60
Clinton City Corporation	0.48	University Of Utah**	1.00
Davis County Public Works	0.61" above Pine View Canal 0.48" below Pine View Canal	Veterans Affairs Medical Cente	0.55
Farmington City	0.49	West Jordan	0.46
Fruit Heights City Corp	0.45	West Valley City	0.46
Hill Air Force Base**	0.80	Park City	0.50
Kaysville City	0.48	Summit County	0.50
Layton City Corporation	0.45	Alpine City	0.53
North Salt Lake	0.60	American Fork City	0.50
South Weber City Corporation	0.43	Cedar Hills City	0.50
Sunset City	0.50	Eagle Mountain	0.40
Syracuse City Corp	0.47	Highland City Corporation	0.50
West Bountiful City	0.50	Lehi City Corporation	0.50
West Point City	0.50	Lindon City	0.50
Woods Cross City Corp	0.48	Mapleton City Corporation	0.55

Facility Operator Name (MS4)	80th Percentile Storm Depth (in)	Facility Operator Name (MS4)	80th Percentile Storm Depth (in)
Brigham City Corporation	0.54	Orem	0.50
Farr West City Corp	0.43	Payson City	0.46
Harrisville City Corporation	0.43	Pleasant Grove City	0.50
Hooper City Corporation	0.48	Provo City Storm Water Service District	.44 to .50 (depending on location)
Marriott-Slaterville City Corp	0.43	Salem City Corporation	0.55
North Ogden City Corporation		Saratoga Springs	0.41
Ogden City	0.48 (Harrison Blvd. to west) 0.62 (Harrison Blvd. to east)	Spanish Fork City**	0.9 Worst 25 Year Storm
Perry City Corporation	0.54	Springville City Corp	0.50
Plain City Corporation	0.48	Utah County	depth varies from 0.23 to 0.55, contact Utah County 801-851-8602
Pleasant View City Corporation	0.43	Vineyard	0.50
Riverdale City	0.50	Ivins City Corporation	0.44
Roy City Corporation	0.50	Santa Clara City Corp	0.44
South Ogden City Corporation		St. George	0.44
Uintah City Corporation	0.43	Washington City	0.44
Washington Terrace City Corp	0.43	Elk Ridge	0.52
Weber County	West: 0.60 East: 0.50	Taylorsville	0.45
Weber State University	0.52	Utah State Prison	TBD
West Haven City	0.49	Woodland Hills	0.50

**indicates the MS4 is using a storm depth different than the 80th percentile

Appendix B Storm Water Quality Report Template

Storm Water Quality Report – Template

This is an example of how the suggested report template is completed. Text highlighted in yellow is project specific information. A blank word document of this template can be found here: *https://documents.deq.utah.gov/water-quality/stormwater/DWQ-2018-013750.docx*

Date: 9/1/2019

Project Name: Garden Valley Condominiums

Project ID: 999999

Design Engineer: John Doe, PE

Is the project within a watershed that is 303(d) listed? Yes

If yes:

Name of receiving water(s): Little Cottonwood Creek-2

Listed Impairment(s): pH; Cadmium, Dissolved; Copper, Dissolved

Does the watershed that has an approved TMDL? Yes

If yes:

Approved TMDL(s): Zinc

I have reviewed the storm water quality design and find this report to be complete, accurate, and current.

Project Manager

[name], Project Manager

Storm Water Coordinator

[name], Designate Storm Water Coordinator

Maintenance

[name], Head of Maintenance

[stamp required at final design phase]

Landscaping

[name], Landscape Architect or Equivalent

Project Information

80th Percentile Storm Depth (in): 0.55

New Development

Area of Land Disturbance (ac): 3.7

Project Impervious Area (ac): 2.9

Project Imperviousness (%): 78

Project Volumetric Runoff Coefficient, R_V: 0.69

80th Percentile Volume (cf): 5,110

Predevelopment Hydrologic Condition (cf): 6,200

Project Volume Retention Goal, V_{goal} (cf): 5,110

Redevelopment

Existing Project Impervious Area (ac): _____

Proposed Project Impervious Area (ac): _____

Change in Impervious Area (%): _____

If change in impervious area > 10%:

Existing Project Conditions

Imperviousness (%): _____

Volumetric Runoff Coefficient, R_V: _____

80th Percentile Volume, V_1 (cf): _____

Proposed Project Conditions

Imperviousness (%): _____

Volumetric Runoff Coefficient, R_V: _____

80th Percentile Volume, V_2 (cf): _____

$V_{goal} = V_2 - V_1$ = _____

Subsurface Information

Groundwater

Depth to Groundwater (ft): 17 ft

Historical High Depth to Groundwater if known (ft): 9 ft

Source: Project groundwater monitoring

Groundwater Contamination at Site: None

Soil Information

Infiltration Rate (in/hr): 1.5 in/hr

Hydrologic Soil Group: A

Source: Project geotechnical report

Soil Contamination at Site: None

Drinking Water

Within Drinking Water Source Area Protection: ___No___

Additional Relevant Site Information

LID Drainage Areas

Add additional rows as needed.

Contributing Drainage Area	Area (ac)	Impervious Area (ac)	Imperviousness (%)	Volumetric Runoff Coefficient, R_V	Water Quality Volume, WQV (cf)
CDA 1	0.90	0.50	0.56	0.49	872
CDA 2	0.75	0.45	0.60	0.53	787
CDA 3	0.80	0.80	1.00	0.89	1421
CDA 4	1.25	1.15	0.92	0.82	2038
				Total WQV (cf)	5118

LID BMP Design

Add additional rows as needed.

Contributing Drainage Area	LID BMP Type	Water Quality Volume, WQV (cf)	Runoff Retained (cf)	Percent of Runoff Captured (%)
CDA1	Rain Garden	900	872	100
CDA 2	Infiltration Basin	800	787	100
CDA 3	Bioretention Cell	1450	1421	100
CDA 4	Bioretention Cell	2100	2038	100
		Total Volume Retained (cf)	5118	100

Percent of V_{goal} captured by LID BMPs: __100__ %

If 100% of V_{goal} is not captured, document and provide narrative of technical infeasibilities and/or alternate compliance measures below:

Describe additional storm water quality measures incorporated into the site:

Appendix C LID BMP Fact Sheets

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Minimize Impervious Area *SD-1*



Pollutant Removal Effectiveness

Pollutant removal will vary based on the development's land use category. Refer to *Table 7* to determine pollutants that are to be expected for residential, commercial, industrial, transportation, landscaped, and agricultural land uses.

Minimize the amount of impervious surface at a development by reducing the footprint of impervious features or replacing impervious material with pervious alternatives. When appropriate and as permitted by jurisdiction and development standards, consider the use of pervious materials such as pavers, pervious pavement, or porous concrete for roads, parking lots, sidewalks, driveways, and other design elements that typically account for large portions of a site's impervious surfaces. If reduction of impervious surfaces was not accounted for during the initial design phases, review the plans to identify opportunities to reduce impervious areas. If development standards do not currently allow for narrower roads or pervious materials, work with the appropriate agencies to discuss how to effectively integrate these practices while maintaining functionality of the site and public safety.

Strategies

- Minimize roadway width as much as jurisdictional standards will allow
- Reduce width of parking spots
- Reduce sidewalk widths
- Incorporate *Pervious Surfaces*
- Shared driveways
- One-way streets

Benefits

- Reduce pollutant runoff
- Improve development aesthetic
- Reduce retention volume requirement

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Rain Garden

BR-1



Pollutant Removal Effectiveness

Pollutant	Effectiveness
Sediment	High
Nutrients	High
Metals	High
Bacteria	High
Oil/Grease	High

Rain gardens are shallow bioretention areas with engineered or native soils. A variety of plants are used to increase infiltration and nutrient uptake including trees, shrubs, grasses, and other plants suitable for the climate. Rain gardens may be designed with various layers of soil, sand, and aggregate. They may also be designed with the existing soils at the site if the soils are expected to adequately infiltrate, support vegetation, and remove pollutants. They can be topped with a wood or rock mulch, any organic material, or other landscaping features. Performance is increased with high carbon soils. Sand and aggregate layers below the soil layers may provide filtration and storage. Rain gardens are usually well-received by the public for their aesthetic qualities.

Slopes leading to the garden bottom are gentle or steep based on site constraints, such as within urban areas. Ponding depths are typically between 1 to 18 inches. Underdrains and impermeable liners are necessary when subsurface concerns exist such as proximity to a structure, poorly infiltrating soils beneath the cross-section of the garden, or groundwater concerns. When a rain garden must be lined, its volume retention function is eliminated, pollutant removal effectiveness is diminished, and it functions primarily as a detention device; however, it still provides treatment through biofiltration. A bypass mechanism either within the rain garden or upstream of the rain garden should be considered for flood events.

Primary Functions	
Bioretention	Yes
Volume Retention	Yes
Biofiltration	Yes

Design Criteria

Refer to *Design Criteria* in the *Preface to Fact Sheets* for discussion of design criteria parameters.

Parameter	Min. Value	Max. Value	Notes
Depth to Historical High Groundwater	2 ft	No maximum	-
Side Slopes	No minimum	3H:1V	-
Ponding Depth	No minimum	18 in	-
Drawdown Time	12 hours	72 hours	24 to 48 hours preferred. Drawdown time may also depend on local mosquito abatement regulations.
Design Infiltration Rate	0.25 in/hr	6 in/hr	Field testing required for final design. Infiltration rate should be low enough to allow biofiltration processes to occur. During design, infiltration rate, drawdown time, and the soil matrix depth will be directly related.
Freeboard	No minimum	No maximum	Freeboard per jurisdiction standards. For public safety, consider requiring freeboard and a minimum 6-inch embankment when ponding depth is greater than 6 inches.

Calculation Methods

Rain garden design is governed by the water quality volume. The general design steps are:

1. Calculate the water quality volume.
2. Determine the geometry of the rain garden.
3. Based on the rain garden geometry and the porosity of the soil layers, determine the ponding depth and soil matrix depth required to hold the water quality volume.
4. Calculate the drawdown time.
5. Calculate the water quality outlet elevation.

Sample Calculations

Refer to *Calculation Methods* in the *Preface to Fact Sheets* for discussion on the equations used.

A site has 1,500 sf of available open space at the downstream end of a parking lot. The parking lot and an adjacent pervious surface constitute one drainage area that is 0.75 ac in size. The total imperviousness of the drainage area is 0.80. The jurisdiction has a maximum drawdown time of 48 hours and uses a safety factor of 1.5 for water quality design.

Given

Contributing drainage area: 0.75 ac

Imperviousness: 0.80

80th percentile storm depth: 0.55 in

Design infiltration rate: 1.75 in/hr

Determine

The footprint and depth of a rain garden that can retain the water quality volume.

Calculations

Volumetric runoff coefficient, R_V (See *Sample Calculations*)

$R_V = 0.91i - 0.0204$ (Reese method)

$R_V = 0.91(0.80) - 0.0204$

$R_V = 0.71$

Water quality volume, WQV (See *Developing the 80th Percentile Volume*)

$WQV = R_V dA$

WQV = (0.71)(0.55 in)(0.75 ac)(43,560 sf/ac) / (12 in/ft)

WQV = 1,063 cf

Minimum footprint, A_{min} (See *Minimum footprint area*)

A_{min} = (12)(Safety Factor)(WQV) / kt

A_{min} = (12)(1.50)(1,063 cf) / (1.75 in/hr)(48 hrs)

A_{min} = 228 sf

The water quality volume will infiltrate into the existing soil in 48 hours if the rain garden bottom is 228 square feet. However, this does not mean that the rain garden bottom is required to be 228 square feet. A larger footprint with a faster drawdown time may be acceptable and reduce the depth required to retain the water quality volume.

A rain garden with a bottom footprint of 1,063 sf and a 12-inch ponding depth will retain the water quality volume. If a safety factor is desired, it should be accounted for by multiplying the water quality volume by the safety factor.

Rain Garden Effectiveness

Effective rain gardens provide an aesthetically pleasing method for retaining and treating storm water. Visiting rain gardens during rain events will reveal if the garden is draining properly. Rain gardens are performing properly if they are retaining their design volume and treating runoff. Creating and following through on maintenance guidelines are critical to ensuring that a rain garden remains functional.

There are many possible indications that a rain garden has failed or is near failure, such as: ponding beyond the design ponding depth during small storm events, drawdown time exceeds design drawdown time, larger than expected sediment buildup within or upstream of the rain garden, irregular settling of the rain garden bottom creating standing water, sloughing of side slopes, excessive and unmaintained vegetation, lack of vegetation, and no maintenance or no record of maintenance. Although this is not an all-inclusive list, being aware of these items will assist in determining what steps need to be taken to remediate a failing rain garden.

Designer Checklist

If the answer to these questions corresponds to a response box that is red, the BMP should either not be used or additional measures need to be taken to address the issue.

	Yes	No
Does groundwater meet the minimum separation requirement?	☐	☐
Is there available right-of-way, property, or easement?	☐	☐
Is the design infiltration rate within acceptable rates?	☐	☐
Is contaminated groundwater present?	☐	☐
Is the drainage area to the rain garden less than 5 acres? (If no, consider an infiltration basin or subdividing to create smaller drainage areas.)	☐	☐
Do utility conflicts make installation of the rain garden technically infeasible?	☐	☐
Do geotechnical conditions exist that would compromise the stability of the rain garden or surrounding structures?	☐	☐
Does the rain garden provide storage for 100% of the water quality volume? (If no, it may still be appropriate to construct the rain garden if it is technically infeasible to capture 100% of the water quality volume.)	☐	☐
Does an overflow outlet structure or bypass mechanism exist?	☐	☐

Vegetation

Refer to *Vegetation Guidance by BMP Type*.

Installation

Excavation

Rain gardens, like other BMPs whose functionality is dependent on infiltration, will fail if proper care is not taken during excavation and construction. Excavators and heavy machinery should not be used within the rain garden area if infiltration is expected to occur through the rain garden bottom. Additional excavation beyond the rain garden's footprint may be required depending on site conditions to provide soil stability or to be able to tie-in to the surrounding grade.

Activities During Construction

Avoid using heavy machinery within the rain garden footprint during construction as doing so will compact the soils and diminish their infiltrating capabilities. Light machinery and even walking within the rain garden's footprint will also compromise infiltration. Compaction of native soils or backfill below the rain garden subsoils is acceptable if doing so does not prevent infiltration from occurring.

Flows During Construction

Flows during construction should be diverted away from the rain garden to prevent construction site sediment from clogging soils. Scheduling installation of the rain garden shortly after excavation will minimize the impact of unnecessary storm water flows from entering the excavated area. The introduction of unwanted sediment can be prevented by placing fiber rolls or silt fences around the rain garden perimeter during construction.

Additional Guidance

- Require certificates of compliance to verify that construction items meet specification requirements.
- Follow landscaping guidance to ensure that vegetation establishes after installation.

Installation Costs

The following cost items are typically associated with rain garden construction.

- Excavation
- Grading
- Fine grading
- Granular borrow fill
- Landscaping and vegetation
- Top layer
- Engineered soil
- Coarse sand
- Crushed gravel
- Open graded stone
- Geotextile fabric
- Outlet structure or upstream bypass structure (for larger storm events)
- Observation wells
- Curb and gutter
- Impermeable liner (if needed)
- Underdrain system (if needed)
- Irrigation system (if needed)

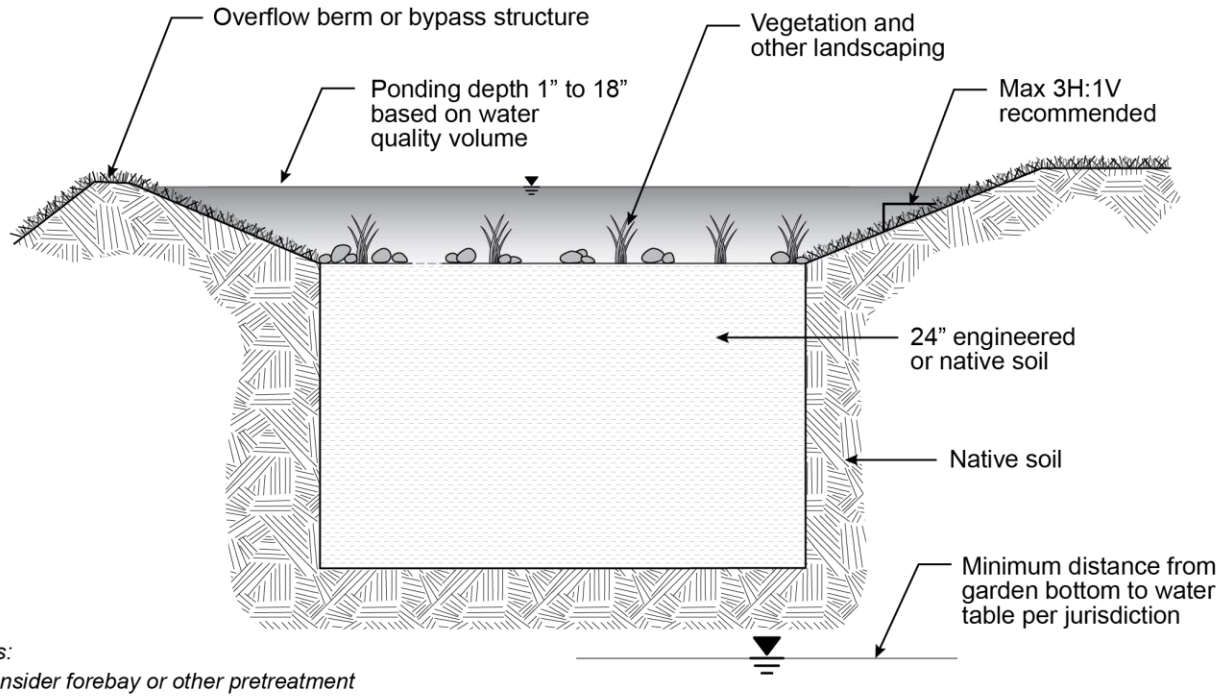
Maintenance

Refer to *Maintenance* and *Maintenance Costs* in the *Preface to Fact Sheets* for general information related to maintenance of bioretention BMPs.

Maintenance Activities

Inspection	Inspection/Maintenance Frequency	Maintenance Activity	Effort
Inspect for adequate vegetative coverage, and impaired or failing vegetation.	Semiannual (Spring, Fall)	Reseed/replant barren spots. Notify the engineer if failing vegetation persists.	Low
Inspect side slopes for erosion, rilling, and sloughing.	Semiannual (Spring, Fall)	Regrade side slope if sloughing does not impact slope stability. Notify the engineer if side slope stability has been compromised and is affecting the functionality of the basin.	Low
Inspect for trash and debris within basin and at inlet and outlet structures.	Semiannual (Spring, Fall) or as needed	Remove and dispose of trash and debris.	Low
Inspect for large deposits of sediment on basin bottom indicating soil clogging.	Semiannual (Spring, Fall) or as needed	Remove and dispose of built up sediment when buildup causes reduction in size of	Low

Inspection	Inspection/Maintenance Frequency	Maintenance Activity	Effort
		basin or if buildup results in standing water. Notify the engineer in the case of standing water as it may indicate clogging within the basin's soil layers.	
Inspect for standing water within rain garden or within observation well.	Semiannual (Spring, Fall) or as needed	Notify the engineer for further inspection.	Medium
Inspect for failure of additional features such as underdrains or irrigation systems.	Semiannual (Spring, Fall) or as needed	Repair as needed.	Medium

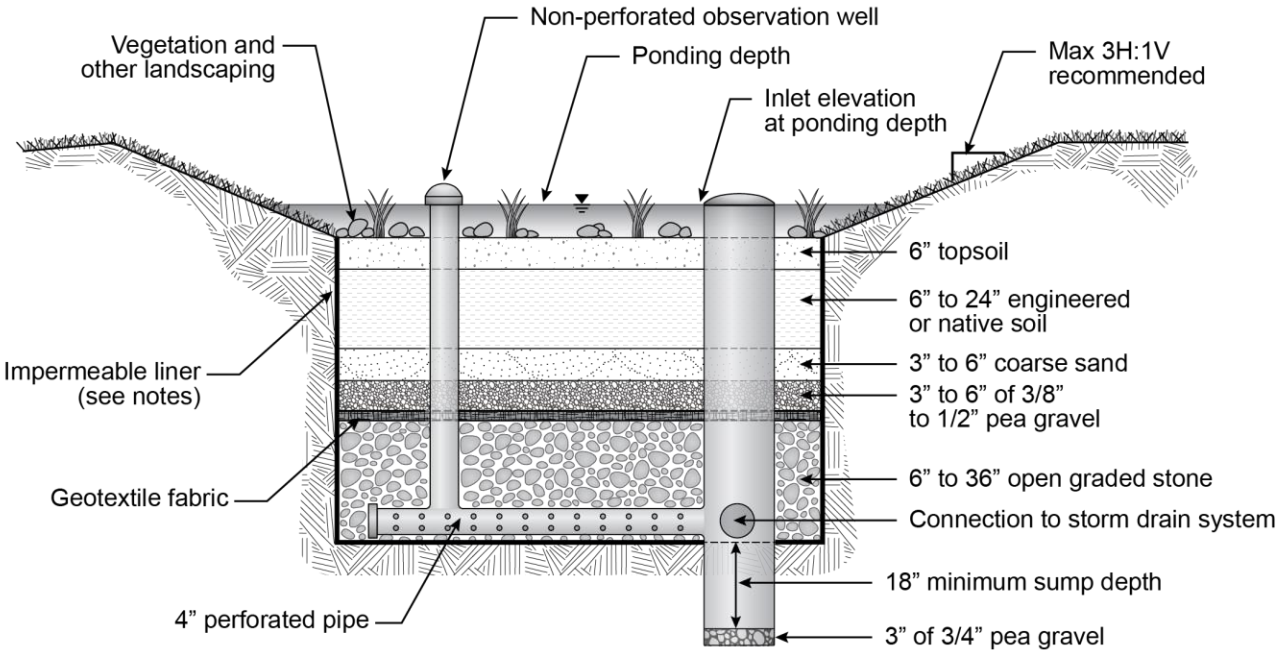


Notes:

- *Consider forebay or other pretreatment*
- *Consider upstream bypass for large storm events*

Rain Garden in Native or Engineered Soils

Not to scale



Notes:

- *Impermeable liner around all sides and bottom of rain garden if groundwater concerns exist*
- *Dimensions shown may vary based on site conditions*
- *Consider forebay or other pretreatment*
- *This treatment option may be considered when infiltration is infeasible*

Rain Garden with Underdrain System

Not to scale

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Bioretention Cell

BR-2



Pollutant Removal Effectiveness

Pollutant	Effectiveness
Sediment	High
Nutrients	High
Metals	High
Bacteria	High
Oil/Grease	High

Bioretention cells are shallow bioretention areas with engineered soil. They typically differ from rain gardens by having a delineation such as a curb, wall, or other distinct boundary. Similar to a rain garden, a variety of plants are used to increase infiltration and nutrient uptake including trees, shrubs, grasses, and other plants suitable for the climate. They may be designed with native soils or various layers of soil, sand, and aggregate. They can be topped with a wood or rock mulch, any organic material, or other landscaping features. Performance is increased with high carbon soils. Sand and aggregate layers below the soil layers provide filtration and storage.

Ponding depths are usually between 1 to 18 inches. In areas with high foot traffic, it may be necessary to provide a safety bench of soil within the cell and a minimum side slope leading to the cell bottom. Underdrains and impermeable liners are necessary when subsurface concerns exist such as proximity to a structure, poorly infiltrating soils, or groundwater concerns. When a bioretention cell must be lined, its volume retention function is eliminated, its pollutant removal effectiveness is diminished, and it functions primarily as a detention device; however, it still provides treatment through biofiltration. A bypass mechanism either within the bioretention cell or upstream of the cell should be considered for flood events.

Primary Functions	
Bioretention	Yes
Volume Retention	Yes
Biofiltration	Yes

Design Criteria

Refer to *Design Criteria* in the *Preface to Fact Sheets* for discussion of design criteria parameters.

Parameter	Min. Value	Max. Value	Notes
Depth to Historical High Groundwater	2 ft	No maximum	-
Ponding Depth	No minimum	18 in	-
Drawdown Time	12 hours	72 hours	24 to 48 hours preferred. Drawdown time may also depend on local mosquito abatement regulations.
Design Infiltration Rate	0.25 in/hr	6 in/hr	Field testing required for final design. Infiltration rate should be low enough to allow biofiltration processes to occur. During design, infiltration rate, drawdown time, and the soil matrix depth will be directly related.
Freeboard	No minimum	No maximum	Freeboard per jurisdiction standards. For public safety, consider requiring freeboard and a minimum 6-inch embankment when ponding depth is greater than 6 inches.

Calculation Methods

Bioretention cell design is governed by the water quality volume. The general design steps are:

1. Calculate the water quality volume.
2. Determine the geometry of the bioretention cell.
3. Based on the bioretention cell geometry and the porosity of the soil layers, determine the ponding depth and soil matrix depth required to hold the water quality volume.
4. Calculate the drawdown time.
5. Calculate the water quality outlet elevation.

Sample Calculations

Refer to *Calculation Methods* in the *Preface to Fact Sheets* for discussion on the equations used.

A drainage area within a proposed roadway will be one-third of an acre with 90% imperviousness. It is proposed that three bioretention cells be placed within the drainage area creating three sub-drainage areas. Each sub-drainage area has the same imperviousness and 'A' soils are present.

Given

Contributing drainage area: 0.11 ac

Imperviousness: 0.90

Storm depth: 0.45 in

Design infiltration rate: 1.60 in/hr

Determine

The footprint and depth of the bioretention cells that can retain the water quality volume.

Calculations

Volumetric runoff coefficient, R_V (See *Sample Calculations*)

$R_{V\text{-}A} = 0.84i^{1.302}$ (R_V based on hydrologic soil group)

$R_{V\text{-}A} = 0.84(0.90)^{1.302}$

$R_V = 0.73$

Water quality volume, WQV (See *Developing the 80th Percentile Volume*)

WQV = (0.73)(0.45 in) (0.11 ac)(43,560 sf/ac) / (12 in/ft)

WQV = 131 cf

Minimum footprint, A_{min} (See *Minimum footprint area*)

A_{min} = (12)(1.50)(131 cf) / (1.60 in/hr)(48 hrs)

A_{min} = 31 sf

The water quality volume will infiltrate into the existing soil in 48 hours if the footprint area of all bioretention cells is 31 square feet. However, this does not mean that the bioretention cell footprint is required to be 31 square feet. A larger footprint with a faster drawdown time is acceptable and will reduce the depth required to retain the water quality volume.

If the bioretention cell were to require an engineered soil layer, the design below with a bottom footprint of 200 sf will retain the water quality volume. If a safety factor is desired, it should be accounted for by multiplying the water quality volume by the safety factor.

Layer	Thickness, in	Porosity	Storage Volume, cf
Ponding	2	1.0	33.3
Top Soil	6	0.25	25
Engineered Soil	6	0.25	25
Coarse Sand	3	0.35	17.5
Pea Gravel	3	0.25	17.5
Aggregate Storage	4	0.4	26.7
Total	24 (soil layers)	0.37 (soil layers weighted)	133 (includes ponding)

Bioretention Cell Effectiveness

Effective bioretention cells provide an aesthetically pleasing method for retaining and treating storm water. Inspecting bioretention cells during rain events will reveal if the cell is draining properly. Bioretention cells are performing properly if they are retaining their design volume and treating runoff. Creating and following through on maintenance guidelines are critical to ensuring that a bioretention cell remains functional.

There are many possible indications that a bioretention cell has failed or is near failure, such as: ponding beyond the design ponding depth during small storm events, drawdown time exceeds design drawdown time, larger than expected sediment buildup within or upstream of the cell, excessive and unmaintained vegetation, lack of vegetation, obstructions at the inlet and outlet locations, and no maintenance or no record of maintenance. Although this is not an all-inclusive list, being aware of these items will assist in determining what steps need to be taken to remediate a failing bioretention cell.

Designer Checklist

If the answer to these questions corresponds to a response box that is red, the BMP should either not be used or additional measures need to be taken to address the issue.

	Yes	No
Does groundwater meet the minimum separation requirement?	☐	☐
Is there available right-of-way, property, or easement?	☐	☐
Is the design infiltration rate within acceptable rates?	☐	☐
Is contaminated groundwater present?	☐	☐
Is the drainage area less than 5 acres? (If no, consider an infiltration basin or subdividing to create smaller drainage areas.)	☐	☐
Do utility conflicts make installation of the bioretention cell technically infeasible?	☐	☐
Do geotechnical conditions exist that compromise the stability of the bioretention cell or surrounding structures?	☐	☐
Does the bioretention cell provide storage for 100% of the water quality volume? (If no, it may still be appropriate to construct the bioretention cell if it is technically infeasible to capture 100% of the water quality volume.)	☐	☐
Does an overflow outlet structure or bypass mechanism exist?	☐	☐

Vegetation

Refer to *Vegetation Guidance by BMP Type*.

Installation

Excavation

Bioretention cells, like other BMPs whose functionality is dependent on infiltration, will fail if proper care is not taken during excavation and construction. Excavators and heavy machinery should not be used within the excavated area if infiltration is expected to occur through the bioretention cell bottom. Additional excavation beyond the footprint may be required depending on site conditions to provide soil stability or to be able to tie-in to the surrounding grade.

Activities During Construction

Avoid using heavy machinery within the bioretention cell footprint during construction as doing so will further compact the soils and diminish their infiltrating capabilities. Light machinery and even walking within the bioretention cell's footprint will also compromise infiltration. Compaction of native soils or backfill below the bioretention cell subsoils is acceptable if doing so does not prevent infiltration from occurring.

Flows During Construction

Flows during construction should be diverted away from the bioretention cell to prevent construction site sediment from clogging soils. Scheduling installation of the bioretention cell shortly after excavation will minimize the impact of unnecessary storm water flows from entering the excavated area. The introduction of unwanted sediment can be prevented by placing fiber rolls or silt fences around the bioretention cell perimeter during construction.

Additional Guidance

- Require certificates of compliance to verify that construction items meet specification requirements.
- Follow landscaping guidance to ensure that vegetation establishes after installation.

Installation Costs

The following cost items are typically associated with bioretention cell construction.

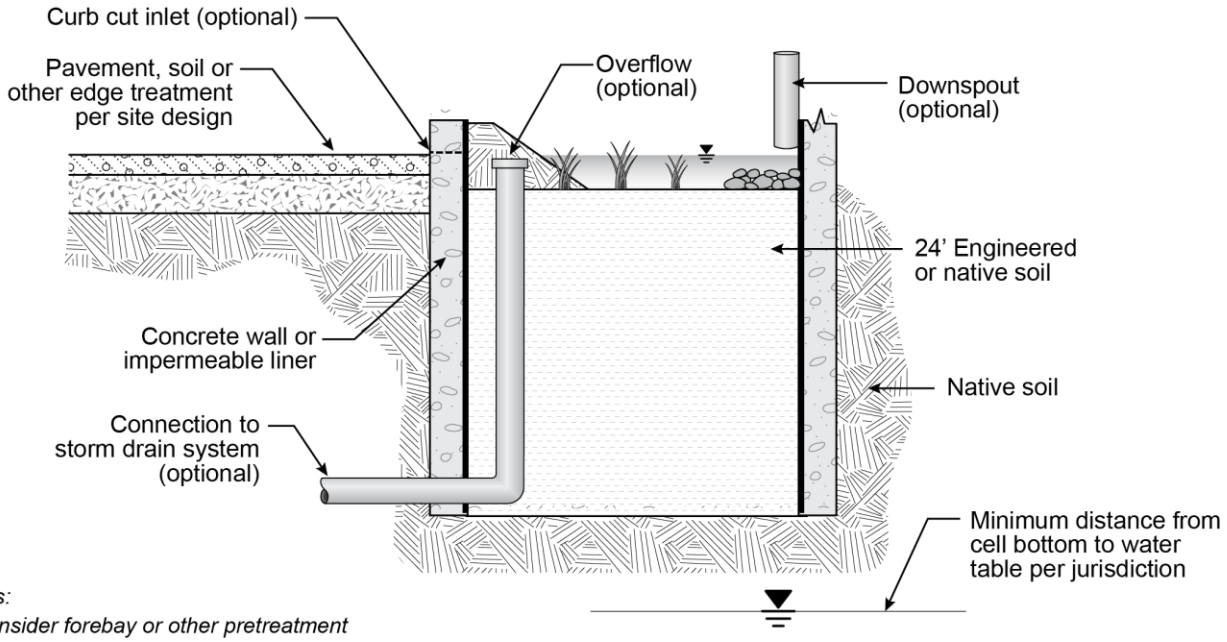
- Excavation
- Landscaping and vegetation
- Top layer
- Engineered soil
- Coarse sand
- Crushed gravel
- Open graded stone
- Geotextile fabric
- Outlet structure or upstream bypass structure (for larger storm events)
- Observation wells
- Curb and gutter
- Impermeable liner (if needed)
- Underdrain system (if needed)
- Irrigation system (if needed)

Maintenance

Refer to *Maintenance* and *Maintenance Costs* in the *Preface to Fact Sheets* for general information related to maintenance of bioretention BMPs.

Maintenance Activities

Inspection	Inspection/Maintenance Frequency	Maintenance Activity	Effort
Inspect for adequate vegetative coverage, and impaired or failing vegetation.	Semiannual (Spring, Fall)	Reseed/replant barren spots. Notify the engineer if failing vegetation persists.	Low
Inspect for trash and debris within basin and at inlet and outlet structures.	Semiannual (Spring, Fall) or as needed	Remove and dispose of trash and debris.	Low
Inspect for large deposits of sediment on bottom indicating soil clogging.	Semiannual (Spring, Fall) or as needed	Remove and dispose of built up sediment when buildup causes reduction in size of basin or if buildup results in standing water. Notify the engineer in the case of standing water as it may indicate clogging within the basin's soil layers.	Low
Inspect for standing water within bioretention cell or within observation well.	Semiannual (Spring, Fall)	Notify the engineer for further inspection.	Medium
Inspect for failure of additional features such as underdrains or irrigation systems.	Semiannual (Spring, Fall)	Repair as needed.	Medium

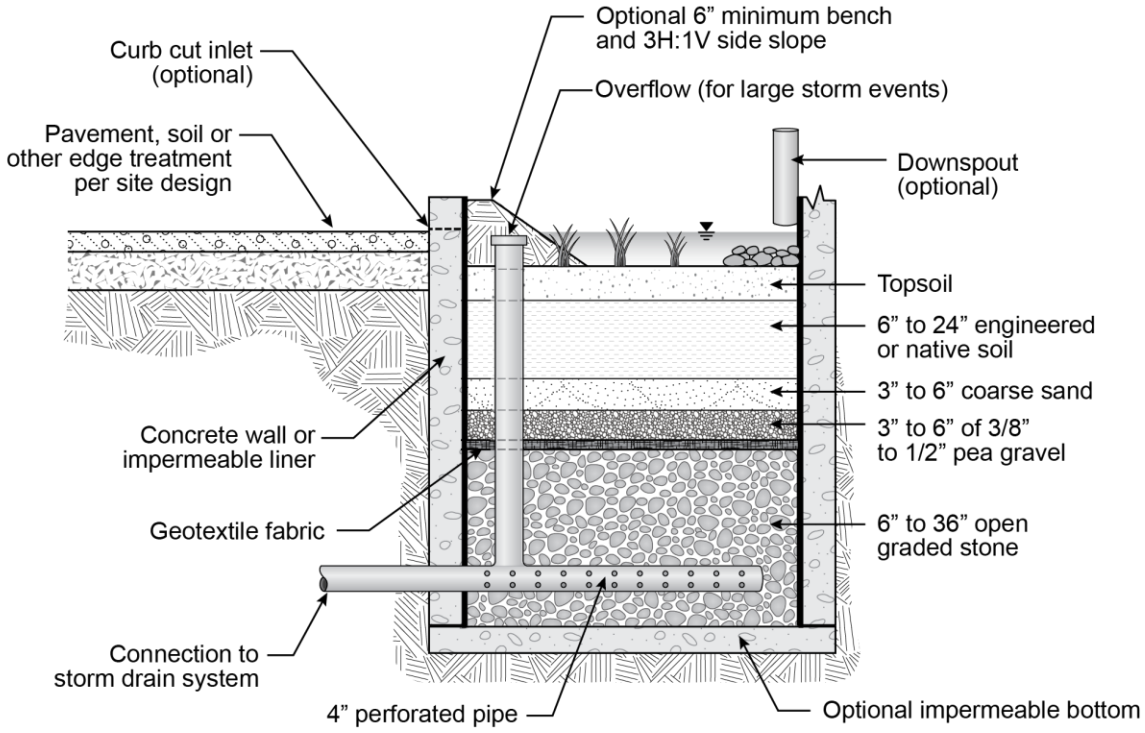


Notes:

- *Consider forebay or other pretreatment*
- *Consider upstream bypass for large storm events*

Bioretention Cell in Native or Engineered Soils

Not to scale



Notes:

- *Overflow elevation must be below elevation of inlet (curb cut, downspout, or other per site design)*
- *Dimensions shown may vary based on site conditions*
- *Consider forebay or other pretreatment*
- *This treatment option may be considered when infiltration is infeasible*

Bioretention Cell with Underdrain System

Not to scale

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Bioswale

BR-3



Pollutant Removal Effectiveness

Pollutant	Effectiveness[1]
Sediment	Medium
Nutrients	Medium
Metals	Medium
Bacteria	Medium
Oil/Grease	High

[1]Removal effectiveness is increased for all pollutants as retention increases.

Bioswales are vegetated open channels designed to convey and treat storm water runoff. They are appropriate when it is desirable to convey flows away from structures or as an alternate conveyance method to pipes, concrete channels, or curbed gutters. Bioswales reduce peak flow rates, reduce flow velocities, filter storm water pollutants, and can also reduce runoff volume through infiltration.

The primary functions of bioswales are bioretention and treatment through biofiltration. Conveying runoff through bioswales allows the runoff to be filtered through two processes: bioretention through a native or engineered soil matrix and biofiltration through the above ground vegetation.

Although volume retention may be accomplished within the native soil or a subsoil matrix of engineered soil and gravel layers, retention is not its primary function. However, retention volumes may be determined by designing ponding areas within the swale or creating check dams. There is research to support the quantification of infiltration when runoff is simply conveyed through the swale (no ponding) but design parameters vary widely. Monitoring bioswales for volume reduction is the most reliable source for future estimates of expected reduction.

Primary Functions	
Bioretention	Yes
Volume Retention	Some
Biofiltration	Yes

Design Criteria

Refer to *Design Criteria* in the *Preface to Fact Sheets* for discussion of design criteria parameters.

Parameter	Min. Value	Max. Value	Notes
Length	Based on hydraulic residence time	No maximum	-
Longitudinal Slope	0.50%	5%	Underdrain recommended below minimum slope
Bottom Width	No minimum	No maximum	-
Side Slope	No minimum	3H:1V	Per jurisdiction requirements
Flow Velocity	No minimum	1.0 ft/s	Maximum permissible shear stress may also dictate maximum flow velocity
Flow Depth	No minimum	2/3 vegetation height	Flow depths greater than vegetation height will bypass the biofiltration processes
Freeboard	No minimum	No maximum	Per jurisdiction requirements
Vegetation Coverage	≥ 65%		Biofiltration is significantly reduced when vegetation coverage is less than 65%
Hydraulic Residence Time	5 min	No maximum	-

Calculation Methods

Bioswale design is governed by the water quality flow. The general design steps are:

1. Calculate the water quality flow.
2. Determine the geometry of the bioswale's cross-section.
3. Determine the flow depth.
4. Determine volume retention within bioswale, if any.
5. Check flow velocity and hydraulic residence time.

Sample Calculations

Refer to *Calculation Methods* in the *Preface to Fact Sheets* for discussion on the equations used.

During the planning phase of a city roadway project it has been decided to remove curbs and instead allow one acre of runoff to sheet flow into a 500 ft bioswale. There are 15 feet of available right-of-way between the edge of pavement and the project limits. A 4-foot sidewalk is also proposed to be within the right-of-way. The city has a requirement that there be no slopes greater than 6H:1V within five feet of the edge of pavement. The city's storm water requirements state that the 2-yr, 6-hr intensity must be used in determining the water quality flow rate. Per city standards, 6 inches of freeboard will be required above the water quality flow depth.

Given

Contributing drainage area: 1.0 ac

Imperviousness: 0.85

80th percentile storm depth: 0.55 in

2-yr, 6-hr storm intensity: 0.16 in/hr

Design Goals

Determine an acceptable swale bottom width and flow depth. Design a soil matrix and determine the volume of runoff that is expected to infiltrate into the bioswale.

Calculations

Volumetric runoff coefficient, R_V (See *Sample Calculations*)

$R_V = 1.14i - 0.371$ (Granato method when $i \geq 0.55$)

$R_V = 1.14(0.85) - 0.371$

$R_V = 0.60$

Water quality flow, WQF

$WQF = R_V iA$

$WQF = (0.60)(0.16 \text{ in/hr})(1.0 \text{ ac})$

$WQF = 0.10$ cfs

Flow depth, y_d (See *Manning's Equation*)

The project team has decided that a 2-foot bottom width will be used for the bioswale. Per city standards, 6 inches of freeboard will be required above the water quality flow depth. Other design information for the bioswale includes:

Longitudinal slope: 2.0%

Side slopes: 3H:1V

Determine the flow depth during the design storm event by setting Manning's equation equal to the WQF and solving the equation for the flow depth, y_d. This calculation is made easier using a goal seek function within a spreadsheet.

$y_d = 1.8$ in

Velocity, v (See *Continuity Equation*)

The city requires that flows remain below 1 ft/s to prevent scouring of the bioswale bottom. With the flow depth known, the continuity equation can be used to determine the flow velocity. The cross-sectional area is calculated to be 0.37 sf.

$v = Q/A$

$v = (0.10 \text{ cfs}) / (0.37 \text{ sf})$

$v = 0.26$ ft/s

Minimum swale length, L_{min}

The city also requires a 5-minute minimum hydraulic residence time to achieve the maximum desired biofiltration. Using the velocity, a minimum swale length can be determined.

$L_{min} = (0.26 \text{ ft/s})(300 \text{ s})$

L_{min} = 79 ft

Any portion of the runoff that enters the swale within 79 ft of the downstream end of the swale will not receive the optimal treatment.

With 6 inches of freeboard and a side slope of 3H:1V, the top width of the bioswale is 6.00 ft. With 15 feet of available right-of-way, 6 of which are available for the swale, at the planning level there is adequate space for the bioswale. If needed, the swale's top width could be narrowed by decreasing the bottom width, which would also result in a deeper flow depth.

Water quality volume, WQV (See *Developing the 80th Percentile Volume*)

WQV = (0.60)(0.55 in)(1.0 ac)(43,560 sf/ac) / (12 in/ft)

WQV = 1,194 cf

Volume Reduction

The swale will also include check dams that are 6 inches high to increase the volume retention. With a longitudinal slope of 2%, a 6-inch check dam will create a triangular pool that is 25 ft long before overtopping the check dam. The volume retained behind the check dam is calculated with the bottom width, the check dam height, and the length of the check dam pool.

$V_{check\ dam}$ = (2 ft)(25 ft)(0.5 ft) / 2

$V_{check\ dam}$ = 12.50 cf

If the check dams are spaced every 50 feet, 10 check dams are possible, and the total volume retained by the check dams will be 125 cf.

Additional volume retention can be achieved in any ponding areas that are designed into the swale.

Although methodologies have been developed to determine volume retention within a bioswale, the current body of research varies widely and jurisdictions are encouraged to exercise engineering judgment (See *Volume Reduction*).

A conservative design for the soil matrix below the swale will allow for the maximum possible percentage of the water quality volume to be captured. For flood control purposes, zero infiltration may be assumed to prevent downstream piping from being undersized if the bioswale's volume reduction is overestimated. Accounting for the ten check dams, the soil matrix below will provide storage for the remaining portion of the water quality volume (1,182 cf). Whether the full remaining volume is captured can be determined by monitoring the bioswale for volume retention.

Layer	Thickness, in	Porosity	Storage Volume, cf
Engineered Soil	12	0.25	250
Coarse Sand	3	0.35	87.5
Pea Gravel	3	0.25	62.5
Aggregate Storage	20	0.4	667
Total	52 (soil layers)	0.35 (soil layers weighted)	1067 (includes ponding)

Bioswale Effectiveness

Bioswales are effective when they can accomplish their design goals of conveying flows to a downstream receiving structure, BMP, or other receiving area. Flows through the swale should be relatively steady and uniform during a rain event unless retention areas and check dams are part of the swale design. Established vegetation with adequate coverage is an indication of a healthy bioswale along with minimal sediment and lack of invasive vegetation.

Designer Checklist

If the answer to these questions corresponds to a response box that is red, the BMP should either not be used or additional measures need to be taken to address the issue.

	Yes	No
If longitudinal slope is less than minimum, can an underdrain be installed?	☐	☐
If an underdrain is needed, is sufficient hydraulic head available for proper drainage?	☐	☐
Do flows result in a shear stress greater than the maximum permissible for selected vegetation?	☐	☐
Do utility conflicts make installation of the bioswale technically infeasible?	☐	☐
Will the bioswale provide conveyance for larger storm events? (If yes, the geometry of the bioswale will need to accommodate the larger events.)	☐	☐
Is the bioswale providing pretreatment for a downstream BMP?	☐	☐
Is the bioswale connecting directly to the storm drain network? (If yes, the outlet structure elevation will need to be determined.)	☐	☐

Vegetation

Refer to *Vegetation Guidance by BMP Type*.

Installation

Excavation

Bioswale construction is a relatively straightforward process of excavating the swale's subsurface trench prior to backfilling with any underdrain system, open graded stone, engineered soil, and geotextile fabric. Additional excavation beyond the swale's footprint may be required depending on site conditions to provide soil stability or to be able to tie-in to the surrounding grade.

Activities During Construction

Crews should avoid stepping within the trench except when necessary as doing so will compact the native soil that is expected to infiltrate runoff.

Flows During Construction

Flows during construction should be diverted away from the bioswale to prevent construction site sediment from clogging soils and to prevent erosion of the swale bed. Scheduling installation of the bioswale shortly after excavation will minimize the impact of unnecessary storm water flows from entering the excavated area. The introduction of unwanted sediment can be prevented by placing fiber rolls or silt fences around the bioswale perimeter during construction. Creating the upstream inlet or connection should be the last construction activity before flows are permitted to be conveyed as designed through the bioswale.

Additional Guidance

- Require certificates of compliance to verify that construction items meet specification requirements.
- Follow landscaping guidance to ensure that vegetation establishes after installation.

Installation Costs

The following cost items are typically associated with bioswale construction.

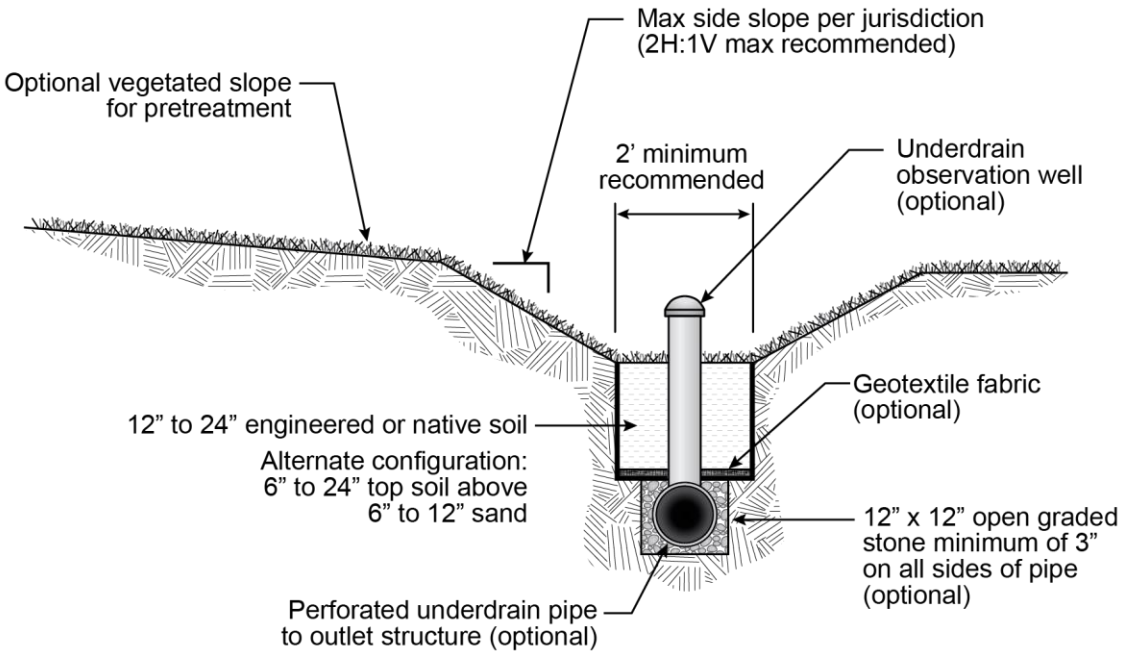
- Excavation
- Grading
- Fine grading
- Granular borrow fill
- Landscaping and vegetation
- Top layer
- Engineered soil
- Open graded stone
- Geotextile fabric
- Impermeable liner
- Outlet structure or upstream bypass structure (for larger storm events)
- Observation wells
- Underdrain system (if needed)
- Outlet protection such as riprap or other (if needed)

Maintenance

Refer to *Maintenance* and *Maintenance Costs* in the *Preface to Fact Sheets* for general information related to maintenance of bioretention BMPs.

Maintenance Activities

Inspection	Inspection/Maintenance Frequency	Maintenance Activity	Effort
Inspect for adequate vegetative coverage, and impaired or failing vegetation.	Semiannual (Spring, Fall)	Reseed/replant barren areas. Notify engineer if issue persists.	Low
Inspect side slopes for erosion, rilling, and sloughing.	Semiannual (Spring, Fall)	Regrade side slope if slope stability is not affected by sloughing. Notify engineer if stability is affecting basin functionality.	Low
Inspect for standing water within bioswale or within observation well.	Semiannual (Spring, Fall)	Notify engineer for further inspection.	Medium
Inspect for trash and debris at inlet and outlet structures.	Prior to mowing, at least semiannually	Remove trash and debris.	Low
Inspect vegetation height.	As needed	Mow swale as needed.	Low



Notes:

- *Engineered soil may improve filtration*
- *Underdrain recommended for longitudinal slopes < 1%*
- *Optional items shown for use of underdrain*
- *Dimensions shown may vary based on site conditions*
- *Use of underdrain system may be considered when infiltration is infeasible*

Bioswales

Not to scale

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Vegetated Strip

BR-4



Pollutant Removal Effectiveness

Pollutant	Effectiveness[1]
Sediment	High
Nutrients	Medium
Metals	Medium
Bacteria	High
Oil/Grease	High

[1]Removal effectiveness is increased for all pollutants as retention increases.

Vegetated strips are designed to receive and treat sheet flow from adjacent surfaces. This is accomplished by slowing runoff velocity to allow for pollutants and sediments to settle and by filtering out pollutants in the vegetation before entering the storm sewer system. Vegetated strips are best utilized for storm water treatment from roads, parking lots, and other impervious surfaces.

Primary Functions	
Bioretention	Yes
Volume Retention	Some
Biofiltration	Yes

The primary functions of vegetated strips are bioretention and biofiltration. Bioretention within a vegetated strip occurs as runoff enters the soil and pollutants are removed through physical, chemical, and biological processes. Similar biofiltration processes occur to provide treatment when runoff passes through the strip's vegetation. Biofiltration is significantly reduced when vegetation coverage is less than 65%. In arid locations a gravel strip may be used as a substitute for the vegetated strip. The lack of vegetation will cause biofiltration and bioretention to be greatly reduced; however, the runoff velocity will still be decreased and allow for pollutants and sediments to settle out. Volume retention through infiltration will also occur as runoff enters the gravel's void spaces.

Design Criteria

Refer to *Design Criteria* in the *Preface to Fact Sheets* for discussion of design criteria parameters.

Parameter	Min. Value	Max. Value	Notes
Length (direction of flow travel)	15 ft	No maximum	-
Longitudinal Slope	No minimum	4H:1V	Per jurisdiction requirements
Flow Velocity	No minimum	1.0 ft/s	Maximum permissible shear stress may also dictate maximum flow velocity
Flow Depth	No minimum	2/3 vegetation height	Flow depths greater than vegetation height will bypass the biofiltration processes
Freeboard	No minimum	No maximum	Per jurisdiction requirements
Vegetation Coverage	≥ 65%		Biofiltration is significantly reduced when vegetation coverage is less than 65%

Calculation Methods

Vegetated strip design is governed by the water quality flow. The general design steps are:

1. Calculate the water quality flow.
2. Determine the flow depth.
3. Check flow velocity.

Sample Calculations

Refer to *Calculation Methods* in the *Preface to Fact Sheets* for discussion on the equations used.

A roadway project is proposing to widen a road that is near a canal. Due to high groundwater and poor soils, retention on-site is not feasible. Treatment is still an option, however, and the design team has decided to establish vegetation within the twenty feet between the edge of pavement and the canal. The city's storm water requirements state that the 2-yr, 2-hr intensity must be used in determining the water quality flow rate.

Given

Contributing drainage area: 0.25 ac

Imperviousness: 1.00

2-yr, 2-hr storm intensity: 0.318 in/hr

Design Goals

Determine that the flow depth will be less than 1 inch.

Calculations

Volumetric runoff coefficient, R_V (See *Sample Calculations*)

$R_{V\text{-}A} = 0.84i^{1.302}$ (R_V based on hydrologic soil group)

$R_V = 0.84(1.0)^{1.302}$

$R_V = 0.84$

Water Quality Flow, WQF

$WQF = R_V iA$

$WQF = (0.84)(0.318 \text{ in/hr})(0.25 \text{ ac})$

$WQF = 0.067 \text{ cfs}$

There is available right-of-way for a 300-foot long strip that is 20 feet wide. The embankment side slope is 10H:1V which corresponds to a 10% longitudinal slope for the vegetated strip.

Flow depth, y_d (See *Manning's Equation*)

Calculation of the flow depth is typically done using Manning's equation setting the equation equal to the water quality flow and solving for the flow depth.

$y_d = [(nQ)/1.49LS^{0.5}]^{0.6}$

$y_d = [(0.2)(0.071 \text{ cfs}) / (1.49)(300 \text{ ft})(0.02)^{0.5}]^{0.6}$

$y_d = 0.04 \text{ in}$

Velocity, v (See *Continuity Equation*)

The city requires that flows remain below 1 ft/s to prevent scouring of the strip bottom. With the flow depth known, the cross-sectional area is calculated to be 1.10 sf.

$v = Q/A$

$v = 0.067 \text{ cfs} / 1.10 \text{ sf}$

$v = 0.06 \text{ ft/s}$

Volume Reduction

Although methodologies have been developed to determine volume retention within a bioswale, the current body of research varies widely and jurisdictions are encouraged to exercise engineering judgment (See *Volume Reduction*).

Vegetated Strip Effectiveness

Vegetated strips are effective when they can accomplish their design goals of conveying sheet flow to the receiving area. Flows through the vegetated strip should be relatively steady and uniform during a rain event and should not create rilling or other visible signs of erosion. Established vegetation with adequate coverage is an indication of a healthy vegetated strip along with minimal sediment and lack of invasive vegetation.

Designer Checklist

If the answer to these questions corresponds to a response box that is red, the BMP should either not be used or additional measures need to be taken to address the issue.

	Yes	No
Is the vegetated strip length greater than or equal to the minimum required length?	☐	☐

Do flows result in a shear stress greater than the maximum permissible for selected vegetation?	☐	☐
Is the vegetated strip providing pretreatment for a downstream BMP?	☐	☐
Is the slope in the direction of flow less than or equal to the jurisdiction's standards?	☐	☐

Vegetation

Refer to *Vegetation Guidance by BMP Type*.

Installation

Vegetated strips can be installed as part of normal construction activities. An appropriate grass such as turf sod should be installed per specifications. If additional vegetation such as shrubs or bushes will be used within the strip, follow landscaping guidance to ensure that vegetation establishes after installation. To maximize infiltration performance, minimize use of heavy machinery.

Additional Guidance

- Require certificates of compliance to verify that construction items meet specification requirements.

Installation Costs

The following cost items are typically associated with bioswale construction.

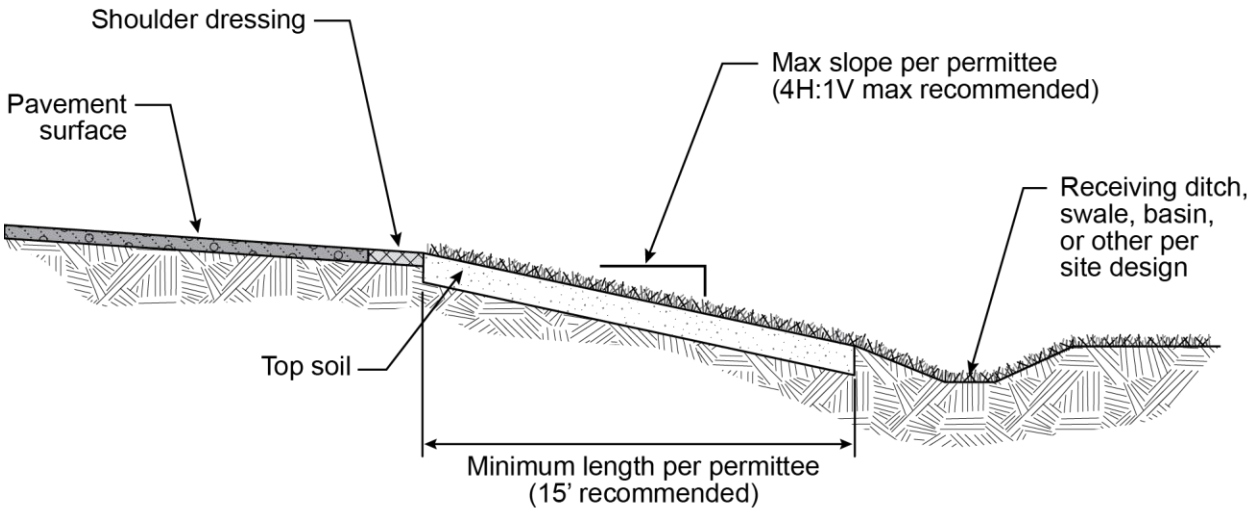
- Grading
- Landscaping and vegetation
- Topsoil
- Engineered soil
- Shoulder dressing upstream of vegetated strip

Maintenance

Refer to *Maintenance* and *Maintenance Costs* in the *Preface to Fact Sheets* for general information related to maintenance of bioretention BMPs.

Maintenance Activities

Inspection	Inspection/Maintenance Frequency	Maintenance Activity	Effort
Inspect upstream end of vegetated strip for sediment buildup that may be impeding sheet flow.	Semiannual (Spring, Fall) or as needed	Remove and dispose of sediment buildup.	Low
Inspect grass length.	As needed	Mow strip as needed.	Low
Inspect for erosion, rilling, and sloughing.	Semiannual (Spring, Fall)	Regrade side slope if slope stability is not affected by sloughing. Notify engineer if stability is affecting basin functionality.	Low
Inspect for adequate vegetative coverage, and impaired or failing vegetation.	Semiannual (Spring, Fall) or as needed	Reseed/replant barren areas. Notify engineer if issue persists.	Low



Notes:

- *Dimensions shown may vary based on site conditions*

Vegetated Strips

Not to scale

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Tree Box Filter

BR-5



Source: Montgomery County, Maryland Department of Environmental Protection

Pollutant Removal Effectiveness

Pollutant	Effectiveness
Sediment	High
Nutrients	Medium
Metals	Medium
Bacteria	High
Oil/Grease	High

Tree box filters are bioretention systems that are appropriate in urban drainage areas where space is limited. An underground concrete vault contains the soil matrix that provides bioretention and has a grated top where vegetation grows. Tree box filters are typically designed as flow-through devices, meaning that they do not retain storm water but rather allow flows to pass through them. However, a bottomless concrete vault will function as a bioretention system that provides infiltration into the native soils. Manufacturers have developed proprietary designs for tree box filters, but they may also be designed.

The primary functions of tree box filters are bioretention and treatment. Runoff from the contributing drainage area enters the tree box through an inlet where bioretention occurs. Storm water is treated by the physical, chemical, and biological processes that occur within the mulch, soil matrix, and plant roots.

Primary Functions	
Bioretention	Yes
Volume Retention	Varies[1]
Biofiltration	Yes

[1]Volume retention may be achieved with a bottomless vault.

Design Criteria

Refer to *Design Criteria* in the *Preface to Fact Sheets* for discussion of design criteria parameters. Tree box filters may be proprietary devices; follow manufacturer specifications to determine design criteria on a case-by-case basis.

Parameter	Min. Value	Max. Value	Notes
Depth to Historical High Groundwater	2 ft	No maximum	May be less than 2 feet if tree box filter has impermeable bottom.
Ponding Depth	No minimum	12 in	-
Drawdown Time	12 hours	72 hours	24 to 48 hours preferred. Drawdown time may also depend on local mosquito abatement regulations.
Design Infiltration Rate	0.25 in/hr	6 in/hr	Field testing required for final design. Infiltration rate should be low enough to allow biofiltration processes to occur. During design, infiltration rate, drawdown time, and the soil matrix depth will be directly related.

Calculation Methods

Tree box filters are typically sized based on their water quality flow but may be sized for their water quality volume when being designed for retention. Both design approaches are dependent on the contributing drainage area and imperviousness. A larger contributing drainage area will require a larger tree box filter.

Tree Box Filter Effectiveness

Tree box filters are effective when they maintain their bioretention and biofiltration capabilities. Proper inspection and maintenance of tree box filters will ensure that the chemical and biological processes that treat runoff perform optimally. Qualified inspection crews are necessary to determine if soils and vegetation are healthy.

The tree box must be able to function hydraulically. Flows must be able to pass through the filter without backing up or maintenance will be required.

Designer Checklist

If the answer to these questions corresponds to a response box that is red, the BMP should either not be used or additional measures need to be taken to address the issue.

	Yes	No
Is there adequate space for a tree box filter?	☐	☐
Is there sufficient hydraulic head for tree box filter to connect to storm drain network?	☐	☐
If retention is desired, will the design infiltration rate permit a reasonable drawdown time?	☐	☐
If retention is desired, is depth to the historical high groundwater from the filter bottom greater than the jurisdiction's minimum separation requirement?	☐	☐

Vegetation

Refer to *Vegetation Guidance by BMP Type*.

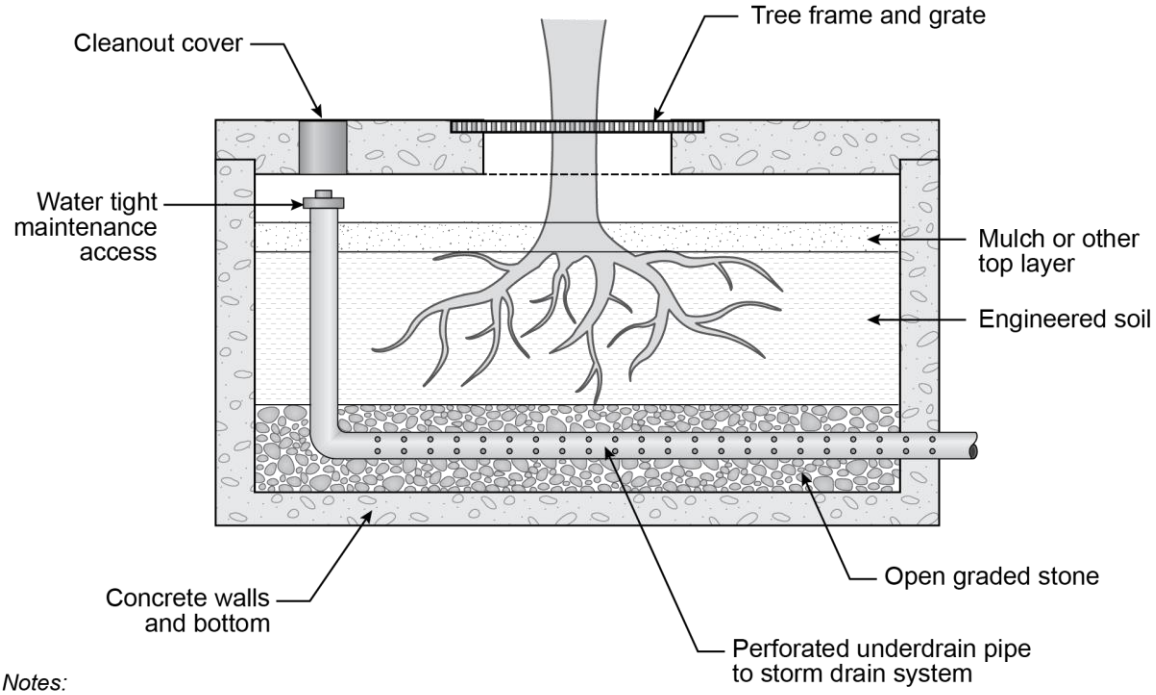
Maintenance

Refer to *Maintenance* and *Maintenance Costs* in the *Preface to Fact Sheets* for general information related to maintenance of bioretention BMPs.

Maintenance Activities

Proper maintenance of tree box filters will be per the manufacturer's specifications, but it typically includes the following:

Inspection	Inspection/Maintenance Frequency	Maintenance Activity	Effort
Inspect for trash and debris within tree box filter and at inlet and outlet structures.	Semiannual (Spring, Fall) or as needed	Remove trash, debris and sediment.	Low
Inspect performance.	Semiannual (Spring, Fall)	Replenish media filter layer with new mulch.	Medium
Inspect for invasive species.	Semiannual (Spring, Fall)	Prune and weed filter box.	Medium



Notes:

- *Dimensions shown may vary based on site conditions*
- *A bottomless design may allow for infiltration*
- *This treatment option may be considered when infiltration is infeasible*

Tree Box Filters

Not to scale

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Green Roof

BR-6



Pollutant Removal Effectiveness

Pollutant	Effectiveness[1]
Sediment	High
Nutrients	Medium[2]
Metals	High
Bacteria	High
Oil/Grease	-

[1]Removal effectiveness is increased for thicker soil layers.
[2]Use of organic matter to establish vegetation may increase nutrient leaching.

A green roof is a vegetated system that is designed to retain and treat rooftop runoff. The primary functions of green roofs are bioretention, volume retention, and filtration. Green roofs capture storm water within the pore space of the soil and vegetation and the moisture is then released through evapotranspiration.

Green roofs can be classified as either extensive or intensive systems. Extensive systems are those in which the soil media is up to 6 inches in depth and support smaller grasses and other vegetative species that do not have deep root systems. Intensive systems are those that support root systems greater than 6 inches such as those from trees and bushes.

The design of green roofs should be done with the coordination of qualified landscaping, structural, and maintenance teams. Vegetation selection and the proper maintenance of vegetation are critical items in the overall performance and functionality of the green roof. The integrity of the roof structure must also be accounted for as large volumes of plants, soils, water, and the weight of the green roof structure will create additional loads on the building.

Primary Functions	
Bioretention	Yes
Volume Retention	Yes
Biofiltration	Yes

Design Criteria

Refer to *Design Criteria* in the *Preface to Fact Sheets* for discussion of design criteria parameters.

Parameter	Extensive	Intensive	Notes
Drawdown Time	12 hours	12 hours	-
Growth Media Depth	< 6 in	6+ in	-
Vegetation	Low growing, low water-use vegetation such as Sedum, herbs, grasses, and perennials	More complex gardens including the species listed for extensive green roofs, but also incorporating trees and shrubs.	-
Load	12-54 lb/sf	72+ lb/sf	-
Roof Slope	5:1 maximum	5:1 maximum	-
Access	Required for maintenance	Required for maintenance	-
Irrigation	Simple irrigation. Only needed during droughts and plant establishment if well designed.	Complex irrigation	-
Drainage	Simple drainage system	Complex drainage system	-

Calculation Methods

Green roof design is governed by the water quality volume; however, special consideration must also be given to vegetation selection and proper installation with the assistance of a landscape architect or other qualified person. Special consideration must also be given to the structural design of the roof, with the assistance of a structural engineer. Neither of those considerations are considered in this discussion of calculation methods. For the purposes of determining if the green roof retains the water quality volume, the general design steps are:

1. Calculate the water quality volume.
2. Determine the porosity of the engineered soil used within the green roof and the retention volume within the soil.
3. Determine the required footprint to retain the water quality volume.

Sample Calculations

Refer to *Calculation Methods* in the *Preface to Fact Sheets* for discussion on the equations used.

An extensive green roof system will be designed for a new building with a roof that is 0.37 acres. The entire roof will drain to the green roof. It was decided that an extensive green roof system with a 6-inch soil matrix will be used. Determine the footprint that will be needed to capture the water quality volume.

Given

Roof area: 0.37 ac

80th percentile storm depth: 0.55 in

Porosity of engineered soil: 0.25

Determine

Determine the footprint of the green roof.

Calculations

The footprint can be determined through iterative calculations. After iterative calculations, it was found that a footprint of 3,405 square feet will capture the water quality volume.

Pervious area (green roof footprint): 3,405 sf (0.078 ac)

Imperviousness of rooftop: 0.79

Volumetric runoff coefficient, R_V (See *Sample Calculations*)

$R_V = 0.91i - 0.0204$ (Reese method)

$R_V = 0.91(0.79) - 0.0204$

$R_V = 0.70$

Water quality volume, WQV (See *Developing the 80th Percentile Volume*)

WQV = (0.70)(0.55 in)(16,117 sf) / (12 in/ft)

WQV = 517 cf

Determine the equivalent storage depth of the engineered soil.

$d_{equivalent}$ = (0.6 in)(0.25)

$d_{equivalent}$ = 1.5 in

Determine the required footprint of the green roof to capture the water quality volume.

Footprint = WQV / $d_{equivalent}$

Footprint = 517 cf / ((1.5 in)/(12 in/ft))

Footprint = 4,121 sf

Green Roof Effectiveness

Green roofs provide an aesthetically pleasing method for retaining and treating storm water runoff. Healthy plants and soils are indications that the green roof is performing as expected. Excessive drainage through the soil layer may be an indication that the soils and vegetation are not retaining runoff; consequently, the evaporation and transpiration processes are not occurring. Qualified horticulturists and/or green roof contractors should be involved in determining the health and effectiveness of the green roof.

Designer Checklist

If the answer to these questions corresponds to a response box that is red, the BMP should either not be used or additional measures need to be taken to address the issue.

	Yes	No
Has a landscape architect been involved in the vegetation selection?	☐	☐
Has a structural engineer been involved in the green roof design?	☐	☐
Are maintenance crews trained and aware of maintenance responsibilities?	☐	☐

Does the green roof provide storage for 100% of the water quality volume? (If no, it may still be appropriate to construct the green roof if it is technically infeasible to capture 100% of the water quality volume.)	☐	☐
Will the green roof partially cover or fully cover the roof?	-	-
Will the green roof be extensive or intensive?	-	-

Vegetation

Refer to *Vegetation Guidance by BMP Type*.

Installation

Green roof installation should be done with proper oversight from qualified environmental or green roof specialists. Any requirements related to working on rooftops should be followed. During construction, vegetation and the growth media should be protected from erosion until vegetation has been established.

Additional Guidance

- Require certificates of compliance to verify that construction items meet specification requirements.

Installation Costs

The following cost items are typically associated with rain garden construction.

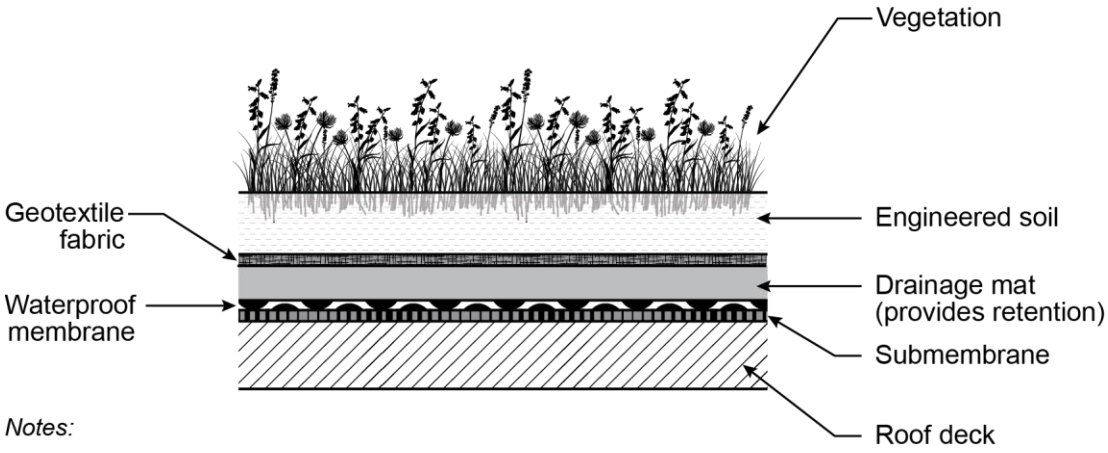
- Vegetation and landscaping expertise
- Horticulturist expertise
- Structural expertise

Maintenance

Refer to *Maintenance* and *Maintenance Costs* in the *Preface to Fact Sheets* for general information related to maintenance of green roofs.

Maintenance Activities

Inspection	Inspection/Maintenance Frequency	Maintenance Activity	Effort
Inspect weed growth.	2-4 weeks during growing season	Remove weeds before they flower.	High
Inspect fertilization.	Annually	Apply fertilizer in accordance with manufacturer recommendations. Avoid hottest/driest parts of the year.	Medium
Inspect water retention.	Semiannual (Spring, Fall) or as needed	If natural precipitation is not adequate for vegetation, water plants.	High



Notes:

- *Dimensions shown may vary based on site conditions*

Green Roof

Not to scale

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Pervious Surfaces

PS-1



Pollutant Removal Effectiveness

Pollutant	Effectiveness[1]
Sediment	High
Nutrients	High
Metals	High
Bacteria	High
Oil/Grease	High

[1]Pollutant removal may occur in the pervious surface or the subsurface.

Pervious surfaces such as permeable pavement, concrete pavers, pervious concrete, modular open pavers, and other types of pervious surfaces provide structural support for light vehicle or pedestrian traffic while also providing open space for storm water infiltration.

The primary function of pervious surfaces is volume retention, but some filtration is possible depending on the type of paver and subsurface selected. A modular open paver that, when installed, provides a certain percentage of pervious area in the form of grass, will allow for filtration processes to occur. Another source of filtration is the choker layer directly beneath the pervious surface.

The subsections beneath the pervious surface are typically a choker layer composed of small gravel and a storage layer of larger rock beneath. Underdrains may be required if existing soils do not adequately infiltrate.

Primary Functions	
Bioretention	Yes[1]
Volume Retention	Yes
Biofiltration	Some

[1]Bioretention occurs in the subsurface and not within the pervious surface.

Design Criteria

Refer to *Design Criteria* in the *Preface to Fact Sheets* for discussion of design criteria parameters.

Parameter	Min. Value	Max. Value	Notes
Drain Time	12 hours	72 hours	-
Design Infiltration Rate	0.25 in/hr	6 in/hr	Field testing required for final design.
Depth to Historical High Groundwater	2 ft	No maximum	-

Calculation Methods

Pervious surface design is governed by the water quality volume. The general design steps are:

1. Calculate the water quality volume.
2. Determine the required thickness of the subsection layers given their porosity and the footprint of the pervious surface area.

Sample Calculations

Refer to *Calculation Methods* in the *Preface to Fact Sheets* for discussion on the equations used.

A development in the planning phase will have a 0.90-acre parking lot. It is proposed that the parking lot be graded so that runoff is conveyed towards stalls that will be constructed with permeable asphalt.

Given

Contributing drainage area: 0.90 ac

Imperviousness: 0.95

80th percentile storm event: 0.48 in

Design infiltration rate: 0.5 in/hr

Design Goals

Determine an acceptable area size and depth of the permeable asphalt section.

Calculations

Volumetric runoff coefficient, R_V (See *Sample Calculations*)

$R_V = 1.14i - 0.371$ (Granato method when i ≥ 0.55)

$R_V = 1.14(0.95) - 0.371$

$R_V = 0.71$

Water quality volume, WQV (See *Developing the 80th Percentile Volume*)

WQV = (0.71)(0.48 in)(0.90 ac)(43,560 sf/ac) / (12 in/ft)

WQV = 1,113 cf

A permeable asphalt area that is 15 ft x 140 ft (2,100 sf) with the following properties will retain the water quality volume and will have an acceptable drawdown time. See *Storage volume within a media with a known porosity* for guidance on determining storage within soils.

Layer	Thickness, in	Porosity	Storage Volume, cf
Permeable Asphalt	4	0.2	140
Choker Layer	4	0.4	280
Aggregate Storage	10	0.4	700
Total	18	0.36 (weighted)	1120

Drawdown time, t

t = Equivalent storage depth / Design infiltration rate

Weighted porosity, n_W = 0.36

Equivalent storage depth = (18 in)(0.37)

Equivalent storage depth = 6.4 in

t = (6.4 in) / (0.5 in/hr)

t = 12.80 hrs

Pervious Surface Effectiveness

Pervious surfaces are effective when runoff from the design storm depth can enter the porous spaces of the pervious surface and successfully infiltrate into the native soil or drain through an underdrain system. Visual inspection of the pervious surface can reveal reasons for failure: for example, sediment-laden sheet flows that are conveyed to the pervious surface, or a down drain might be introducing organic material. Both scenarios are likely to contribute to clogging within the porous spaces of the pervious surface or within the sublayers.

Designer Checklist

If the answer to these questions corresponds to a response box that is red, the BMP should either not be used or additional measures need to be taken to address the issue.

	Yes	No
Will an underdrain system be required?	☐	☐
If an underdrain is needed, is there sufficient head for the underdrain system to drain?	☐	☐
Has the proposed pervious surface performed successfully in similar climate conditions?	☐	☐

Installation

Excavation

Pervious surfaces will fail if proper care is not taken during excavation and construction. Excavators and heavy machinery should not be used if infiltration is expected to occur through the underlying soils beneath the pervious surface's subsection.

Activities During Construction

Avoid using heavy machinery on the revealed soil during construction. Crews should avoid unnecessarily walking on the underlying soils when possible. Compaction of native soils or backfill below the pervious surface subsoils is acceptable if doing so does not prevent infiltration from occurring.

Flows During Construction

Flows during construction should be diverted away from the exposed underlying soil to prevent erosion. Scheduling installation of the pervious surface within a short time span after excavation will minimize the impact of unnecessary storm water flows from entering the excavated area. The introduction of unwanted sediment and storm water flows can be prevented by placing fiber rolls or silt fences around the excavated perimeter during construction.

Additional Guidance

- Require certificates of compliance to verify that construction items meet specification requirements.

Installation Costs

The following cost items are typically associated with construction of pervious surfaces.

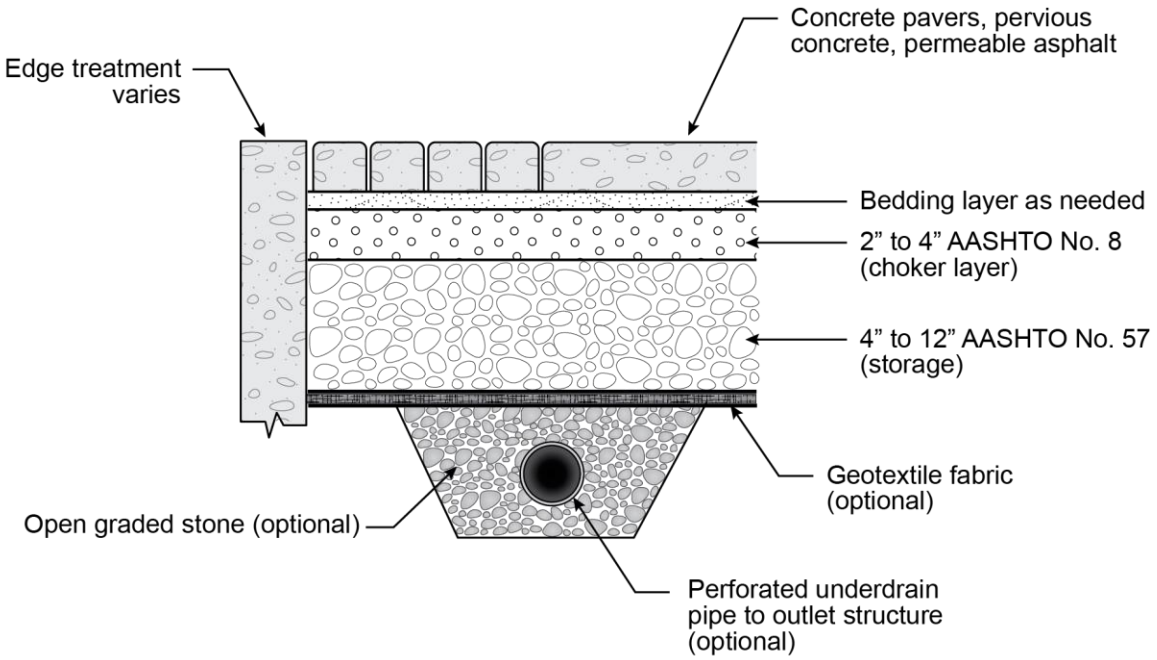
- Excavation
- Grading
- Fine grading
- Pervious surface
- Top layer
- Engineered soil
- Choker layer
- Open graded stone
- Geotextile fabric
- Impermeable liner
- Observation wells (if needed)
- Underdrain system (if needed)

Maintenance

Refer to *Maintenance* and *Maintenance Costs* in the *Preface to Fact Sheets* for general information related to maintenance of pervious surfaces.

Maintenance Activities

Inspection	Inspection/Maintenance Frequency	Maintenance Activity	Effort
Inspect for sediment accumulation.	Semiannual (Spring, Fall)	Use vacuum sweeper followed by pressure washing.	Medium
Inspect for weed growth.	Semiannual (Spring, Fall)	Remove weeds.	LOW
Inspect for standing water on surface or within observation well (if used).	Semiannual (Spring, Fall)	Notify engineer for further inspection.	LOW
Inspect surface for deterioration.	Annual	Notify engineer for further inspection.	LOW
Inspect exfiltration and drainage performance.	As needed, at least annually	Notify engineer for further inspection.	Medium



Notes:

- *Optional items shown for use of underdrain*
- *Dimensions shown may vary based on site conditions*
- *Use of underdrain system may be considered when infiltration is infeasible*

Pervious Surfaces

Not to scale

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Infiltration Basin

ID-1



Pollutant Removal Effectiveness

Pollutant	Effectiveness
Sediment	High
Nutrients	High
Metals	High
Bacteria	High
Oil/Grease	High

Infiltration basins are shallow depressions that use existing soils to retain and provide treatment for storm water runoff. Infiltration basins function by capturing and infiltrating runoff over a specified drawdown time.

The primary functions of infiltration basins are bioretention, volume retention, and filtration. The existing soils remove pollutants through physical, chemical, and biological processes before the storm water reaches the groundwater. Filtration occurs as runoff interacts with grass and other vegetation within the basin and as runoff infiltrates through the soil.

Infiltration basins are typically designed for larger drainage areas where it may be impractical for a BMP such as a bioretention area that requires more maintenance of specialized vegetation over a larger area.

Primary Functions	
Bioretention	Yes
Volume Retention	Yes
Biofiltration	Yes

Pretreatment of runoff may take place in a forebay that will allow for particulate settling. Forebays are typically sized for a percentage of the water quality volume; typically ranging from 10% to 25%.

Design Criteria

Refer to *Design Criteria* in the *Preface to Fact Sheets* for discussion of design criteria parameters.

Parameter	Min. Value	Max. Value	Notes
Water Quality Volume	0.1 ac-ft (4356 cf)	No maximum	-
Freeboard	1 ft		-
Overflow Spillway Length	3 ft spillway length		-
Invert Slope	0% (flat basin bottom)		-
Interior Side Slopes	No minimum	3H:1V	-
Drawdown Time	24 hours	72 hours	48 hours recommended
Design Infiltration Rate	0.25 in/hr	6 in/hr	Field testing required for final design.
Depth to Historical High Groundwater	2 ft	No maximum	-

Calculation Methods

Infiltration basin design is governed by the water quality volume. The general design steps are:

1. Calculate the water quality volume.
2. Determine the geometry of the infiltration basin.
3. Based on the basin geometry, determine the ponding depth required to hold the water quality volume.
4. Calculate the drawdown time.

Calculate the water quality outlet elevation.

Sample Calculations

Refer to *Calculation Methods* in the *Preface to Fact Sheets* for discussion on the equations used.

A 13.50-acre highway development routes all of its storm water to a single infiltration basin. A safety factor of 1.50 is required for infiltration design within the jurisdiction. Adjacent soils are 'A' and are part of the drainage area.

Given

Contributing drainage area: 13.50 ac

Imperviousness: 0.65

80th percentile storm depth: 0.50 in

Soil infiltration rate: 1.35 in/hr

Design Goals

Determine the bottom footprint of the infiltration basin and the elevation of the water quality outlet above the basin bottom.

Calculations

Volumetric runoff coefficient, R_V (See *Sample Calculations*)

$R_{V\text{-}A} = 0.84i^{1.302}$ (R_V based on hydrologic soil group)

$R_{V\text{-}A} = 0.84(0.65)^{1.302}$

$R_V = 0.48$

Water quality volume, WQV (See *Developing the 80th Percentile Volume*)

WQV = (0.48)(0.50 in)(13.50 ac)(43,560 sf/ac) / (12 in/ft)

WQV = 11,761 cf

Minimum footprint, A_{min} (See *Minimum footprint area*)

A_{min} = (12)(1.50)(11,761 cf) / (1.35 in/hr)(48 hrs)

A_{min} = 3,267 sf

The water quality volume will infiltrate into the existing soil in 48 hours if the infiltration basin bottom is 3,267 square feet. However, this does not mean that the infiltration basin bottom is limited to 3,267 square feet.

Water quality elevation, Ele_{WQ}

The elevation of a water quality outlet above the basin bottom is determined by assuming that infiltration occurs only through the bottom of the basin and not through the sides.

$Ele_{WQ} = WQV / A_{min}$

Ele_{WQ} = 11,761 cf / 3,267 sf

Ele_{WQ} = 2.94 ft

Infiltration Basin Effectiveness

Effective infiltration basins take advantage of open spaces for retaining and treating storm water. Established vegetation with adequate coverage is an indication of a healthy infiltration basin along with minimal sediment and lack of invasive vegetation. Side slopes should be stable and show little to no signs of erosion or rilling. Slope sloughing is an indication that geotechnical remediation is needed.

During the design storm event, infiltration basins should, at most, pond up to the water quality outlet. After the rain event, runoff within the basin should infiltrate through the bottom soils within the design drawdown time.

Designer Checklist

If the answer to these questions corresponds to a response box that is red, the BMP should either not be used or additional measures need to be taken to address the issue.

	Yes	No
Does groundwater meet the jurisdiction's minimum separation requirement?	☐	☐
Is there available right-of-way, property, or easement for the infiltration basin?	☐	☐
Is contaminated groundwater present at the infiltration basin location?	☐	☐
Is the water quality volume above the 4,356 cf threshold?	☐	☐

Does the infiltration basin provide storage for 100% of the water quality volume? (If no, it may still be appropriate to construct the infiltration basin if it is technically infeasible to capture 100% of the water quality volume.)	☐	☐
Do utility conflicts make installation of the infiltration basin technically infeasible?	☐	☐
Do geotechnical conditions exist that compromise the stability of the infiltration basin or surrounding structures?	☐	☐
Does an overflow outlet structure or bypass mechanism exist?	☐	☐
Is a fence required?	☐	☐

Vegetation

Refer to *Vegetation Guidance by BMP Type*.

Installation

Excavation

Installation of infiltration basins is a relatively straightforward process of excavation and grading; however, the basin will fail if proper care is not taken during construction. Excavators and heavy machinery should not be used within the basin area to avoid soil compaction.

Activities During Construction

Avoid using heavy machinery within the infiltration basin footprint during construction as doing so will compact the soils and diminish their infiltrating capabilities. Installation of an outlet structure may require machinery.

Flows During Construction

Flows during construction should be diverted away from the infiltration basin to prevent construction site sediment from clogging soils. Seeding or laying turf sod should occur within a short time span after excavation to minimize the impact of unnecessary storm water flows from entering the basin area. The introduction of unwanted sediment can be prevented by placing fiber rolls or silt fences around the basin perimeter during construction.

Additional Guidance

- Require certificates of compliance to verify that construction items meet specification requirements.
- Follow landscaping guidance to ensure that vegetation establishes after installation.

Installation Costs

The following cost items are typically associated with infiltration basin construction.

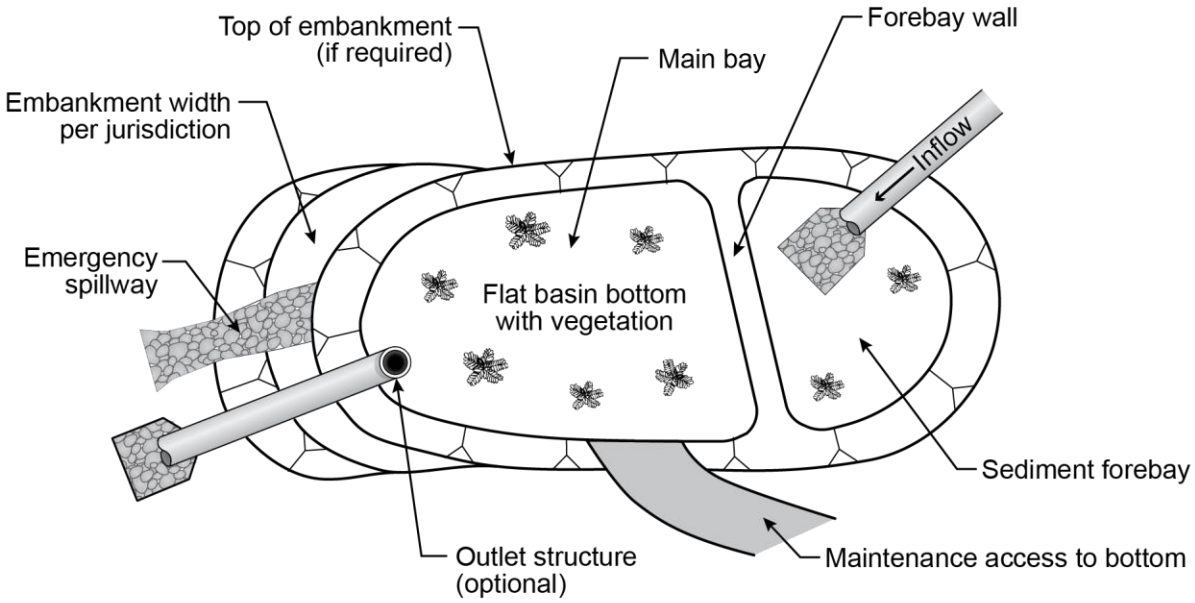
- Excavation
- Grading
- Outlet structure or upstream bypass structure (for larger storm events)
- Forebay and associated items: outlet protection, forebay wall, and connection between forebay and main bay.

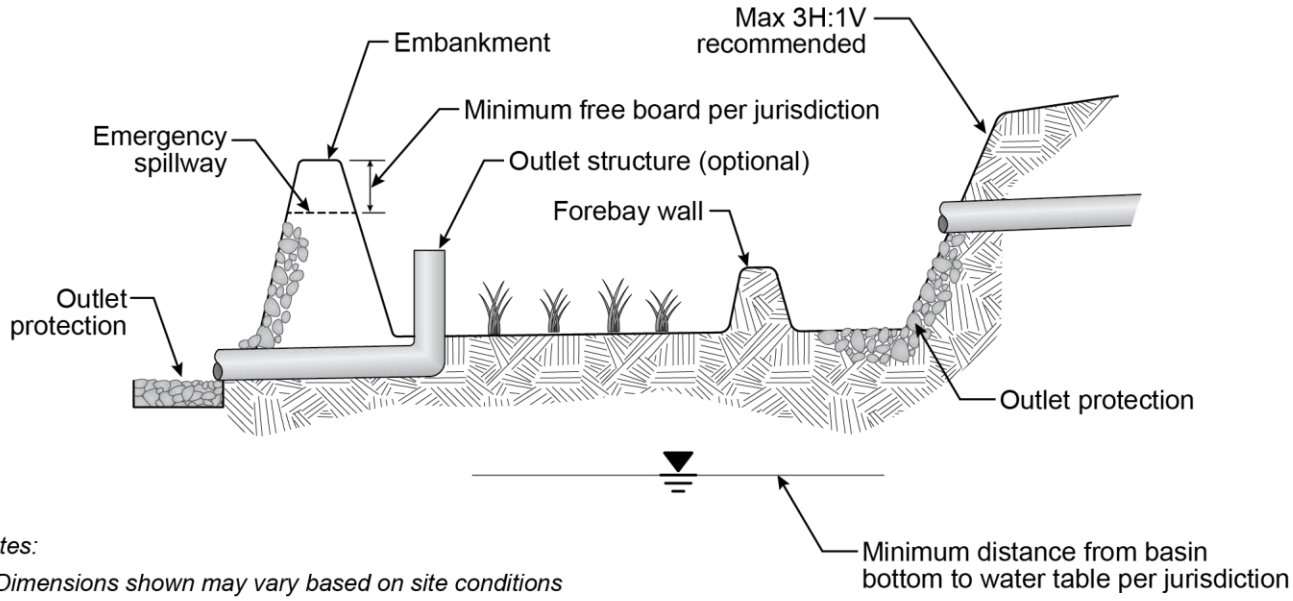
Maintenance

Refer to *Maintenance* and *Maintenance Costs* in the *Preface to Fact Sheets* for general information related to maintenance of infiltration BMPs.

Maintenance Activities

Inspection	Inspection/Maintenance Frequency	Maintenance Activity	Effort
Inspect for trash and debris at inlet and outlet structures.	Semiannual (Spring, Fall) or as needed	Remove and dispose of trash and debris.	LOW
Inspect grass length.	As needed	Mow basin grass.	LOW
Inspect pre-treatment diversion structures for sediment build-up.	Semiannual (Spring, Fall)	Remove and dispose of sediment buildup.	LOW
Inspect topsoil for sediment buildup.	Semiannual (Spring, Fall) or as needed	Remove sediment.	LOW
Inspect for standing water above trench or within observation well (if used).	Semiannual (Spring, Fall)	Notify engineer for further inspection.	LOW





Notes:

- *Dimensions shown may vary based on site conditions*
- *Forebay connection type to main bay will vary: outlet pipe, gabion wall, notched concrete wall, and others are acceptable*
- *Consider upstream bypass for large storm events*

Infiltration Basin

Not to scale

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Infiltration Trench

ID-2



Source: NHDES Soak Up the Rain

Pollutant Removal Effectiveness

Pollutant	Effectiveness
Sediment	High
Nutrients	High
Metals	High
Bacteria	High
Oil/Grease	High

Infiltration trenches are linear excavations that are backfilled with a combination of gravel, open graded stone, and sand layers that provide storage within the pore space of the specified layers. Although typically linear, infiltration trenches can be any shape provided that the footprint and depth are sized to retain the water quality volume.

The primary function of infiltration trenches is volume retention. The trench is designed such that the water quality volume is retained and stored within the gravel and sand layers. Depending on the design of the trench, pollutant removal occurs via filtration as runoff passes through an initial pea gravel layer and ultimately through the bottom sand layer. A geotextile fabric is also recommended along the sidewalls of the trench and under the pea gravel layer.

Primary Functions	
Bioretention	Yes[1]
Volume Retention	Yes
Biofiltration	Some

[1]Bioretention occurs in subsurface and not within the trench.

Design Criteria

Refer to *Design Criteria* in the *Preface to Fact Sheets* for discussion of design criteria parameters.

Parameter	Min. Value	Max. Value	Notes
Depth of Trench	2 ft	No maximum	Maximum depth determined by jurisdiction.
Longitudinal Trench Slope	0%	1%	-
Width	2 ft	No maximum	-
Drawdown Time	12 hours	72 hours	-
Design Infiltration Rate	0.25 in/hr	6 in/hr	Field testing required for final design.
Depth to Historical High Groundwater	2 ft	No maximum	-

Calculation Methods

Infiltration trench design is governed by the water quality volume. The general design steps are:

1. Calculate the water quality volume.
2. Determine the trench footprint.
3. Based on the trench geometry, porosity of the trench layers, and ponding depth (if any), determine the trench depth.
4. Calculate the drawdown time.

Sample Calculations

Refer to *Calculation Methods* in the *Preface to Fact Sheets* for discussion on the equations used.

A proposed park will have a concrete plaza that is 0.40 acres. Runoff from the plaza will flow towards a pervious area. To meet the jurisdiction's retention requirement, the design team proposes to install an infiltration trench adjacent to the plaza.

Given

Contributing drainage area: 0.40 ac

Imperviousness: 1.00

80th percentile storm depth: 0.65 in

Design Goals

Determine that the geometry of an infiltration trench that will retain the water quality volume.

Calculations

Volumetric runoff coefficient, R_V (See *Sample Calculations*)

$R_V = 0.91i - 0.0204$ (Reese method)

$R_V = 0.91(1.0) - 0.0204$

$R_V = 0.89$

Water quality volume, WQV (See *Developing the 80th Percentile Volume*)

WQV = (0.89)(0.70 in)(0.40 ac)(43,560 sf/ac) / (12 in/ft)

WQV = 840 cf

There are 100 linear feet adjacent to the plaza that are available for the infiltration trench. Based on the grading at the trench, ponding above the trench will not occur. A trench that is 4.5 ft wide with the following properties will be able to retain the water quality volume. See *Storage volume within a media with a known porosity* for guidance on determining storage within soils.

Layer	Thickness, in	Porosity	Storage Volume, cf
Pea Gravel	4	0.25	37.5
Open Graded Stone	52	0.4	780
Sand Layer	6	0.15	33.8
Total	66	0.37 (weighted)	851

The equivalent storage depth of the water quality volume within the 4,500-sf infiltration trench is:

d = 851 cf / 4,500 sf

d = 1.9 ft

d = 23 in

Drawdown time, t

The infiltration rate of the surrounding soils is 1.5 in/hr.

t = Equivalent storage depth / infiltration rate

t = 23 in / 1.5 in/hr

t = 15 hrs

Infiltration Trench Effectiveness

Effective infiltration trenches take advantage of limited or narrow spaces where bioretention areas or infiltration basins are impractical. Visible sediment buildup on the top layer of the trench could be an indication that clogging is present within the trench or that runoff is simply passing over the trench and not being captured. Although some vegetation intrusion or organic debris is likely not a concern, proper grooming and maintenance will contribute to a trench's extended life-span.

During the design storm event, runoff should be conveyed toward and enter the trench per the design plans. Recent new construction, regrading, or resurfacing within the contributing drainage area should be noted as it may impact flow paths or the introduction of new pollutants.

Designer Checklist

If the answer to these questions corresponds to a response box that is red, the BMP should either not be used or additional measures need to be taken to address the issue.

	Yes	No
Does groundwater meet the jurisdiction's minimum separation requirement?	☐	☐
Is the infiltration rate of the existing soils within acceptable rates?	☐	☐
Is contaminated groundwater present at the infiltration trench location?	☐	☐
Do utility conflicts make installation of the infiltration trench technically infeasible?	☐	☐
Do geotechnical conditions exist that compromise the stability of the infiltration trench or surrounding structures?	☐	☐
Does the infiltration trench provide storage for 100% of the water quality volume? (If no, it may still be appropriate to construct the infiltration trench if it is technically infeasible to capture 100% of the water quality volume.)	☐	☐
Does an overflow outlet structure or bypass mechanism exist, if needed?	☐	☐

Vegetation

Vegetation is not typical for an infiltration trench.

Installation

Excavation

Excavation for infiltration trenches is typically linear but alternate geometries are possible. During excavation, light machinery should be used to avoid excessive compaction.

Activities During Construction

Avoid using heavy machinery within the infiltration trench footprint during construction as doing so will compact the soils and diminish their infiltrating capabilities.

Flows During Construction

Flows during construction should be diverted away from the infiltration trench to prevent construction site sediment from clogging soils. The introduction of unwanted sediment can be prevented by placing fiber rolls or silt fences around the trench perimeter during construction.

Additional Guidance

- Require certificates of compliance to verify that construction items meet specification requirements.

Installation Costs

The following cost items are typically associated with infiltration trench construction.

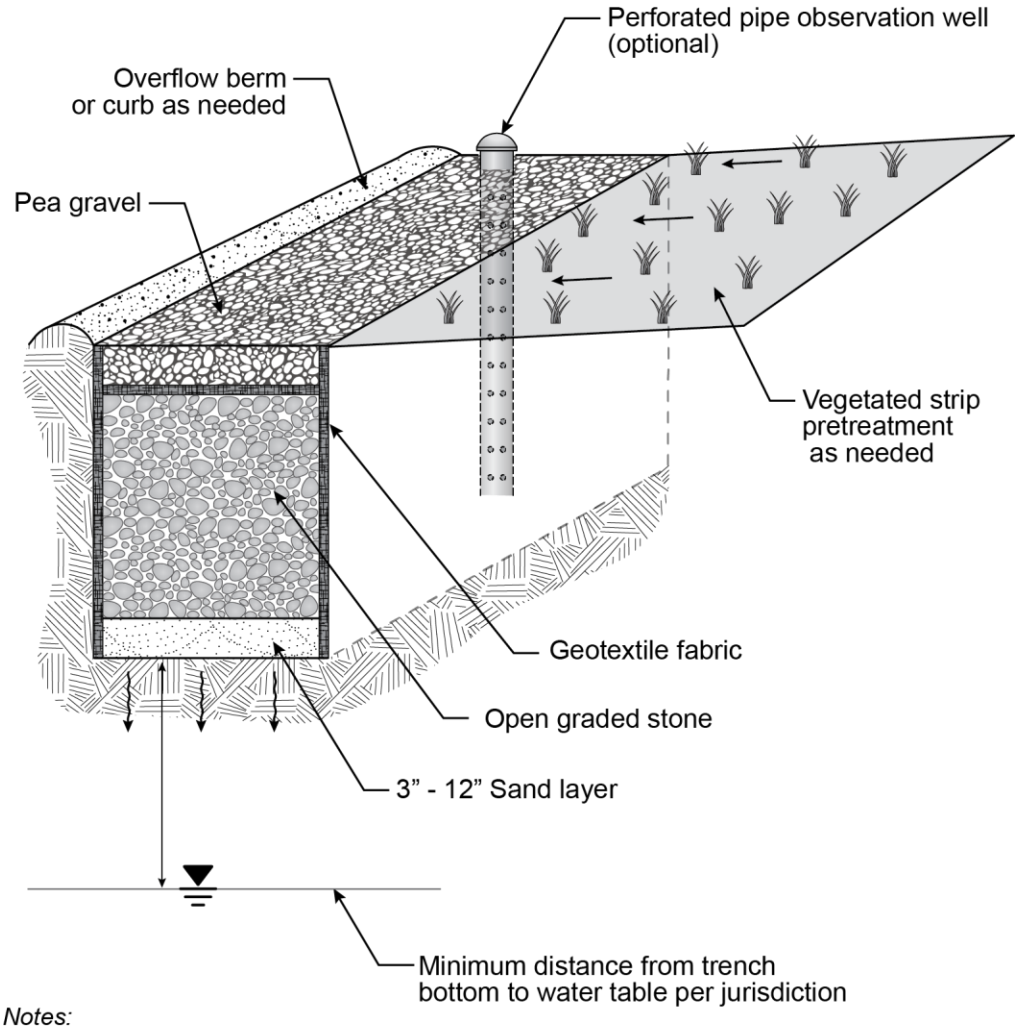
- Excavation
- Landscaping and vegetation
- Pea gravel
- Open graded stone
- Sand layer
- Geotextile separator

Maintenance

Refer to *Maintenance* and *Maintenance Costs* in the *Preface to Fact Sheets* for general information related to maintenance of infiltration BMPs.

Maintenance Activities

Inspection	Inspection/Maintenance Frequency	Maintenance Activity	Effort
Inspect for trash and debris at inlet and outlet structures.	Semiannual (Spring, Fall) or as needed	Remove and dispose of trash and debris.	LOW
Inspect grass length, if any, on top of trench.	As needed	Mow trench grass.	LOW
Inspect pre-treatment diversion structures for sediment buildup.	Semiannual (Spring, Fall) or as needed	Remove and dispose of sediment build up.	LOW
Inspect tree growth near trench.	Semiannual (Spring, Fall)	Remove trees in vicinity of the trench.	LOW
Inspect for standing water above trench or within observation well.	Semiannual (Spring, Fall)	Notify engineer for further inspection.	LOW



Notes:

- *Dimensions shown may vary based on site conditions*

Infiltration Trench

Not to scale

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Dry Well

ID-3



Pollutant Removal Effectiveness

Pollutant	Effectiveness
Sediment	High
Nutrients	High
Metals	High
Bacteria	High
Oil/Grease	High

Dry wells are underground storage areas that are sized to retain the water quality volume and infiltrate runoff into the existing soils.

The primary functions of dry wells are bioretention and volume retention. Bioretention does not occur within the dry well but occurs in the native soils immediately surrounding the dry well.

Dry wells contribute to aquifer recharge and as such classify as a subclass of Underground Injection Control (UIC) Class V wells. Refer to the DWQ website on storm water drainage wells (link below) for more information relating to the UIC Program.

Primary Functions	
Bioretention	Yes
Volume Retention	Yes
Biofiltration	No

Storm Water Drainage Wells: https://deq.utah.gov/legacy/programs/water-quality/utah-underground-injection-control/drainage-wells/index.htm

Design Criteria

Refer to *Design Criteria* in the *Preface to Fact Sheets* for discussion of design criteria parameters.

Parameter	Min. Value	Max. Value	Notes
Depth to Historical High Groundwater	2 ft	No maximum	-
Drawdown Time	24 hours	72 hours	-
Building Setback	10 ft	No maximum	-
Design Infiltration Rate	0.25 in/hr	6 in/hr	Field testing required for final design.

Calculation Methods

Dry well design is governed by the water quality volume. The general design steps are:

1. Calculate the water quality volume.
2. Determine the dry well geometry.
3. Determine the drawdown time.

Sample Calculations

Refer to *Calculation Methods* in the *Preface to Fact Sheets* for discussion on the equations used.

A drywell is proposed at the downstream end of a swale that is being proposed adjacent to a new road.

Given

Contributing drainage area: 0.72 ac

Imperviousness: 0.40

80th percentile storm depth: 0.54 in

Infiltration rate of surrounding soil: 3 in/hr

Design Goals

Determine the dry well geometry required to hold the water quality volume.

Calculations

Volumetric runoff coefficient, R_V (See *Sample Calculations*)

$R_V = 0.225i + 0.05$ (Granato method when $i < 0.55$)

$R_V = 0.225(0.40) + 0.05$

$R_V = 0.14$

Water quality volume, WQV (See *Developing the 80th Percentile Volume*)

WQV = (0.14)(0.54 in)(0.72 ac)(43,560 sf/ac) / (12 in/ft)

WQV = 198 cf

A dry well that has a 6 ft diameter and is 7 ft deep will hold 198 cf.

For a conservative estimate at the planning stage, the dry well's drawdown time is based on the infiltration rate of the surrounding soil and ignores the effects of the pressure head within the dry well. A more detailed determination of the drawdown should be done for final design.

Drawdown time, t

t = Dry well depth / infiltration rate

t = (7 ft)(12 in/ft) / 3 in/hr

t = 28 hrs

Dry Well Effectiveness

Effective dry wells optimize infiltrating soils within limited space to retain storm water runoff while not introducing stability concerns to nearby development or structures. The design storm volume within a functioning dry well will drawdown within the design time and leave no standing water inside of the well. Pretreatment should be provided prior to entering the dry well and the pretreatment method should be determined based on the expected pollutants. Entry to the dry well should be unobstructed and free of debris that will restrict flows from entering.

Designer Checklist

If the answer to these questions corresponds to a response box that is red, the BMP should either not be used or additional measures need to be taken to address the issue.

	Yes	No
Does groundwater meet the jurisdiction's minimum separation requirement?	☐	☐
Is the infiltration rate of the existing soils within acceptable rates?	☐	☐
Is contaminated groundwater present at the dry well location?	☐	☐
Do utility conflicts make installation of the dry well technically infeasible?	☐	☐
Do geotechnical conditions exist that compromise the stability of the dry well or surrounding structures?	☐	☐
Is pretreatment provided upstream of or within the dry well?	☐	☐

Installation

Excavation

Excavate area in which dry well will be placed.

Activities During Construction

Take proper safety measures to cover the excavated dry well area before putting the dry well in place. If the dry well is designed to infiltrate through the well bottom, place and level gravel within the excavation to provide a foundation for the well structure.

Flows During Construction

Flows during construction can enter the dry well if the grated manhole lid contains a filtering material.

Additional Guidance

- Require certificates of compliance to verify that construction items meet specification requirements.
- Obtain a permit through the UIC Program

Installation Costs

The following cost items are typically associated with dry well construction.

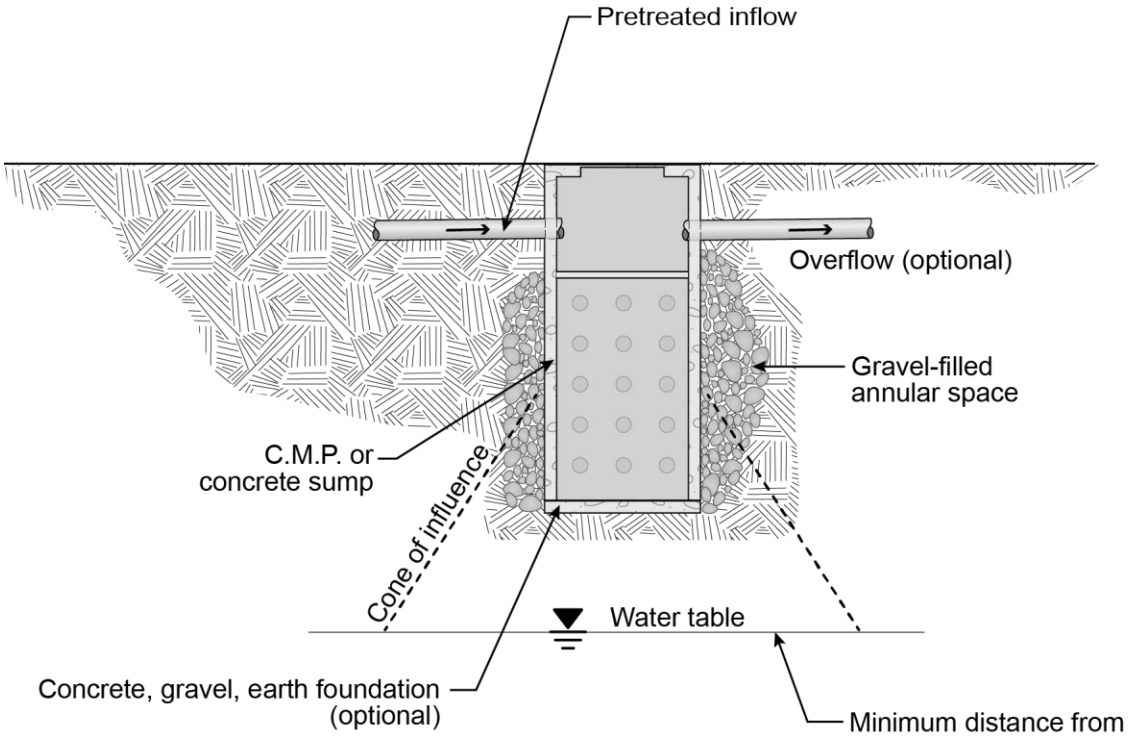
- Excavation
- Dry well
- Permit application fees for Class V Injection Wells
- Gravel-filled annular space surrounding dry well
- Pretreatment upstream of dry well
- Overflow connection to downstream system
- Gravel foundation (optional)

Maintenance

Refer to *Maintenance* and *Maintenance Costs* in the *Preface to Fact Sheets* for general information related to maintenance of dry wells.

Maintenance Activities

Inspection	Inspection/Maintenance Frequency	Maintenance Activity	Effort
Inspect water depth.	Initially after every major storm, then annually.	Remove and dispose of built up sediment when buildup causes reduction in detention capacity. Notify the engineer.	Medium
Inspect inlet for obstructions.	Semiannual (Spring, Fall) or as needed	Remove obstructions.	LOW
Inspect structural elements.	As determined by jurisdiction.	Repair or reconstruct deficient structural components.	Medium



Notes:

- *Dimensions shown may vary based on site conditions*

Dry Well

Not to scale

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Underground Infiltration Galleries ID-4



Source: StormTech

Pollutant Removal Effectiveness

Pollutant	Effectiveness
Sediment	High
Nutrients	High
Metals	High
Bacteria	High
Oil/Grease	High

Underground storage devices are proprietary alternatives to above ground storage when space at the project site is limited. They may be sized for the 80th percentile volume similar to how they are sized for flood control volumes. When underground storage is used for water quality, its primary functions are bioretention as runoff infiltrates into the underlying soil and volume retention. They are constrained by subsurface conditions such as depth to the historical high groundwater, soil infiltration rates, and other site-specific constraints that prevent infiltration. Designing underground storage devices is done with the assistance of the device manufacturer.

Primary Functions	
Bioretention	Yes
Volume Retention	Yes
Biofiltration	No

Pretreatment for underground systems will vary. Pretreatment removes sediment that will potentially clog elements of the underground system such as geotextile fabrics or bedding layers. If the manufacturer does not include a pretreatment system as part of the device, it may be necessary to design a separate pretreatment system such as a settling basin upstream before entering the underground system.

Underground systems are typically modular and allow for configurations that range from large areas such as would be needed underneath a parking lot to linear installations like within a park strip or underneath a bioswale.

Design Criteria

Underground storage devices are proprietary devices; follow manufacturer specifications to determine design criteria on a case-by-case basis.

Calculation Methods

Underground storage device design is governed by the water quality volume (when sizing for the water quality event). It is not uncommon for manufacturers to provide sizing tools based on the desired storage volume. The general design steps are:

1. Calculate the water quality volume.
2. Determine manufacturer's recommendations given the water quality volume and other site conditions.

Underground Infiltration Effectiveness

With regular maintenance and inspection, it can be determined if the underground system is performing as expected. As part of the design process, determine how the system will be inspected. Possible inspection methods include the use of observation wells or structural vaults at tie-in locations with the site's storm drain network. Inspect for any soil displacement or movement at the perimeter of the system and any depressions above the system.

Designer Checklist

If the answer to these questions corresponds to a response box that is red, the BMP should either not be used or additional measures need to be taken to address the issue.

	Yes	No
Does groundwater meet the jurisdiction's minimum separation requirement?	☐	☐
Is the infiltration rate of the existing soils within acceptable rates?	☐	☐
Is contaminated groundwater present?	☐	☐
Do utility conflicts exist that make installation of the device technically infeasible?	☐	☐
Do geotechnical conditions exist that compromise the stability of the device or surrounding structures?	☐	☐
Is pretreatment provided upstream of or within the underground storage device?	☐	☐
Is the soil bearing capacity of the underlying soil sufficient for the system?	☐	☐
Will the underground system support the expected loads above it?	☐	☐

Installation

Excavation
Excavate the footprint of the underground system.

Activities During Construction

Avoid using heavy machinery within the excavated footprint during construction as doing so will compact the soils and diminish their infiltrating capabilities. Avoid using heavy machinery on top of the underground system as well. Follow all installation guidelines from the manufacturer.

Flows During Construction

Flows during construction should be diverted away from the excavated area to prevent construction site sediment from clogging soils.

Additional Guidance

- Follow all manufacturer's requirements.

Installation Costs

The following cost items are typically associated with installation of underground storage systems.

- Excavation
- Geotextile fabric
- Underground storage devices
- Aggregate (bedding, overlay, other as needed)
- Observation wells
- Pretreatment upstream of system (if not provided)

Maintenance

Underground systems are typically designed with accessible pretreatment areas such as a manhole. Refer to manufacturer's guidelines.

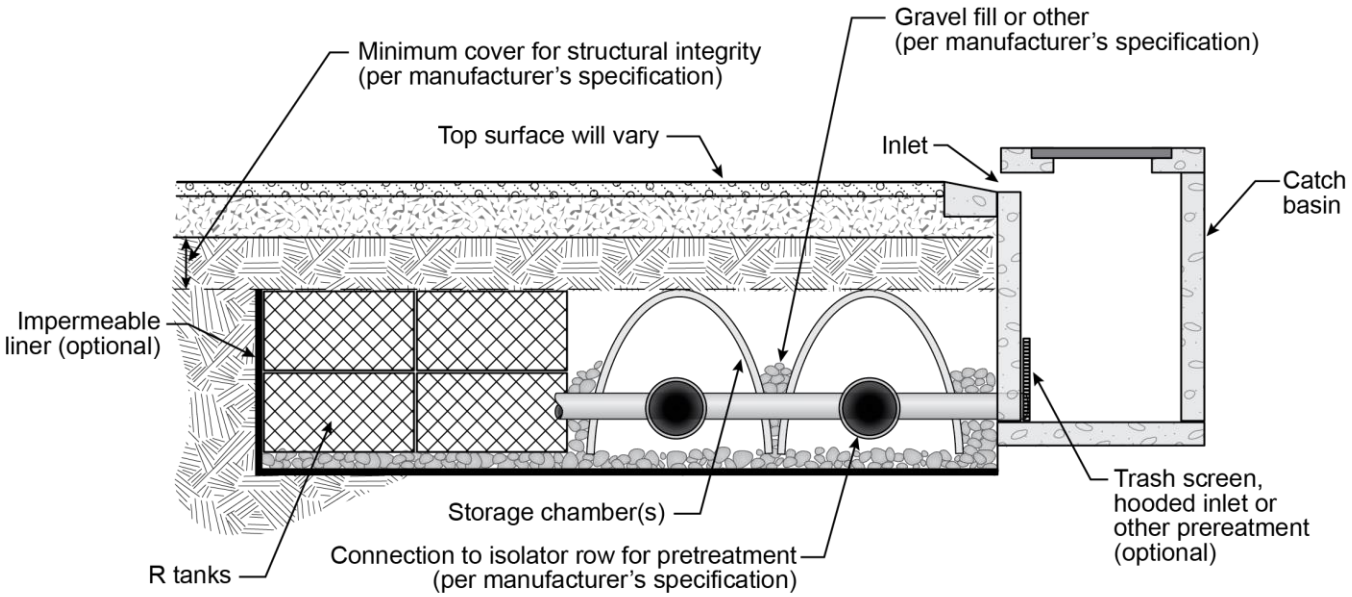
Maintenance Activities

Typical maintenance activity includes removal of sediment or debris within the pretreatment area. High pressure washing of geotextile fabrics or replacement of filter fabrics may also be needed. Refer to manufacturer's guidelines for specific activities and frequency of inspections.

Manufacturers

The following table of manufacturers is for reference only and does not constitute an endorsement.

Manufacturer	Device Type(s)	URL
StormTech	Chambers	http://www.stormtech.com/
ACF Environmental	Chambers R Tanks	https://www.acfenvironmental.com
ConTech	Chambers	https://www.conteches.com



Notes:

- *Configurations will vary*
- *Impermeable liner around undergroundsystem if groundwater concerns exist*
- *If impermeable liner is used, provide outlet to prevent standing water*

Underground Infiltration Gallery

Not to scale

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WATER QUALITY

Harvest and Reuse *HR-1*



Pollutant Removal Effectiveness

Pollutant removal will vary based on the ultimate use of the harvested runoff.

Harvest and reuse refers to any type of runoff collection system that captures rainfall, stores it temporarily, and reuses it for irrigation, landscaping, or other non-potable uses. Harvest and reuse systems inherently retain the volume of runoff that it captures. Depending on the subsequent use after being captured, they also provide bioretention and filtration to the released runoff.

Harvest and reuse systems may be used in lieu of directly connecting rooftop drains to storm sewer systems; where downdrains discharge to impervious surfaces and the opportunity for irrigation or landscaping exists; as part of a home owner's irrigation plan; or for any other non-potable purpose where storm water is determined to be acceptable such as vehicle or machinery washing.

Primary Functions	
Bioretention	Varies
Volume Retention	Yes
Biofiltration	Varies

As of 2010, Utah's legislative code 73-3-1.5 requires that if more than 100 gallons of rainwater (13.4 cf) are captured, it must be registered through the Utah Division of Water Rights (https://waterrights.utah.gov/forms/rainwater.asp). The code also limits the total capture to 2,500 gallons (334.2 cubic feet). See the code for additional requirements.

Design Criteria

Design criteria for harvest and reuse devices or systems will vary widely. The governing principles of harvest and reuse are based on the system's function and capacity. For example, a rain barrel that provides occasional irrigation to a flower bed should be appropriately sized for the 80th percentile volume and be able to release the volume within an appropriate time that does not flood out the flower bed. A larger harvest and reuse system, such as an underground detention vault or above ground pond will be required to meet geotechnical or structural design criteria. The applications of harvest and reuse systems are endless; specific design criteria should be determined on a case-by-case basis with site-specific consideration.

Calculation Methods

Harvest and reuse systems are governed by the water quality volume. The general design steps are:

1. Calculate the water quality volume.
2. Size device for the water quality volume.

Sample Calculations

Refer to *Calculation Methods* in the *Preface to Fact Sheets* for discussion on the equations used.

A commercial development will have two buildings with roofs that are 2,500 square feet each. Rain barrels that will release to flower beds will be included as part of the design. Each roof is considered one drainage area.

Given

Contributing drainage area: 2,500 sf

Contributing drainage area: 0.057 ac

Imperviousness: 1.00

80th percentile storm depth: 0.55 in

Design Goals

Capture all runoff from the 80th percentile storm within rain barrels.

Calculations

Volumetric runoff coefficient, R_V (See *Sample Calculations*)

$R_V = 0.91i - 0.0204$ (Reese method)

$R_V = 0.91(1.0) - 0.0204$

$R_V = 0.89$

Water quality volume, WQV (See *Developing the 80th Percentile Volume*)

WQV = (0.89)(0.55 in)(0.057 ac)(43,560 sf/ac) / (12 in/ft)

WQV = 102 cf

WQV = 763 gallons

If 55-gallon rain barrels are used, 14 rain barrels will be needed for each roof and the capture will need to be registered with the Division of Water Rights.

Harvest and Reuse Effectiveness

The effectiveness of a harvest and reuse system is dependent on its use. Detention devices should be free of standing water to prevent stagnation and vector concerns. Systems that provide irrigation or that are part of landscaping features should be inspected regularly to ensure proper performance.

Designer Checklist

If the answer to these questions corresponds to a response box that is red, the BMP should either not be used or additional measures need to be taken to address the issue.

	Yes	No
Will stagnation of runoff be prevented by frequent release of the harvested runoff?	☐	☐
Does quantity of harvested runoff require registration with the Division of Water Rights?	☐	☐

Installation

Installation of harvest and reuse systems will vary depending on its use. Rain barrels can simply be connected to a down drain. More complicated systems require additional coordination.

Depending on the quantity of runoff being harvested, it will be necessary to register the detention device with the Division of Water Rights.

Installation Costs

The following cost items are typically associated with harvest and reuse systems.

-Detention device

-Upstream connection to detention device

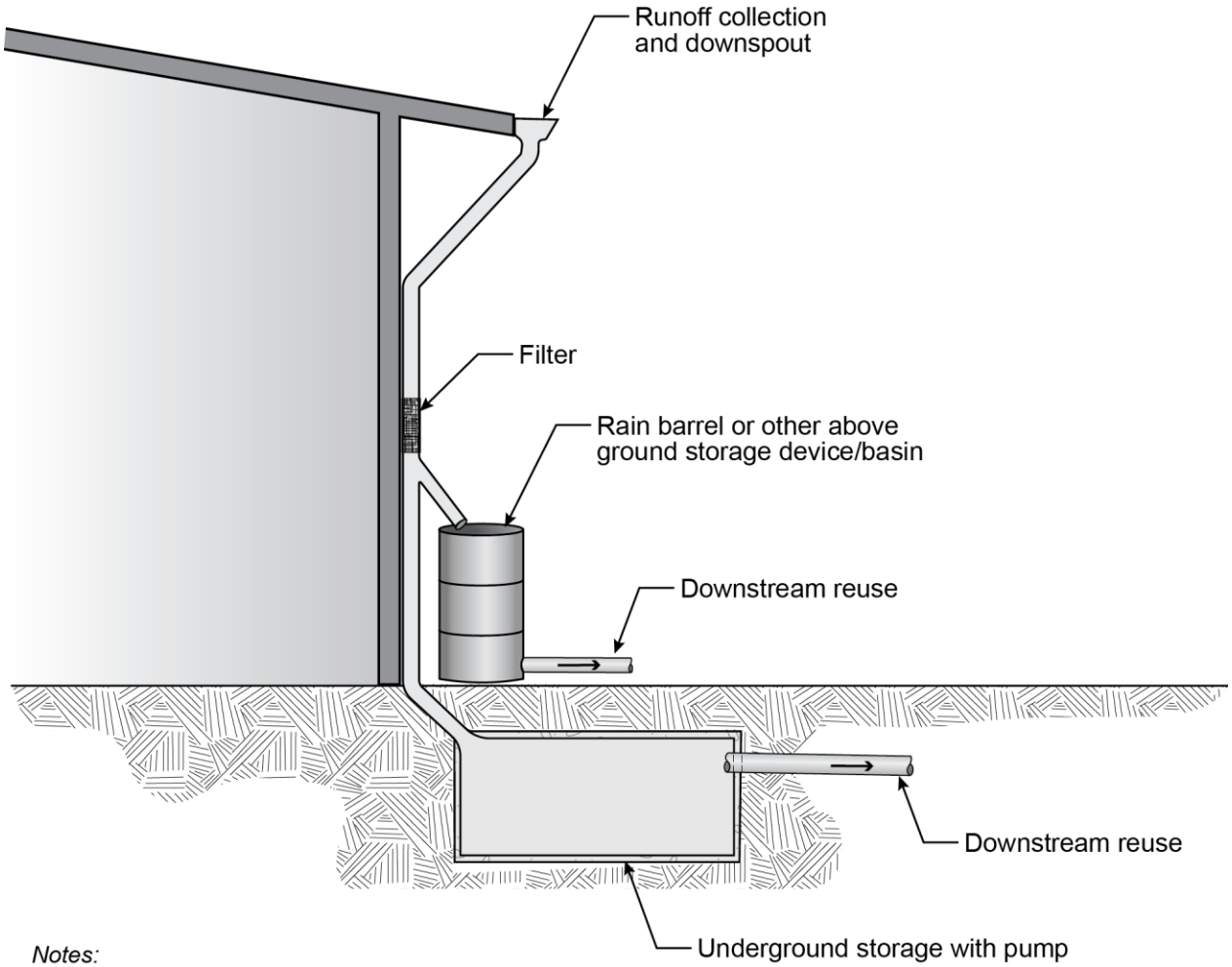
-Other items will be dependent on site-specific use

Maintenance

Refer to *Maintenance* and *Maintenance Costs* in the *Preface to Fact Sheets* for general information related to maintenance of harvest and reuse systems.

Maintenance Activities

Inspection	Inspection/Maintenance Frequency	Maintenance Activity	Effort
Inspect for mosquitos.	Semiannual (Spring, Fall)	Implement larvicide or other remediation.	LOW
Inspect harvesting device for leaking.	Semiannual (Spring, Fall)	Replace harvesting device.	LOW
Inspect condition of system components.	Semiannual (Spring, Fall)	Replace and repair components.	Medium



Notes:

- *Configurations and applications may vary*

Harvest and Reuse

Not to scale

Appendix D Utah Plant Hardiness Zones

Plant Hardiness Zones

Source Data:
Plant Hardiness Zone, USDA 2018;
County Boundaries, Roads, USGS 2018

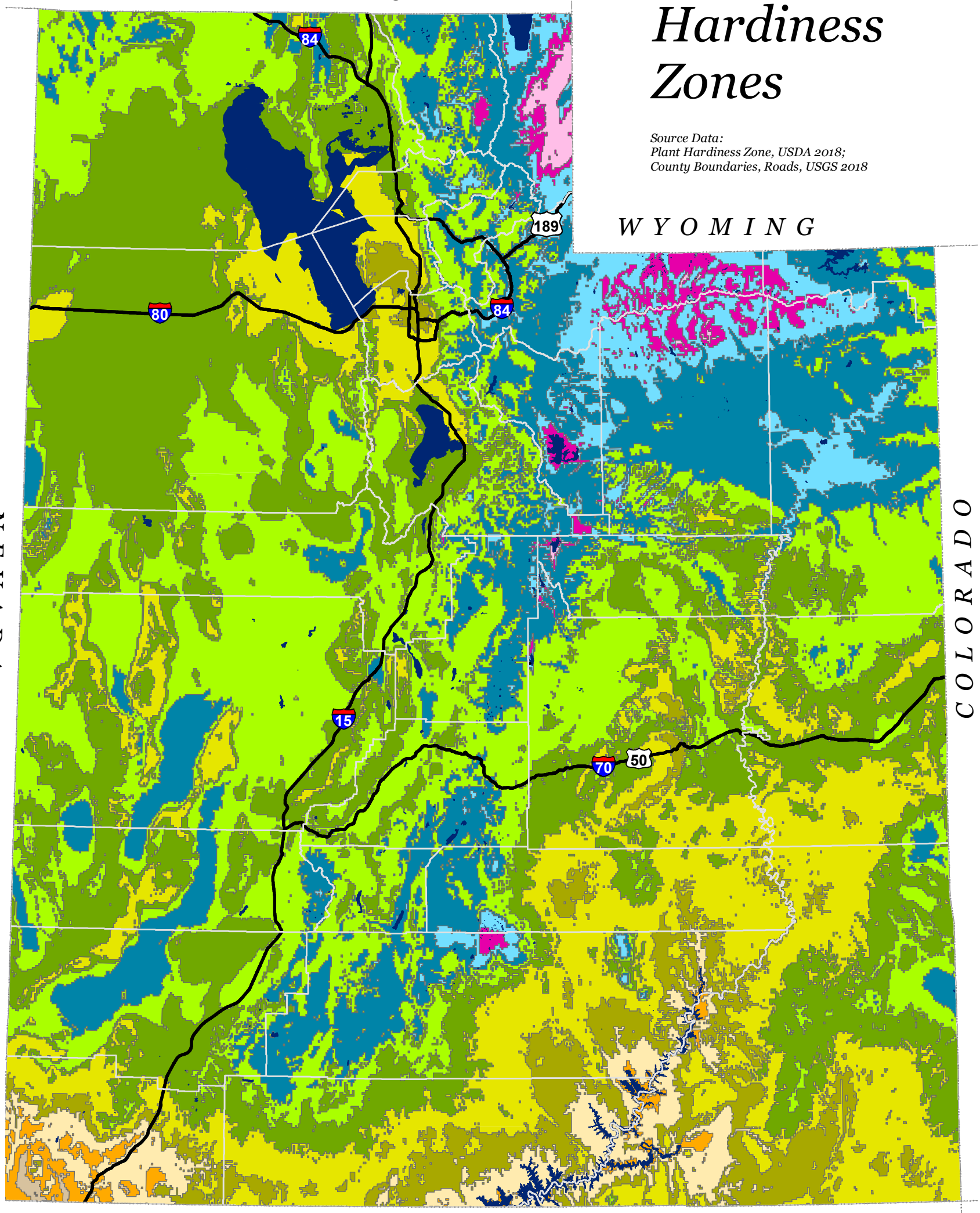
I D A H O

W Y O M I N G

N E V A D A

C O L O R A D O

A R I Z O N A



HARDINESS ZONE

3b: -35 to -30 F	5a: -20 to -15 F	7a: 0 to 5 F	9a: 20 to 25 F
	5b: -15 to -10 F	7b: 5 to 10 F	9b: 25 to 30 F
4a: -30 to -25 F	6a: -10 to -5 F	8a: 10 to 15 F	Lake/Pond
4b: -25 to -20 F	6b: -5 to 0 F	8b: 15 to 20 F	

0 12.5 25 50 75 100

Miles

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epg

Appendix E Utah Plant Selection Matrix by Climate Zone and BMP

Plants		Zones												Best Management Practices (BMPs)							
Trees		3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	Basin Bottom	Basin Edge	Basin Upland	Swales	Strips	Bioretention Cells/ Rain Gardens	Tree Box Filters	Green Roofs
Acer campestre	Hedge Maple		x	x	x	x	x	x	x	x	x	x					x		x			
Acer campestre 'Carnival'	Carnival Hedge Maple		x	x	x	x	x	x	x	x	x	x					x		x			
Acer ginnala	Amur Maple	x	x	x	x	x	x	x	x	x	x						x	x		x	x	
Acer glabrum	Rocky Mountain Maple				x	x	x	x	x	x	x	x	x	x			x	x	x	x		
Acer grandidentatum	Bigtooth Maple	x	x	x	x	x	x	x	x	x	x	x					x					
Acer grandidentatum 'Schmidt'	Rocky Mountain Glow Maple		x	x	x	x	x	x	x	x	x	x					x					
Acer griseum	Paperbark Maple		x	x	x	x	x	x	x	x	x	x					x					
Acer microphyllum	Big Leaf Maple						x	x	x	x					x	x		x		x	x	
Acer negundo 'Sensation'	Sensation Boxelder		x	x	x	x	x	x									x		x		x	
Acer palmatum sp.	Japanese Maples				x	x	x	x	x	x	x	x					x		x			
Acer palmatum "Garnet"	Garnet Japanese Maple				x	x	x	x	x	x	x	x	x	x			x					
Acer palmatum 'Bloodgood'	Bloodgood Japanese Maples				x	x	x	x	x	x	x	x					x					
Acer palmatum 'Trompenburg'	Trompenburg Japanese Maple				x	x	x	x	x	x	x	x					x					
Acer platanoides	Norway Maple		x	x	x	x	x	x	x	x							x		x			
Acer platanoides 'Columnare'	Columnar Norway Maple		x	x	x	x	x	x	x	x							x		x			
Acer platanoides 'Crimson Sentry'	Crimson Sentry Norway Maple	x	x	x	x	x	x	x	x	x							x		x			
Acer pseudoplatanus 'Esk Sunset' ESKIMO SUNSET	Eskimo Sunset Sycamore Maple'				x	x	x	x	x	x	x	x					x					
Acer pseudoplatanus 'Spaethii'	Purple Sycamore Maple				x	x	x	x	x	x	x	x	x	x			x		x			
Acer pseudoplatanus 'Tunpetti' REGAL PETTICOAT	Regal Petticoat Sycamore Maple		x	x	x	x	x	x	x	x	x	x	x	x			x		x			x
Acer rubrum	Red Maple	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Acer saccharinum	Silver Maple		x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	
Acer tataricum	Tatarian Maple	x	x	x	x	x	x	x	x	x	x	x					x	x		x	x	
Acer tataricum ssp. Ginnala	Amur Maple	x	x	x	x	x	x	x	x	x	x	x					x		x			
Acer tataricum 'GarAnn' PP 15,023	HOT WINGS® Tatarian maple		x	x	x	x	x	x	x	x	x	x	x	x			x	x		x	x	
Acer x feemanii 'Jeffersred'	Autumn Blaze Maple	x	x	x	x	x	x	x	x	x	x	x					x	x	x	x	x	
Aesculus hippocastanum	Horsechestnut	x	x	x	x	x	x	x	x	x	x	x					x	x	x	x		
Aesculus x arnoldiana 'Autumn Splendor'	Autumn Splendor Horse Chestnut		x	x	x	x	x	x	x	x								x	x	x		
Alnus incana sp. Tenufolia	Thinleaf Alder	x	x	x	x	x											x		x			
Alnus rubra	Red Alder		x	x	x	x											x		x			
Alnus sinuata	Sitka Alder		x	x	x	x											x		x	x		
Amelanchier arborea	Serviceberry		x	x	x	x	x	x	x	x	x	x	x	x			x					
Amelanchier laevis 'Spring Flurry'	Spring Flurry Serviceberry	x	x	x	x	x	x	x											x			
Betula alleghaniensis	Yellow Birch	x	x	x	x	x	x	x									x					
Betula nigra	River Birch		x	x	x	x	x	x	x	x	x	x	x	x		x		x	x	x		
Betula occidentalis	Water Birch	x	x	x	x	x									x	x	x	x	x	x	x	
Betula papyrifera	Paper Birch	x	x	x	x	x	x	x							x	x	x	x	x	x	x	
Betula pendula	Silver Birch	x	x	x	x	x	x	x							x	x	x	x	x	x	x	
Betula pubescens	White Birch	x	x	x	x	x	x	x							x	x	x	x	x	x	x	
Carpinus betulus 'Fastigiata'	Pyramidal European Hornbeam		x	x	x	x	x	x	x	x	x	x							x	x		
Carpinus caroliniana	American Hornbeam	x	x	x	x	x	x	x	x	x	x	x	x	x		x						
Carya cordiformis	Bitternut Hickory		x	x	x	x	x	x	x	x	x	x	x	x			x					
Carya glabra	Pignut Hickory		x	x	x	x	x	x	x	x	x	x	x	x			x					
Carya illinoinensis	Pecan				x	x	x	x	x	x	x	x	x	x	x	x		x		x		
Carya ovata	Shagbark Hickory		x	x	x	x	x	x	x	x	x	x					x					
Carya laciniosa	Shellbark Hickory				x	x	x	x	x	x	x	x					x					
Catalpa speciosa	Catalpa				x	x	x	x	x	x	x	x	x	x			x	x	x			x
Celtis occidentalis	Common Hackberry		x	x	x	x	x	x	x	x	x	x	x	x			x	x		x	x	
Celtis occidentalis 'Prairie Pride'	Prairie Pride Hackberry	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	
Celtis tenuifolia	Dwarf Hackberry				x	x	x	x	x	x	x	x	x	x			x					
Cercis canadensis	Eastern Redbud				x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	
Cercis canadensis 'Forest Pansy'	Forest Pansy Redbud				x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	
Cercis canadensis 'Ruby Falls'	Ruby Falls Redbud						x	x	x	x	x	x	x	x			x	x	x	x	x	
Cercis canadensis 'The Rising Sun'	Rising Sun Redbud				x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	
Cercis occidentalis	Western Redbud						x	x	x	x	x	x	x	x		x	x		x			
Chilopsis linearis	Desert Willow								x	x	x	x	x	x		x	x		x			
Citrus limon	Lemon												x	x								x
Corylus colurna	Turkish Filbert			x	x	x	x	x	x	x							x	x	x			
Cotinus coggygria 'Grace'	American Smoke Tree, Grace				x	x	x	x	x	x	x	x								x		
Cotinus coggygria 'Royal Purple'	Royal Purple Smoketree				x	x	x	x	x	x	x	x								x		
Crataegus arnoldiana	Arnold Hawthorn				x	x	x	x	x	x	x	x	x	x			x	x				
Crataegus crusgalli	Cockspur Hawthorn		x	x	x	x	x	x	x	x	x	x					x					

Plants		Zones													Best Management Practices (BMPs)							
Trees		3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	Basin Bottom	Basin Edge	Basin Upland	Swales	Strips	Bioretention Cells/ Rain Gardens	Tree Box Filters	Green Roofs
Crataegus crusgalli 'var. inermis	Thornless Cockspur Hawthorn		x	x	x	x	x	x	x	x	x	x					x					
Crataegus douglasii	Black/ Douglas Hawthorn		x	x	x	x	x	x									x		x	x		
Crataegus laevigata	English Hawthorn		x	x	x	x	x	x	x	x	x	x					x	x	x			
Fraxinus pennsylvanica	Green Ash	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x		
Ginkgo biloba	Maidenhair Tree	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x		
Ginkgo biloba 'Fairmount'	Fairmount Ginkgo				x	x	x	x	x	x	x	x			x	x	x	x	x	x		
Ginkgo biloba 'PNI 2720'	Princeton Sentry Ginkgo	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x		
Gleditsia triacanthos 'Impcole' IMPERIAL	Imperial Honeylocust		x	x	x	x	x	x	x	x	x	x					x	x	x	x		
Gleditsia triacanthos 'Imperial'	Imperial Honey Locust		x	x	x	x	x	x	x	x	x	x					x	x	x	x		
Gleditsia triacanthos 'Shademaster'	Shademaster Honeylocust				x	x	x	x	x	x	x	x			x	x	x	x	x	x		
Gleditsia triacanthos 'Skyline'	Skyline Honelocust	x	x	x	x	x	x	x	x	x	x	x					x	x	x	x		
Gleditsia triacanthos var. inermis 'Suncole'	Sunburst Honey Locust	x	x	x	x	x	x	x	x	x	x	x					x	x	x	x		
Gymnocladus dioica	Kentucky Coffeetree				x	x	x	x	x	x	x	x	x	x			x			x		
Juglans nigra	Black Walnut				x	x	x	x	x	x	x	x	x	x			x			x		
Koelreuteria paniculate	Golden Raintree				x	x	x	x	x	x	x	x	x	x			x		x	x		
Lagunaria pattersonii	Norfolk Island Hibiscus												x	x		x						
Laurus nobilis	Sweet Bay									x	x	x	x									x
Liquidambar styraciflua	Sweet Gum				x	x	x	x	x	x	x	x	x	x	x	x		x		x		
Liriodendron tulipifera 'Aureomarginatum'	Majestic Beauty Tulip Tree				x	x	x	x	x	x	x	x	x	x		x						
Liriodendron tulipifera 'Fastigiatum'	Columnar Tulip Tree				x	x	x	x	x	x	x	x	x	x			x					
Maackia amurensis	Amur Maackia	x	x	x	x	x	x	x	x	x									x			
Magnolia grandiflora	Souhthern Magnolia							x	x	x	x	x	x	x	x	x			x	x		
Magnolia virginiana	Sweet Bay Magnolia				x	x	x	x	x	x	x	x	x	x	x	x		x		x		
Malus pumila 'Obelisk' STARK CRIMSON SPIRE	Stark Crimson Spire Apple		x	x	x	x	x	x	x	x	x	x	x	x			x	x				
Malus pumila 'Tuscan' STARK EMERALD SPIRE	Stark Emerald Spire Apple		x	x	x	x	x	x	x	x	x	x	x	x			x	x				
Malus sargentii 'Tina'	Tina Sargent Crabapple		x	x	x	x	x	x	x	x	x	x					x	x				
Malus 'Adams'	Adams Crabapple		x	x	x	x	x	x	x	x	x	x	x	x			x	x				
Malus 'Prairifire'	Prairifire Crabapple				x	x	x	x	x	x	x	x					x	x				
Malus 'JFSKW213MZ'	Raspberry Spear Upright Crabapple		x	x	x	x	x	x	x	x							x	x				
Malus 'JFS-KW5' ROYAL RAINDROPS	Royal Raindrops Crabapple		x	x	x	x	x	x	x	x	x	x	x	x			x	x				
Malus 'Royalty'	Royalty Crabapple				x	x	x	x	x	x	x	x					x	x				
Malus 'Spring Snow'	Spring Snow Crabapple				x	x	x	x	x	x	x	x					x	x				
Malus 'Weepcanzam'	Candied Apple Crabapple		x	x	x	x	x	x	x	x	x	x					x	x				
Morus alba	White Mulberry	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x			
Morus alba 'Chaparral'	Chaparral Weeping Mulberry		x	x	x	x	x	x	x	x	x	x						x	x			
Morus alba 'Kingan'	Kingan Mulberry				x	x	x	x	x	x	x	x	x	x				x	x			
Nyssa sylvatica	Black Gum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	
Olea europaea 'Swan Hill'	Swan Hill Olive									x	x	x	x				x		x			x
Olea europaea 'Tolley's Upright'	Tolley's Upright Olive									x	x	x	x				x		x			x
Ostrya virginiana	Hop-Hornbeam	x	x	x	x	x	x	x	x	x	x	x	x	x			x					
Platanus occidentalis	Sycamore		x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x		
Platanus racemosa	Western Sycamore						x	x	x	x	x	x	x	x		x	x					
Platanus x acerifolia	London Plane Tree (American Sycamore)		x	x	x	x	x	x	x	x	x	x				x		x		x		
Platanus x hispanica	London Plane Tree		x	x	x	x	x	x	x	x	x	x				x				x		
Populus angustifolia	Narrowleaf Cottonwood	x	x	x	x	x	x	x	x	x	x	x					x		x	x		
Populus fremontii	Fremont Cottonwood		x	x	x	x	x	x							x	x	x	x	x	x		
Populus tremuloides	Quaking Aspen	x	x	x	x	x	x	x									x	x	x	x		
Populus trichocarpa	Black Cottonwood		x	x	x	x	x	x									x	x	x	x		
Prunus americana	American Plum	x	x	x	x	x	x	x	x	x	x	x				x	x	x				
Prunus armeniaca 'Moongold'	Moongold Apricot		x	x	x	x	x	x	x	x	x	x				x		x				
Prunus armeniaca 'Tilton'	Tilton Apricot		x	x	x	x	x	x	x	x	x	x	x	x		x		x				
Prunus cerasifera 'Krauter Vesuvius'	Krauter Vesuvius Cherry Plum				x	x	x	x	x	x	x	x	x			x		x				
Prunus cerasifera 'Pissardii'	Pissard's Cherry Plum				x	x	x	x	x	x	x	x	x	x		x		x				
Prunus lauracerasus 'Chestnut Hill'	Chestnut Hill Cherry Laurel						x	x	x	x	x	x	x	x		x		x				
Prunus maackii	Amur Chokecherry	x	x	x	x	x	x	x								x	x	x				
Prunus nigra 'Princess Kay'	Princess Kay plum			x	x	x	x	x	x	x	x	x	x	x		x		x				
Prunus padus	Bird Cherry	x	x	x	x	x	x	x								x		x	x			
Prunus persica 'Elberta'	Elberta Dwarf Peach				x	x	x	x	x	x	x	x	x	x		x		x				
Prunus persica 'Hale Haven'	Hale Haven Dwarf Peach			x	x	x	x	x	x	x	x	x				x		x				
Prunus persica var. nectarina 'Red Gold'	Red Gold Nectarine				x	x	x	x	x	x	x	x	x	x		x		x				
Prunus salicina 'Santa Rosa'	Santa Rosa Plum						x	x	x	x	x	x	x	x		x		x				

Plants		Zones													Best Management Practices (BMPs)							
Trees		3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	Basin Bottom	Basin Edge	Basin Upland	Swales	Strips	Bioretention Cells/ Rain Gardens	Tree Box Filters	Green Roofs
Prunus virginiana	Chokecherry	x	x	x	x	x	x	x	x	x						x	x	x	x	x		
Prunus virginiana 'Scubert'	Canada Red Chokecherry	x	x	x	x	x	x	x	x	x						x		x		x		
Prunus x blireana	Blireana Plum			x	x	x	x	x	x	x	x	x				x		x				
Prunus x cerasifera 'Cripoizam'	Crimson Pointe Flowering Plum		x	x	x	x	x	x	x	x	x	x	x	x		x		x				
Pyrus calleryana 'Chanticleer'	Chanticleer Flowering Pear				x	x	x	x	x	x	x	x	x	x					x			
Quercus alba	White Oak	x		x	x	x	x	x	x	x	x	x	x	x			x					
Quercus bicolor	Swamp White Oak	x	x	x	x	x	x	x	x	x	x	x				x	x	x	x	x		
Quercus gambelii	Gambel Oak		x	x	x	x	x	x	x	x	x	x			x	x	x	x				
Quercus imbricaria	Shingle Oak																x					
Quercus macrocarpa	Bur Oak	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x		x		
Quercus muehlenbergii	Chinkapin Oak				x	x	x	x	x	x							x					
Quercus palustris	Pin Oak		x	x	x	x	x	x	x	x	x	x				x	x					
Quercus prinoides	Dwarf Chinkapin Oak	x	x	x	x	x	x	x	x	x	x	x					x					
Quercus robur	English Oak				x	x	x	x	x	x	x	x					x	x				
Quercus robur f. fastigiata	Columnar English Oak				x	x	x	x	x	x	x	x					x	x	x			
Quercus rubra	Northern Red Oak				x	x	x	x	x	x	x	x					x	x	x			
Quercus undulata	Wavyleaf Oak				x	x	x	x	x	x	x	x					x	x				
Quercus 'Clemson' HERITAGE	Heritage Oak		x	x	x	x	x	x	x	x	x						x	x				
Robinia 'Purple Robe'	Purple Robe Locust	x	x	x	x	x	x	x	x	x	x	x							x	x		
Salix alba	White Willow		x	x	x	x											x	x		x		
Salix amygdaloides	Peachleaf Willow		x	x	x	x											x	x	x	x		
Salix lasiandra	Pacific Willow	x	x	x												x	x	x		x		
Salix nigra	Black Willow	x	x	x	x	x											x	x		x		
Salix sitchensis	Sitka Willow		x	x	x												x	x		x		
Salix prolixa	Mackenzie Willow		x	x	x	x											x	x		x		
Sambucus coerulea	Blue Elderberry		x	x	x	x	x	x									x	x		x		
Sambucus racemosa 'SMNSRD4' LEMONY LACE	Lemony Lace Elderberry	x	x	x	x	x	x	x	x	x										x		
Sambucus racemosa 'Sutherland Gold'	Sutherland Gold Elderrberry	x	x	x	x	x	x	x	x	x	x	x								x		
Shepherdia argentea	Silver Buffaloberry	x	x	x	x	x	x	x									x			x		
Sophora japonica 'Halka'	Millstone Japanese Pagoda Tree				x	x	x	x	x	x	x	x							x			
Sophora japonica 'Regent'	Regent Japanese Pagodatree				x	x	x	x	x	x	x								x			
Sorbus aucuparia	European Mountain Ash	x	x	x	x	x	x	x									x					
Syringa reticulata 'Ivory Silk'	Ivory Silk Tree Lilac	x	x	x	x	x	x	x	x	x									x			
Syringa vulgaris 'Sensation'	Sensation Lilac	x	x	x	x	x	x	x	x	x										x		
Taxodium distichum	Bald Cypress		x	x	x	x	x	x	x	x	x	x	x	x						x	x	
Taxodium distichum 'Shawnee Brave'	Shawnee Brave Bald Cypress		x	x	x	x	x	x	x	x	x	x	x	x					x	x	x	
Tilia americanna	American Linden	x	x	x	x	x	x	x	x	x	x	x					x					
Tilia cordata 'Greesnspire'	Greenspire Linden		x	x	x	x	x	x	x	x	x	x					x		x			
Tilia tomentosa	Silver Linden		x	x	x	x	x	x	x	x	x	x							x	x		
Tilia tomentosa 'Sterling'	Sterling Silver Linden		x	x	x	x	x	x	x	x	x								x	x		
Ulmaus parvifolia 'Emer II' ALLEE	Allee Lacebark Elm		x	x	x	x	x	x	x	x	x	x	x	x					x			x
Ulmus pumila	Siberian Elm		x	x	x	x	x	x	x	x	x	x	x	x			x	x		x		x
Ulmus x 'Morton' ACCOLADE	Accolade Elm			x	x	x	x	x	x	x	x	x	x	x					x			
Ulmus 'Frontier'	Frontier Elm				x	x	x	x	x	x	x	x	x	x					x			
Ulmus 'Homestead'	Homestead Elm	x	x	x	x	x	x	x	x	x	x	x	x	x					x	x		
Zelkova serrata	Japanese Zelkova				x	x	x	x	x	x	x	x							x			
Zelkova serrata 'Green Vase'	Green Vase Zelkova				x	x	x	x	x	x	x	x	x						x			
Zelkova serrata 'Kiwi Sunset'	Kiwi Sunset Zelkova				x	x	x	x	x	x	x	x							x			
Zelkova serrata 'Village Green'	Village Green Zelkova				x	x	x	x	x	x	x	x							x			
Conifers																						
Cedrus libani 'Beacon Hill'	Beacon Hill Cedar of Lebanon						x	x	x	x							x					
Juniperus osteosperma	Utah Juniper	x	x	x	x	x	x	x	x	x							x	x	x			x
Juniperus scopulorum 'Blue Arrow'	Blue Arrow Juniper		x	x	x	x	x	x	x	x	x	x	x	x			x	x		x		x
Juniperus scopulorum 'Skyrocket'	Skyrocket Juniper	x	x	x	x	x	x	x	x	x	x	x					x	x		x		x
Juniperus scopulorum 'Woodward'	Woodward columnar juniper	x	x	x	x	x	x	x	x	x	x	x	x	x			x			x		x
Juniperus virginiana 'Blue Arrow'	Blue Arrow Eastern Red Cedar		x	x	x	x	x	x	x	x	x	x	x	x			x	x				x
Juniperus virginiana 'Hillspire'	Hillspire Eastern Red Cedar	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x				x
Picea pungens	Colorado Spruce	x	x	x	x	x	x	x	x	x	x	x					x	x				
Picea pungens 'Baby Blue Eyes'	Baby Blue Eyes Spruce	x	x	x	x	x	x	x	x	x							x					
Picea pungens 'Hoopsii'	Hoop's Blue Spruce	x	x	x	x	x	x	x	x	x							x					
Picea pungens 'Iseli Fastigiate'	Iseli Fastigiate Spruce	x	x	x	x	x	x	x	x	x	x	x					x					

Plants		Zones												Best Management Practices (BMPs)							
Trees		3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	Basin Bottom	Basin Edge	Basin Upland	Swales	Strips	Bioretention Cells/ Rain Gardens	Tree Box Filters	Green Roofs
Picea pungens 'Mesa Verde'	Mesa Verde Spruce	x	x	x	x	x	x	x	x	x	x	x					x					
Picea pungens 'The Blues'	The Blues Blue Spruce																x					
Picea pungens var. glauca 'MonWal'	Sparkler Colorado Blue Spruce	x	x	x	x	x	x	x	x	x	x	x					x					
Pinus mugo	Mugo Pine	x	x	x	x	x	x	x	x	x							x	x		x		x
Pinus mugo fastigiata 'Wells Dolly's Choice'	Wells Dolly's Choice Mugo Pine	x	x	x	x	x	x	x	x	x										x		
Pinus mugo 'Carsten's Wintergold'	Carsten's Wintergold Mugo Pine	x	x	x	x	x	x	x	x	x							x	x		x		x
Pinus mugo 'Jakobsen'	Pinus mugo 'Jakobsen'	x	x	x	x	x	x	x	x	x							x	x		x		x
Pinus nigra	Austrian Pine				x	x	x	x	x	x	x	x					x			x		
Pinus nigra 'Arnold Sentinel'	Arnold Sentinel Austrian Pine		x	x	x	x	x	x	x	x	x	x								x		
Pinus ponderosa	Ponderosa Pine	x	x	x	x	x	x	x	x	x							x	x		x		
Pinus strobus 'Blue Shag'	Blue Shag Eastern White Pine		x	x	x	x	x	x	x	x	x	x					x	x				
Pinus sylvestris	Scots Pine	x	x	x	x	x	x	x	x	x	x	x								x		
Pseudotsuga menziesii	Douglas Fir		x	x	x	x	x	x									x					
Thuja occidentalis	American Arbovitae	x	x	x	x	x	x	x	x	x					x	x	x	x	x	x	x	
Thuja occidentalis 'Hetz Midget'	Hetz Midget Arborvitae	x	x	x	x	x	x	x	x	x					x	x	x			x		

Plant Select, 2018; Conservation Garden Park, 2018; Charter Township of Canton, 2006; USDA-Natural Resources Conservation Service, 2000; Missouri Botanical Garden, 2018;

Plants For A Future, 2018; Monrovia, 2018; Growing Green Guide, 2018; Central Coast Low Impact Development Initiative; San Francisco Water Power Sewer, 2016

Plants		Zones												Best Management Practices (BMPs)							
Shrubs		3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	Basin Bottom	Basin Edge	Basin Upland	Swales	Strips	Bioretention Cells/ Rain Gardens	Tree Box Filters	Green Roofs
Alnus rugosa	Speckled Alder	x	x	x	x	x	x	x								x						
Amelanchier alnifolia	Saskatoon Serviceberry	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x		x		
Amelanchier alnifolia 'Obelisk'	Standing Ovation Serviceberry	x	x	x	x	x	x	x	x	x	x	x						x		x		
Arctostaphylos x coloradensis	Panchito Manzanita			x	x	x	x	x	x	x	x	x				x						
Arctostaphylos x coloradensis 'Chieftain'	Chieftain Manzanita				x	x	x	x	x	x	x	x				x						
Aronia arbutifolia 'Brilliantissima'	Brilliant Red Chokeberry		x	x	x	x	x	x	x	x	x	x	x	x						x	x	
Aronia melanocarpa var. elata	Black Chokeberry		x	x	x	x	x	x	x	x	x	x	x	x		x				x	x	
Artemisia filifolia	Sand Sagebrush		x	x	x	x	x	x	x	x	x	x								x		
Artemisia nova	Black Sagebrush	x	x	x	x	x	x	x												x		
Atriplex canescens	Four-Wing Saltbrush						x	x	x	x	x	x	x	x			x	x		x		
Baccharis pilularis	Coyote Brush										x	x	x	x		x	x		x			
Berberis aquifolium	Barberry				x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	
Berberis aquifolium repens	Creeping Oregon Grape				x	x	x	x	x	x	x	x			x	x		x	x	x	x	
Berberis thunbergii f. atropurpurea	Japanese Barberry		x	x	x	x	x	x	x	x	x	x				x		x	x			
Berberis thunbergii f. atropururea 'Atropurpurea Nana'	Crimson Pygmy Japanese Barberry		x	x	x	x	x	x	x	x	x	x						x	x			
Berberis thunbergii f. atropurpurea 'Golden Ring'	Golden Ring Japanese Barberry		x	x	x	x	x	x	x	x	x	x	x	x				x	x			
Berberis thunbergii f. atropurpurea 'Helmond Pillar'	Helmond Pillar Japanese Barberry		x	x	x	x	x	x	x	x	x	x						x	x			
Berberis thunbergii f. atropurpurea 'Rose Glow'	Rose Glow Japanese Barberry		x	x	x	x	x	x	x	x	x	x						x	x			
Berberis thunbergii 'Goruzam'	Golden Ruby Barberry		x	x	x	x	x	x	x	x	x	x						x	x			
Berberis thunbergii 'Maria'	Sunjoy Gold Pillar Japanese Barberry		x	x	x	x	x	x	x	x	x	x						x	x			
Berberis thunbergii 'Orange Rocket'	Orange Rocket Barberry		x	x	x	x	x	x	x	x	x	x	x	x				x	x			
Berberis thunbergii 'Pygruzam'	Pygmy Ruby Japanese Barberry		x	x	x	x	x	x	x	x	x	x						x	x			
Betula pumila	Bog Birch	x	x	x	x	x	x	x	x	x	x	x	x	x		x						
Buxus microphylla 'Golden Triumph'	Golden Triumph Boxwood				x	x	x	x	x	x	x	x	x	x								x
Buxus microphylla 'Green Gem'	Boxwood 'Green Gem'		x	x	x	x	x	x	x	x	x	x	x	x								x
Callistemon 'Little John'	Little John Dwarf Bottlebrush									x	x	x	x				x		x			x
Caragana arborescens	Siberian Peashrub	x	x	x	x	x	x	x	x	x	x	x					x	x		x		x
Caragana arborescens 'Pendula'	Weeping Pea Shrub	x	x	x	x	x											x	x		x		x
Caragana frutex 'Globosa'	Globe Peashrub	x	x	x	x	x	x	x	x	x	x	x								x		
Caryopteris x clandonensis 'Dark Knight'	Dark Knight Bluebeard						x	x	x	x	x	x	x	x						x		
Caryopteris x clandonensis 'Heavenly Blue'	Heavenly Blue Bluebeard				x	x	x	x	x	x	x	x	x	x						x		
Caryopteris x clandonensis 'Korball'	Blue Balloon Caryopteris				x	x	x	x	x	x	x	x	x	x						x		
Caryopteris x clandonensis 'Janice'	Lil Miss Sunshine Bluebeard				x	x	x	x	x	x	x	x	x	x						x		
Caryopteris x clandonensis 'MiniBleu'	Petit Bleu Bluebeard				x	x	x	x	x	x	x	x	x	x						x		
Ceanothus americanus	New Jersey Tea		x	x	x	x	x	x	x	x	x	x				x	x					
Celtis occidentalis	Common Hackberry		x	x	x	x	x	x	x	x	x	x	x	x					x	x	x	
Cephalanthus occidentalis	Buttonbush				x	x	x	x	x	x	x	x	x	x	x	x		x		x		
Chrysothamnus (Ericameria) nauseosus var. nauseosus	Baby Blue Rabbitbrush		x	x	x	x	x	x	x	x	x	x	x	x						x		
Cornus alba 'Cream Cracker'	'Cornus alba 'Cream Cracker'	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x		x		
Cornus alba 'Elegantissima'	Variegated Red Twig Dogwood	x	x	x	x	x	x	x	x	x	x	x					x	x		x		
Cornus amomum	Silky Dogwood				x	x	x	x	x	x	x	x				x						
Cornus foemina	Gray Dogwood									x	x	x	x				x					
Cornus sanguinea 'Midwinter Fire'	Midwinter Fire Dogwood				x	x	x	x	x	x							x	x		x	x	
Cornus sericea	Red Twig Dogwood	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x		x	x	
Cornus sericea 'Baileyi'	Bailey Red Twig Dogwood	x	x	x	x	x	x	x	x	x	x	x					x	x		x	x	
Cornus sericea 'Budd's Yellow'	Budd's Yellow Dogwood	x	x	x	x	x	x	x	x	x							x	x		x	x	
Cornus sericea 'Cardinal'	Cardinal Red Twig Dogwood	x	x	x	x	x	x	x	x	x	x	x					x	x		x	x	
Cornus sericea 'Farrow'	Artic Fire Dogwood	x	x	x	x	x	x	x	x	x							x	x		x	x	
Cornus sericea 'Flaviramea'	Yellow Twig Dogwood	x	x	x	x	x	x	x	x	x	x	x					x	x		x	x	
Cornus sericea 'Isanti'	Isanti Red Twig Dogwood	x	x	x	x	x	x	x	x	x	x	x					x	x		x	x	
Cornus sericea 'Kelseyi'	Kelsey's Dwarf Red Twig Dogwood	x	x	x	x	x	x	x	x	x	x	x					x	x		x	x	
Cornus stolonifera 'Neil Z' PUCKER UP	Pucker Up Red Twig Dogwood	x	x	x	x	x	x	x	x	x	x	x				x		x		x	x	
Corylus americana	American Filbert		x	x	x	x	x	x	x	x	x	x	x	x			x					
Cotinus coggygria 'Ancot' GOLDEN SPIRIT	Smoke Tree, 'Golden spirit'			x	x	x	x	x	x	x								x	x	x		
Cotoneaster adpressus 'Little Gem'	Little Gem Cotoneaster				x	x	x	x	x	x	x	x								x		
Cotoneaster apiculatus	Cranberry Cotoneaster				x	x	x	x	x	x	x	x								x		
Cotoneaster divaricatus	Spreading Cotoneaster		x	x	x	x	x	x	x	x										x		
Cotoneaster integerrimus	European Cotoneaster	x	x	x	x	x											x	x		x		
Cotoneaster racemiflorus var. soongoricus	Sungari redbead cotoneaster	x	x	x	x	x	x	x	x	x	x	x								x		
Cotoneaster x suecicus 'Coral Beauty'	Coral Beauty Cotoneaster			x	x	x	x	x	x	x										x		
Fallugia paradoxa	Apache Plume		x	x	x	x	x	x	x	x	x	x								x		
Forestiera neomexicana	New Mexico Privet		x	x	x	x	x	x	x	x	x	x	x	x						x		
Forsythia x 'Meadowlark'	Meadowlark Forsythia	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x				
Hamamelis virginiana	Witch Hazel	x	x	x	x	x	x	x	x	x	x	x					x					
Helianthemum 'Ben Ledi'	Ben Ledi Sun Rose		x	x	x	x	x	x	x	x	x	x	x	x						x		

Plants		Zones												Best Management Practices (BMPs)							
Shrubs		3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	Basin Bottom	Basin Edge	Basin Upland	Swales	Strips	Bioretention Cells/ Rain Gardens	Tree Box Filters	Green Roofs
Helianthemum 'Ben More'	Ben More Sun Rose				x	x	x	x	x	x	x	x	x	x						x		
Helianthemum 'Cheviot'	Cheviot Sun Rose		x	x	x	x	x	x	x	x	x	x	x	x						x		
Helianthemum 'Dazzler'	Dazzler Sun Rose		x	x	x	x	x	x	x	x	x	x	x	x						x		
Helianthemum 'Henfield Brilliant'	Henfield Brilliant Sun Rose		x	x	x	x	x	x	x	x	x	x	x	x						x		
Helianthemum 'Raspberry Ripple'	Raspberry Ripple Sun Rose		x	x	x	x	x	x	x	x	x	x	x	x						x		
Helianthemum 'Rhodanthe Carneum'	Rhodanthe Carneum Sun Rose		x	x	x	x	x	x	x	x	x	x	x	x						x		
Helianthemum 'St. Mary's'	St Mary's Sun Rose		x	x	x	x	x	x	x	x	x	x	x	x						x		
Helianthemum 'Wisley Primrose'	Wisley Primrose Sun Rose		x	x	x	x	x	x	x	x	x	x	x	x						x		
Holodiscus discolor	Oceanspray				x	x	x	x	x	x	x	x	x	x		x			x			
Ilex verticillata	Winterberry (Michigan Holly)	x	x	x	x	x	x	x	x	x	x	x	x	x		x						
Juniperus chinensis 'Daub's Frosted'	Daub's Frosted Juniper		x	x	x	x	x	x	x	x	x	x	x	x								x
Juniperus chinensis 'Kaizuka'	Kaizuka Juniper				x	x	x	x	x	x	x	x	x	x								x
Juniperus chinensis 'Spearmint'	Spearmint Juniper	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Juniperus communis	Common Juniper	x	x	x	x	x	x	x														x
Juniperus communis 'Repanda'	Juniperus communis 'Repanda'	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Juniperus horizontalis 'Bar Harbor'	Bar Harbor Juniper	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Juniperus horizontalis 'Blue Chip'	Blue Chip Juniper	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Juniperus horizontalis 'Hughes'	Hughes Juniper	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Juniperus horizontalis 'Monber'	Icee Blue Juniper	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Juniperus horizontalis 'Wiltonii'	Blue Rug Juniper	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Juniperus osteosperma	Utah Juniper	x	x	x	x	x	x	x	x	x												x
Juniperus sabina 'Buffalo'	Buffalo Juniper	x	x	x	x	x	x	x	x	x	x	x										x
Juniperus sabina 'Skandia'	Skandia Juniper		x	x	x	x	x	x	x	x												x
Juniperus scopulorum	Rocky Mountain Juniper		x	x	x	x	x	x	x	x	x	x	x	x								x
Juniperus scopulorum 'Gray Gleam'	Gray Gleam Juniper		x	x	x	x	x	x	x	x												x
Juniperus scopulorum 'Skyrocket'	Skyrocket Juniper	x	x	x	x	x	x	x	x	x	x	x										x
Juniperus scopulorum 'Tabletop'	Tabletop Juniper	x	x	x	x	x	x	x	x	x												x
Juniperus x pfitzeriana 'Monsan'	Sea of Gold Juniper	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Juniperus × pfitzeriana 'Sea Green'	Sea Green Juniper	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Lindera benzoin	Spicebush		x	x	x	x	x	x	x	x	x	x	x	x			x					
Lonicera korolkowii 'Floribunda'	BLUE VELVET® honeysuckle	x	x	x	x	x	x	x	x	x	x	x					x	x				
Lonicera maackii	Amur Honeysuckle	x	x	x	x	x	x	x	x	x	x	x					x	x				
Lonicera nitida 'Lemon Beauty'	Lemon Beauty Box Honeysuckle							x	x	x	x	x	x	x								x
Lonicera periclymenum 'Winchester'	Winchester Honeysuckle				x	x	x	x	x	x	x	x	x	x								x
Lonicera x brownii 'Dropmore Scarlet'	Dropmore Scarlet Trumpet Honeysuckle		x	x	x	x	x	x	x	x	x	x	x	x								x
Mahonia aquifolium 'Compacta'	Dwarf Oregon Grape		x	x	x	x	x	x	x	x	x	x	x	x				x	x	x		
Mahonia repens	Creeping Mahonia, Oregon Grape				x	x	x	x	x	x	x	x						x	x	x		
Maireana sedifolia	Pearl Bluebush										x	x	x	x								x
Nandina domestica 'Nana'	Nandina						x	x	x	x	x	x	x	x			x		x			x
Pentaphylloides floribunda	Shrubby Cinquefoil				x	x	x	x									x	x		x		
Philadelphus coronarius 'Aureus'	Golden Mock Orange				x	x	x	x	x	x	x	x	x	x	x	x		x		x		
Philadelphus lewisii 'Blizzard'	Blizzard Mock Orange	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x		
Philadelphus lewisii 'Cheyenne'	Cheyenne Mock Orange	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x		
Philadelphus lewisii 'PWY01S'	CHEYENNE® mock orange	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Physocarpus opulifolius	Nine Bark	x	x	x	x	x	x	x	x	x	x	x					x					
Physocarpus opulifolius 'Amber Jubilee'	Amber Jubilee Ninebark	x	x	x	x	x	x	x	x	x	x	x					x					x
Physocarpus opulifolius 'Dart's Gold'	Dart's Gold Ninebark	x	x	x	x	x	x	x	x	x							x					x
Physocarpus opulifolius 'Diabolo'	Diabolo Ninebark	x	x	x	x	x	x	x	x	x							x					x
Physocarpus opulifolius 'Nanus'	Dwarf Ninebark	x	x	x	x	x	x	x	x	x	x	x	x	x			x					x
Physocarpus opulifolius 'Nugget'	Nugget Ninebark	x	x	x	x	x	x	x	x	x	x	x					x					x
Physocarpus opulifolius 'Seward'	Summer Wine Ninebark	x	x	x	x	x	x	x	x	x	x	x					x					x
Physocarpus opulifolius 'POIPD2'	Petite Plum Ninebark	x	x	x	x	x	x	x	x	x	x	x					x					x
Physocarpus opulifolius 'SMPOTW'	Tiny Wine Ninebark	x	x	x	x	x	x	x	x	x	x	x					x					x
Pinus mugo	Mugo Pine	x	x	x	x	x	x	x	x	x										x		
Pinus mugo 'Big Tuna'	Big Tuna Mugo Pine	x	x	x	x	x	x	x	x	x										x		
Pinus mugo 'Mops'	Mops Mugo Pine	x	x	x	x	x	x	x	x	x										x		
Pinus mugo 'Slowmound'	Slowmound Mugo Pine	x	x	x	x	x	x	x	x	x										x		
Pittosporum tobira	Mock Orang												x	x		x	x		x			x
Potentilla fruticosa 'Gold Drop'	Gold Drop Shrubby Cinquefoil	x	x	x	x	x	x	x	x	x						x	x			x		
Potentilla fruticosa 'Goldfinger'	Goldfinger Shrubby Cinquefoil	x	x	x	x	x	x	x	x	x						x	x			x		x
Potentilla fruticosa 'McKay's White'	McKay's White Shrubby Cinquefoil	x	x	x	x	x	x	x	x	x						x	x			x		
Potentilla fruticosa 'Monsidh'	Frosty Shrubby Cinquefoil	x	x	x	x	x	x	x	x	x						x	x			x		
Prunus besseyi	Western Sand Cherry		x	x	x	x	x	x	x	x	x	x				x	x					
Prunus besseyi 'Pawnee Buttes'	Pawnee Buttes Western Sand Cherry		x	x	x	x	x	x	x	x	x	x				x	x					
Prunus besseyi 'P011S'	PAWNEE BUTTES® sand cherry	x	x	x	x	x	x	x	x	x	x	x				x	x					

Plants		Zones													Best Management Practices (BMPs)							
Shrubs		3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	Basin Bottom	Basin Edge	Basin Upland	Swales	Strips	Bioretention Cells/ Rain Gardens	Tree Box Filters	Green Roofs
Prunus glandulosa 'Sinensis'	Dwarf Flowering Almond				x	x	x	x	x	x	x					x	x					
Prunus virginiana	Chokecherry	x	x	x	x	x	x	x								x	x	x				x
Prunus x cistena	Purple-Leaf Sand Cherry	x	x	x	x	x	x	x	x	x	x	x				x	x					
Purshia tridentata	Antelope Bitterbrush				x	x	x	x	x	x	x	x	x	x						x		
Ribes aureum	Golden Currant	x	x	x	x	x	x	x									x	x		x		
Ribes cereum	Wax Currant		x	x	x	x														x		
Rhamnus frangula 'Columnaris'	Tallhedge Buckthorn	x	x	x	x	x	x	x	x	x	x									x		
Rhamnus frangula 'Ron Williams'	Fine Line Buckthorn	x	x	x	x	x	x	x	x	x	x									x		
Rhus aromatica	Fragrant Sumac	x	x	x	x	x	x	x	x	x	x	x	x	x			x					
Rhus aromatica 'Gro-Low'	Grow-Low Sumac	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x				x
Rhus glabra	Smooth Sumac	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x		x		
Rhus glabra 'Laciniata'	Cutleaf Smooth Sumac	x															x	x		x		
Rhus trilobata	Three-Leaf Sumac		x	x	x	x	x	x	x	x	x	x					x	x	x	x		x
Rhus trilobata 'Autumn Amber'	Autumn Amber Sumac		x	x	x	x	x	x	x	x	x	x					x	x	x	x		x
Rhus typhina 'Bailtiger'	Tiger Eyes Sumac		x	x	x	x	x	x	x	x	x	x					x	x	x			
Ribes aureum	Golden Currant	x	x	x	x	x	x	x	x							x	x	x	x	x		x
Ribes cereum	Wax Currant		x	x	x	x											x	x	x			
Rosa palustris	Swamp Rose		x	x	x	x	x	x	x	x	x	x	x	x		x						
Rosa woodsii	Woods' Rose		x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x		
Rosmarinus officinalis 'Arp'	Arp Rosemary						x	x	x	x	x	x	x	x								x
Rosmarinus officinalis 'Huntington Carpet'	Huntington Carpet Rosemary										x	x	x	x								x
Salix bebbiana	Bebb's Willow		x	x	x	x											x	x		x		
Salix boothii	Bebb's Willow		x	x	x	x											x	x		x		
Salix drummondiana	Drummond Willow	x	x	x													x	x		x		
Salix exigua	Coyote Willow	x	x	x													x	x		x		
Salix geyeriana	Geyer Willow	x	x	x													x	x		x		
Salix lemmonii	Lemmon Willow	x	x	x													x	x		x		
Salix lutea	Yellow Willow	x	x	x													x	x		x		
Salix planifolia	Planeleaf Willow	x	x	x													x	x		x		
Salix scouleriana	Scouler Willow		x	x	x	x	x	x									x	x		x		
Salvia clevelandii	Cleveland Sage								x	x						x	x		x			
Salvia leucophylla	Purple Sage						x	x	x	x	x	x	x	x		x	x		x			
Salvia spathacea	Hummingbird Sage										x	x	x	x		x	x		x			
Sambucus canadensis	Elderberry	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x					
Sambucus mexicana	Western Elderberyy						x	x	x	x	x	x	x	x		x	x		x			
Sambucus nigra 'EIFFEL 1'	Black Tower Elderberry		x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	
Sambucus nigra 'Eva'	Black Lace Elderberry		x	x	x	x	x	x	x	x					x	x	x	x	x	x	x	
Sambucus nigra 'Gerda' x	Black Beauty Elderberry		x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	
Sambucus nigra f. laciniata	Cutleaf Elderberry		x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	
Shepherdia argentea	Silver Buffaloberry	x	x	x	x	x	x	x									x	x	x			x
Spirea alba	Meadowsweet	x	x	x	x	x	x	x	x	x						x	x					
Spirea x vanhouttei	Vanhoutte Spirea	x	x	x	x	x	x	x	x	x	x	x					x	x				
Symphoricarpos albus	Snowberry	x	x	x	x	x	x	x	x	x					x	x	x	x	x	x		
Symphoricarpos x chenaultii 'Hancock'	Hancock Coralberry		x	x	x	x	x	x	x	x										x		
Syringa vulgaris 'Charles Joly'	Charles Joly Lilac	x	x	x	x	x	x	x	x	x							x	x				
Syringa vulgaris 'President Grevy'	President Grevy Lilac	x	x	x	x	x	x	x	x	x							x	x				x
Syringa vulgaris 'Sensation'	Sensation Lilac	x	x	x	x	x	x	x	x	x							x	x				
Taxus cuspidata 'Monloo' EMERALD SPREADER	Emerald Spreader Japanese Yew		x	x	x	x	x	x	x	x										x		
Viburnum dentatum	Arrowwood	x	x	x	x	x	x	x	x	x	x	x					x					
Viburnum dentatum 'Ralfph Senior' AUTUMN JAZZ	Autum Jazz Viburnum	x	x	x	x	x	x	x	x	x	x	x					x					
Viburnum lentago	Nannyberry	x	x	x	x	x	x	x	x	x	x	x	x			x						
Viburnum trilobum	American Highbush Cranberry	x	x	x	x	x	x	x	x	x						x						
Viburnum x burkwoodii	Burkwood Viburnum				x	x	x	x	x	x	x	x	x							x		

Plant Select, 2018; Conservation Garden Park, 2018; Charter Township of Canton, 2006; USDA-Natural Resources Conservation Service, 2000; Missouri Botanical Garden, 2018;

Plants For A Future, 2018; Monrovia, 2018; Growing Green Guide, 2018; Central Coast Low Impact Development Initiative; San Francisco Water Power Sewer, 2016

Plants		Zones													Best Management Practices (BMPs)							
Grasses		3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	Basin Bottom	Basin Edge	Basin Upland	Swales	Strips	Bioretention Cells/ Rain Gardens	Tree Box Filters	Green Roofs
Acorus calamus	Sweet Flag		x	x	x	x	x	x	x	x	x	x	x	x		x				x		
Acorus gramineus	Grassy-Leaved Sweet Flag						x	x	x	x	x	x	x	x	x	x		x		x		
Agropyron spp.	BioNative Wheatgrass Mix		x	x	x	x	x	x	x	x							x	x	x			
Agrostis sp.	Redtop Bentgrass	x	x	x	x	x	x	x							x	x	x	x	x	x	x	
Andropogon gerardii	Big Blue Stem		x	x	x	x	x	x	x	x	x	x	x	x						x		
Andropogon gerardii 'PWIN01S'	WINDWALKER® big bluestem				x	x	x	x	x	x	x	x								x		
Bouteloua gracilis	Blue Grama	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x		x
Bouteloua gracilis 'Blonde Ambition'PP 22,048	Blonde Ambition grama grass		x	x	x	x	x	x	x	x	x	x	x	x				x	x	x		x
Buchloe dactyloides	Buffalo Grass	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x		x
Buchloe dactyloides 'Cody'	Cody Buffalo Grass	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x		x
Buchloe dactyloides 'Legacy'	Legacy Buffalo Grass	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x	x	x
Calamagrostis x acutiflora 'Avalanche'	Avalanche Feather Reed Grass		x	x	x	x	x	x	x	x	x	x	x	x								x
Calamagrostis x acutiflora 'Eldorado'	Eldorado Feather Reed Grass		x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x
Calamagrostis x acutiflora 'Karl Foerster'	Karl Foerster Feather Reed Grass		x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x
Calamagrostis x acutiflora 'Overdam'	Overdam Feather Reed Grass				x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x
Calamagrostis brachytricha	Korean feather reed grass		x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x
Carex 'Silver Sceptre'	Silver Scepter Sedge				x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	
Carex albula	Frosty Curlse Sedge								x	x	x	x	x	x								x
Carex buchananii	Fox Red Curly Sedge			x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x
Carex dolichostachya 'Kaga Nishiki'	Gold Fountains Sedge				x	x	x	x	x	x	x	x	x	x								x
Carex elata 'Aurea'	Bowles Golden Sedge		x	x	x	x	x	x	x	x	x	x	x	x								x
Carex glauca	Blue Sedge				x	x	x	x	x	x	x	x	x	x								x
Carex lacustris	Common Lake Sedge				x	x	x	x	x	x										x		
Carex lurida	Bottlebrush Sedge	x	x	x	x	x	x	x	x	x	x	x				x						
Carex morrowii 'Aurea-variegata'	Variegated Japanese Sedge				x	x	x	x	x	x	x	x	x	x								x
Carex morrowii 'Ice Dance'	Ice Dance Japanese Sedge				x	x	x	x	x	x	x	x	x	x								x
Carex oshimensis 'Everlite' Plant Patent #28,568	EverColor Everlite Variegated Sedge				x	x	x	x	x	x	x	x	x	x								x
Carex phyllocephala 'Sparkler'	Sparkler Sedge								x	x	x	x	x	x								x
Carex siderosticha 'Banana Boat'	Banana Boat Creeping Sedge				x	x	x	x	x	x	x	x	x	x								x
Carex stricata	Common Tussock Sedge	x	x	x	x	x	x	x	x	x	x	x					x					
Carex testacea	Orange New Zealand Sedge						x	x	x	x	x	x	x	x								x
Carex vulpinoidea	Brown Fox Sedge	x	x	x	x	x	x	x	x	x						x	x					
Cephalanthus occidentalis	Buttonbush				x	x	x	x	x	x	x	x	x	x						x		
Cynodon dactylon	Bermuda Grass								x	x	x	x	x	x	x	x	x	x	x	x	x	x
Decodon verticillatus	Swamp Loosestrife	x	x	x	x	x	x	x	x	x	x	x	x	x						x		
Deschampsia cespitosa 'Northern Lights'	Northern Lights Tufted Hair Grass		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Deschampsia cespitosa var. vivipara	Tufted Hair Grass		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Elocharis palustris	Creeping Spike Rush	x	x	x	x	x	x	x	x	x	x	x			x	x		x		x	x	
Elodea canadensis	Common Waterweed		x	x	x	x	x	x	x	x	x	x	x	x						x		
Elymus canadensis	Canadian Wild Rye	x	x	x	x	x	x	x	x	x	x	x				x	x					
Eriogonum caespitosum	Mat Buckwheat		x	x	x	x	x	x	x	x	x	x	x	x						x	x	
Festuca spp.	BioMeadow Fine Fescue Mix		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Festuca arundinacea	Dwarf Tall Fescue				x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x
Festuca arundinacea 'Bolero'	BioTurf Dwarf Fescue Mix				x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x
Festuca arundinacea 'Bonsai'	Bonsai Dwarf Tall Fescue				x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x
Festuca glauca	Blue Fescue		x	x	x	x	x	x	x	x	x	x	x	x			x	x		x	x	x
Festuca glauca 'Boulder Blue'	Border Blue Fescue		x	x	x	x	x	x	x	x	x	x	x	x			x	x		x		x
Festuca glauca 'Elijah Blue'	Elijah Blue Fescue		x	x	x	x	x	x	x	x	x	x						x	x	x		x
Glyceria striata	Fowl Manna Grass	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Helictotrichon sempervirens	Blue Oat Grass		x	x	x	x	x	x	x	x	x	x	x	x				x	x	x		x
Hibiscus laevis	Halberd-Leaved Rose Mallow		x	x	x	x	x	x	x	x	x	x	x	x						x		
Imperata cylindrica 'Rubra'	Japanese Blood Grass				x	x	x	x	x	x	x	x	x	x						x	x	
Juncus effusus	Common Rush		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Koeleria macrantha 'BarKoel' TURTLETURF	Turtleturf Prairie Junegrass		x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x	
Lomondra longifolia 'LM300' Plant Patent #15,420	Breeze Dwarf Mat Rush										x	x	x	x								x
Miscanthus x giganteus	Giant Chinese Silver Grass		x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x		x
Miscanthus 'Purpurascens'	Flame Grass		x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x		x
Miscanthus sacchariflorus	Silver Banner Grass				x	x	x	x	x	x	x	x	x	x			x	x	x	x		x
Miscanthus sinensis 'Adagio'	Adagio Maiden Grass				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x

Plants		Zones													Best Management Practices (BMPs)							
Grasses		3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	Basin Bottom	Basin Edge	Basin Upland	Swales	Strips	Bioretention Cells/ Rain Gardens	Tree Box Filters	Green Roofs
Miscanthus sinensis 'Cabaret'	Cabaret Japanese Silver Grass				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Miscanthus sinensis 'Gold Bar'	Gold Bar Maiden Grass				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Miscanthus sinensis 'Gracillimus'	Gracillimus Maiden Grass				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Miscanthus sinensis 'Graziella'	Graziella Maiden Grass				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Miscanthus sinensis 'Silberfeder' SILVER FEATHER	Silver Feather Maiden Grass		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Miscanthus sinensis 'Strictus'	Porcupine Grass				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Miscanthus sinensis 'varigatus'	Variegated Maiden Grass				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Miscanthus sinensis 'Punktchen' LITTLE DOT	Little Dot Maiden Grass				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Miscanthus sinensis 'Morning Light'	Morning Light Maiden Grass				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Miscanthus sinensis 'Yaku Jima'	Yaku Jima Maiden Grass				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Miscanthus sinensis 'Zebrinus'	Zebra Grass				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Muhlenbergia rigens	Deer Grass						x	x	x	x	x	x	x	x		x	x	x	x			
Nasella tenuissima	Mexican Feather Grass						x	x	x	x	x	x	x	x								x
Panicum virgatum	Switch Grass				x	x	x	x	x	x	x	x	x	x		x	x		x			
Panicum virgatum 'Dallas Blues'	Dallas Blues Switch Grass				x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	
Panicum virgatum 'Cloud Nine'	Cloud Nine Switch Grass				x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	
Panicum virgatum 'Heavy Metal'	Heavy Metal Switch Grass				x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	
Panicum virgatum 'Prairie Sky'	Prairie Sky Switch Grass		x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	
Panicum virgatum 'Rotstrahlbusch'	Red Switch Grass				x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	
Panicum virgatum 'Shenandoah'	Shenandoah Switch Grass				x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	
Panicum virgatum 'Strictum'	Upright Switch Grass		x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	
Pennisetum alopecuroides 'Little Bunny'	Little Bunny Dwarf Fountain Grass						x	x	x	x	x	x	x	x						x	x	
Pennisetum alopecuroides 'Moudry'	Black Flowering Fountain Grass				x	x	x	x	x	x	x	x	x	x						x		
Pennisetum orientale 'Karley Rose'	Karley Rose Oriental Fountain Grass				x	x	x	x	x	x	x	x								x		
Poa pratensis	BioBlue Kentucky Bluegrass Mix				x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x
Schizachyrium scoparium	Little Bluestem				x	x	x	x	x	x	x	x	x	x						x	x	x
Schizachyrium scoparium 'Blaze'	Blaze Little Bluestem		x	x	x	x	x	x	x	x	x	x	x	x						x	x	x
Schizachyrium scoparium 'MinnblueA'	Blue Heaven Little Bluestem	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Schizachyrium scoparium 'Prairie Blues'	Prairie Blues Little Bluestem		x	x	x	x	x	x	x	x	x	x	x	x						x	x	x
Schizachyrium scoparium 'Standing Ovation' PP25,202	Standing Ovation little bluestem	x	x	x	x	x	x	x	x	x	x	x								x	x	x
Scirpus atrovirens	Dark Green Rush	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x					
Spartina pectinata	Prairie Cordgrass		x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	
Sporobolus airoides	Alkali Sacaton		x	x	x	x	x	x	x	x	x	x	x	x						x	x	
Sporobolus wrightii	Giant sacaton				x	x	x	x	x	x	x	x								x	x	
Sporobolus wrightii 'Windbreaker'	Windbreaker Giant Sacaton				x	x	x	x	x	x	x	x	x	x						x	x	

Plant Select, 2018; Conservation Garden Park, 2018; Charter Township of Canton, 2006; USDA-Natural Resources Conservation Service, 2000; Missouri Botanical Garden, 2018;

Plants For A Future, 2018; Monrovia, 2018; Growing Green Guide, 2018; Central Coast Low Impact Development Initiative; San Francisco Water Power Sewer, 2016

Plants		Zones													Best Management Practices (BMPs)							
Perennials		3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	Basin Bottom	Basin Edge	Basin Upland	Swales	Strips	Bioretention Cells/ Rain Gardens	Tree Box Filters	Green Roofs
Achillea millefolium 'Lilac Beauty'	Lilac Beauty Yarrow	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x			x
Achillea millefolium 'Little Susie'	Little Susie Yarrow	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x			x
Achillea millefolium 'Paprika'	Paprika Yarrow	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x			x
Achillea millefolium 'Pink Grapefruit'	Pink Grapefruit Yarrow	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x			x
Agalinus tenuifolia	Slender False Foxglove	x	x	x	x	x	x	x	x	x	x	x	x	x			x					
Agastache 'Blue Fortune'	Blue Fortune Hyssop				x	x	x	x	x	x	x	x	x	x								x
Agastache 'Desert Sunrise'	Desert Sunrise Hummingbird Mint				x	x	x	x	x	x	x	x	x	x								x
Agastache 'Kudos Gold'	Kudos Gold Dwarf Hummingbird Mint				x	x	x	x	x	x	x	x	x	x								x
Agastache 'Pink Pop'	Pink Pop Hummingbird Mint				x	x	x	x	x	x	x	x	x	x								x
Agastache 'Pstessene'	CORONADO® Red hyssop				x	x	x	x	x	x	x	x	x	x								x
Agastache 'Summer Glow'	Giant Hyssop				x	x	x	x	x	x	x	x	x	x								x
Agastache aurantiaca	Orange Hummingbird Mint				x	x	x	x	x	x	x	x	x	x								x
Agastache aurantiaca 'Apricot Sprite'	Apricot Sprite Hyssop				x	x	x	x	x	x	x	x	x	x								x
Agastache aurantiaca 'Coronado'	Coronado Hummingbird Mint				x	x	x	x	x	x	x	x	x	x								x
Agastache aurantiaca 'P012S'	CORONADO® hyssop				x	x	x	x	x	x	x	x	x	x								x
Agastache cana 'Sinning' PP 13,673	SONORAN SUNSET® hyssop				x	x	x	x	x	x	x	x	x	x								x
Agastache foeniculum 'Golden Jubilee'	Golden Jubilee Hyssop		x	x	x	x	x	x	x	x	x	x										x
Agastache rupestris	Sunset hyssop			x	x	x	x	x	x	x	x	x	x	x								x
Agastache x 'Blue Boa'	Blue Boa Hummingbird Mint				x	x	x	x	x	x	x	x	x	x								x
Angelica atropurpurea	Great Angelica		x	x	x	x	x	x	x	x							x					
Aguilegia caerulea	Rocky Mountain Columbine	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x	
Aquilegia formosa	Western Columbine	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x	
Aquilegia McKana Group	McKana Hybrid Columbine	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x	
Allium schoenoprasum	Chives		x	x	x	x	x	x	x	x	x	x										x
Armeria maritima 'Bloodstone'	Bloodstone Thrift	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x	x
Armeria maritima 'Cotton Tail'	Cotton Tail Thrift	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x	x
Armeria maritima 'Düsseldorfer Stolz' DUSSELDORF PRIDE	Dusseldorf Pride Thrift	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x	x
Armeria maritima 'Rubifolia'	Red Leaf Thrift	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x	x
Armeria maritima 'Splendens'	Splendens Common Thrift	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x	x
Asarum caudatum	Wild Ginger								x	x	x	x	x	x	x	x		x		x	x	
Asclepias incarnata	Swamp Milkweed	x	x	x	x	x	x	x								x	x					
Ceratostigma plumbaginoides	Blue Plumbago				x	x	x	x	x	x	x	x	x	x								x
Coreopsis tripteris	Tall Coreopsis	x	x	x	x	x	x	x	x	x	x	x					x					
Delosperma cooperi 'Eye Candy' Patent Applied For	Eye Candy Ice Plant								x	x	x	x	x	x								x
Delosperma cooperi 'Jewel of Desert'	Jewel of Desert Ice Plant				x	x	x	x	x	x	x	x	x	x								x
Delosperma cooperi 'Jewel of the Desert Garnet'	Jewel of the Desert Garnet Icepant				x	x	x	x	x	x	x	x	x	x								x
Delosperma cooperi 'Jewel of the Desert Topaz'	Jewel of the Desert Topaz Ice Plant				x	x	x	x	x	x	x	x	x	x								x
Delosperma cooperi 'Perfect Orange' Plant Patent Applied For	Perfect Orange Ice Plant								x	x	x	x	x	x								x
Delosperma cooperi 'WOWDOY3' Plant Patent #25,600	Wheels of Wonder Orange Wonder Ice Plant				x	x	x	x	x	x	x	x	x	x								x
Delosperma cooperi 'WOWDRW5' Plant Patent #25,572	Wheels of Wonder Violet Wonder Ice Plant				x	x	x	x	x	x	x	x	x	x								x
Eupatorium maculatum	Spotted Joe-Pye Weed		x	x	x	x	x	x	x	x	x	x					x					
Eupatorium perfoliatum	Common Boneset	x	x	x	x	x	x	x	x	x	x	x				x	x					
Euphorbia rigida	Spurge								x	x	x	x	x	x			x					x
Gentiana andrewsii	Bottle Gentian	x	x	x	x	x	x	x	x	x							x					
Guara lindheimeri	Bee Blossom				x	x	x	x	x	x	x	x	x	x								x
Helenium autumnale	Sneezeweed	x	x	x	x	x	x	x	x	x	x	x				x	x					
Heuchera micrantha var. diversifolia 'Palace Purple'	Palace Purple Coral Bells		x	x	x	x	x	x	x	x	x	x	x	x		x			x			
Iris virginica shrevei	Blue Flag Iris				x	x	x	x	x	x	x	x	x	x		x	x			x		
Lavandula angustifolia	English Lavendar				x	x	x	x	x	x	x	x				x	x	x				x
Lavandula angustifolia 'Armtipp01' Plant Patent #24,827	Big Time Blue English Lavender				x	x	x	x	x	x	x	x	x	x		x	x					x
Lavandula angustifolia 'Betty's Blue'	Betty's Blue Lavender						x	x	x	x	x	x	x	x		x	x					x
Lavandula angustifolia 'Granny's Bouquet'	Granny's Bouquet Lavender		x	x	x	x	x	x	x	x	x	x				x	x	x				x
Lavandula angustifolia 'Hidecote'	Hidcote True Lavender				x	x	x	x	x	x	x	x				x	x	x				x
Lavandula angustifolia 'Lavance Purple'	Lavance Purple Lavender				x	x	x	x	x	x	x	x	x	x		x	x	x				x
Lavandula angustifolia 'Munstead'	Munstead Lavender				x	x	x	x	x	x	x	x				x	x	x				x
Lavandula angustifolia 'Thumbelina Leight'	Thumbelina Leigh English Lavender				x	x	x	x	x	x	x	x	x	x		x	x					x
Lavandula angustifolia 'Pastor's Pride'	Pastor's Pride Lavender				x	x	x	x	x	x	x	x	x	x		x	x					x
Lavandula angustifolia 'Wee One'	Wee One dwarf English lavender				x	x	x	x	x	x	x	x	x	x		x	x	x				x

Plants		Zones													Best Management Practices (BMPs)							
Perennials		3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	Basin Bottom	Basin Edge	Basin Upland	Swales	Strips	Bioretention Cells/ Rain Gardens	Tree Box Filters	Green Roofs
Lavandula x ginginsii 'Goodwin Creek Gray'	Goodwin Creek Gray Lavender								x	x	x	x	x	x		x	x					x
Lavandula x intermedia 'Provence'	Provence French Lavender				x	x	x	x	x	x	x	x	x	x		x	x					x
Lobelia siphilitica	Great Blue Lobelia		x	x	x	x	x	x	x	x	x	x	x	x			x					
Ludwigia alternifolia	Seedbox		x	x	x	x	x	x	x	x	x	x				x	x					
Mimulus cardinalis	Scarlet Monkey Flower								x	x	x	x	x	x		x			x			
Mimulus ringens	Mondey Flower	x	x	x	x	x	x	x	x	x	x	x				x						
Nepeta 'Pstike' PP 18,904	LITTLE TRUDY® catmint		x	x	x	x	x	x	x	x	x	x	x	x								x
Nepeta racemosa 'Blue Wonder'	Blue Wonder Catmint															x	x					x
Nepeta x faassenii 'Junior Walker'	Junior Walker Catmint					x	x	x	x	x	x	x	x	x		x	x					x
Nepeta x faassenii 'Novanepjun' Plant Patent #23,074	Junior Walker Catmint				x	x	x	x	x	x	x	x	x	x		x	x					x
Nepeta x faassenii 'Walker's Low'	Walker's Low Catmint		x	x	x	x	x	x	x	x	x	x	x	x		x	x					x
Ocimum basilicum 'Boxwood'	Boxwood Basil												x	x								x
Ocimum basilicum 'Fino Verde'	Fino Verde Basil												x	x								x
Origanum distamnus	Dittany of Crete								x	x	x	x	x	x								x
Origanum vulgare	Oregano		x	x	x	x	x	x	x	x	x	x							x			x
Peltandra virginica	Arrow Arrum				x	x	x	x	x	x	x	x	x	x		x	x					
Penstemon 'Dark Towers'	Dark Towers Penstemon				x	x	x	x	x	x	x	x				x						
Penstemon 'Midnight Blue'	Midnight Blue Penstemon			x	x	x	x	x	x	x	x	x				x						
Penstemon x 'Coral Baby'	Coral Baby penstemon				x	x	x	x	x	x	x	x				x						
Penstemon barbatus 'Elfin Pink'	Elfin Pink Penstemon		x	x	x	x	x	x	x	x	x	x				x						
Penstemon barbatus 'Navigator'	Navigator Penstemon		x	x	x	x	x	x	x	x	x	x				x						
Penstemon digitalis 'Husker Red'	Husker Red Penstemon	x	x	x	x	x	x	x	x	x	x	x				x						
Penstemon fruticosus 'Purple Haze'	Purple Haze Penstemon				x	x	x	x	x	x	x	x				x						
Penstemon grandiflorus 'P010S'	PRAIRIE JEWEL® penstemon	x	x	x	x	x	x	x	x	x	x	x	x	x		x						
Penstemon grandiflorus 'Prairie Jewel'	Prairie Jewel Penstemon	x	x	x	x	x	x	x	x	x	x	x	x	x		x						
Penstemon heterophyllus 'Margarita BOP'	Margarita BOP Penstemon						x	x	x	x	x	x	x	x		x						
Penstemon linarioides ssp. coloradoensis 'P014S'	SILVERTON® bluemat penstemon		x	x	x	x	x	x	x	x	x	x	x	x		x						
Penstemon mensarum	Grand Mesa beardtongue	x	x	x	x	x	x	x	x	x	x	x	x	x		x						
Penstemon pseudospectabilis	Desert beardtongue				x	x	x	x	x	x	x	x	x	x		x						
Penstemon rostriflorus	Bridges' penstemon			x	x	x	x	x	x	x	x	x				x						
Penstemon x mexicali 'Carolyn's Hope' PPAF	Carolyn's Hope pink penstemon			x	x	x	x	x	x	x	x	x				x						
Penstemon x mexicali 'Pike's Peak Purple'	Pike's Peak Purple Beardtongue															x						
Penstemon x mexicali 'Psmyers'	SHADOW MOUNTAIN® penstemon			x	x	x	x	x	x	x	x	x				x						
Penstemon x mexicali 'PWIN02S'	WINDWALKER® garnet penstemon			x	x	x	x	x	x	x	x	x				x						
Penstemon x mexicali 'P007S'	PIKES PEAK PURPLE® penstemon			x	x	x	x	x	x	x	x	x				x						
Penstemon x mexicali 'P008S'	RED ROCKS® penstemon			x	x	x	x	x	x	x	x	x				x						
Physotegia virginiana	Obedient Plant	x	x	x	x	x	x	x	x	x	x	x	x	x			x					
Pontederia cordata	Pickerel Weed	x	x	x	x	x	x	x	x	x	x	x	x	x		x						
Pycnanthemum muticum	Mountain Mint		x	x	x	x	x	x	x	x							x					
Pycanthemum virginianum	Common Mountain Mint	x	x	x	x	x	x	x	x	x							x					
Rudbeckia laciniata	Wild Golden Glow	x	x	x	x	x	x	x	x	x	x	x	x	x		x						
Rosa rugosa	Pink Rugosa Rose	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Rumex sanguineus ssp. sanguineus	B+B392loody Sorrel/ Red Dock						x	x	x	x	x	x	x	x								x
Sagittaria latifolia	Common Arrowhead				x	x	x	x	x	x	x	x	x	x		x	x					
Salvia microphylla x greggii 'EGGBEN001' Plant Patent #24,152	Heatwave Glitter Sage						x	x	x	x	x	x	x	x								x
Salvia microphylla x greggii 'EGGBEN003' Plant Patent #24,155	Heatwave Glimmer Sage						x	x	x	x	x	x	x	x								x
Salvia microphylla x greggii "EGGBEN004' Plant Patent #24154	Heatwave Sparkle Sage						x	x	x	x	x	x	x	x								x
Salvia microphylla x greggii 'EGGBEN005' Plant Patent #24,151	Heatwave Blaze Sage						x	x	x	x	x	x	x	x								x
Salvia nemorosa 'Blue Marvel'	Blue Marvel Sage		x	x	x	x	x	x	x	x	x	x	x	x								x
Salvia nemorosa 'Rose Marvel' Plant Patent Applied For	Rose Marvel Salvia			x	x	x	x	x	x	x	x	x	x	x								x
Santolina virens	Green Lavender Cotton										x	x	x	x								x
Santolina virens 'Lemon Fizz'	Lemon Fizz Lavender Cotton								x	x	x	x	x	x								x
Sedum 'Cherry Tart' Plant Patent #24,603	Sunsparkler Cherry Tart Stonecrop		x	x	x	x	x	x	x	x	x	x	x	x								x
Sedum '17-03' Pink Plant Patent Applied For	Purple Crush Stonecrop		x	x	x	x	x	x	x	x	x	x	x	x								x
Sedum album chloroticum 'Baby Tears'	Baby Tears Stonecrop		x	x	x	x	x	x	x	x	x	x	x	x								x
Sedum aldolphii	Golden Sedum										x	x	x	x								x
Sedum oreganum	Oregon Stonecrop	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Sedum spathulifolium	Broadleaf Stonecrop		x	x	x	x	x	x	x	x	x	x	x	x		x	x					x

Plants		Zones													Best Management Practices (BMPs)							
Perennials		3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	Basin Bottom	Basin Edge	Basin Upland	Swales	Strips	Bioretention Cells/ Rain Gardens	Tree Box Filters	Green Roofs
Sedum spurium 'Bronze Carpet'	Bronze Carpet Stonecrop	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Sedum spurium 'Schorbuser Blut'	Dragon's Blood Stonecrop	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Sedum rupestre 'Variegated'	Variegated Stonecrop	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Sedum x cremnosedum 'Little Gem'	Little Gem Stonecrop										x	x	x	x								x
Sidalcea 'Party Girl'	Party Girl Prairie Mallow				x	x	x	x	x	x						x	x		x			
Silphium perfoliatum	Cup Plant	x	x	x	x	x	x	x	x	x	x	x	x	x			x					
Sisyrinchium 'Devon Skies'	Devon Skies Blue-Eyed Grass								x	x	x	x	x	x								x
Sisyrinchium angustifolium 'Lucerne'	Lucerne Blue-Eyed Grass				x	x	x	x	x	x	x	x	x	x								x
Solidago rugosa 'Fireworks'	Fireworks Goldenrod		x	x	x	x	x	x	x	x	x	x	x	x			x					
Stachys byzantina 'Helen von Stein'	Helen von Stein Lamb's Ear		x	x	x	x	x	x	x	x	x	x				x	x		x			
Stachys byzantina 'Primrose Heron'	Primrose Heron Lambs Ear		x	x	x	x	x	x	x	x	x	x				x	x		x			
Symphyotrichum novae-angliae	New England Aster		x	x	x	x	x	x	x	x	x	x					x					
Symphyotrichum puniceum	Swamp Aster	x	x	x	x	x	x	x	x	x	x	x	x	x			x					
Thymus argenteus 'Hi Ho Silver'	Hi Ho Silver Thyme				x	x	x	x	x	x	x	x	x	x								x
Thymus pseudolanuginosus	Woolly Thyme				x	x	x	x	x	x	x	x				x	x		x			x
Thymus serpyllum	Creeping Thyme					X	X	X	X	X	X	X	X	X								x
Thymus serpyllum 'Elfin'	Elfin Thyme					X	X	X	X	X	X	X	X	X								x
Thymus serpyllum 'Pink Chintz'	Pink Chintz Thyme				X	X	X	X	X	X	X	X	X	X								x
Thymus vulgaris	English Thyme				x	x	x	x	x	x	x	x	x	x								x
Typha latifolia	Broadleaf Cattail	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x		x		
Verbena hastata	Blue Verain	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	
Vernonia fasciculata	Common Ironweed		x	x	x	x	x	x	x	x	x	x	x	x		x	x					
Zizia aurea	Golden Alexander	x	x	x	x	x	x	x	x	x	x	x					x					

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Plants		Zones													Best Management Practices (BMPs)							
Groundcovers		3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	Basin Bottom	Basin Edge	Basin Upland	Swales	Strips	Bioretention Cells/ Rain Gardens	Tree Box Filters	Green Roofs
Ajuga x 'Toffe Chip' Plant Patent # 18,805	**Toffe Chip Carpet Bugle**		x	x	x	x	x	x	x	x	x	x	x	x								x
Campanula 'Samantha'	Samantha Bellflower				x	x	x	x	x	x	x	x	x	x								x
Diachondra repens	Diochondra								x	x	x	x	x	x	x	x		x		x	x	x
Delosperma 'Strong Red'	Strong Red Ice Plant								x	x	x	x	x	x								x
Delosperma coperi 'Jewel of Desert Garnet' Plant Patent #23, 471	Jewel of Desert Garnet Ice Plant				x	x	x	x	x	x	x	x	x	x								x
Delosperma coperi 'Jewel of Desert Moonstonet' Plant Patent #23, 49	Jewel of Desert Moonstone Ice Plant				x	x	x	x	x	x	x	x	x	x								x
Juniperus horizontalis 'Bar Harbor'	Bar Harbor Juniper	x	x	x	x	x	x	x	x	x	x	x								x		x
Juniperus horizontalis 'Hughes'	Hughes Juniper	x	x	x		x	x	x	x	x	x	x	x	x						x		x
Juniperus horizontalis 'Plumosa Compacta'	Compact Plumosa Juniper	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Juniperus horizontalis 'Prince of Wales'	Prince of Wales Juniper	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Juniperus horizontalis 'Youngstown'	Youngstown Andorra Juniper	x	x	x	x	x	x	x	x	x	x	x	x	x								x
Juniperus sabina 'Buffalo'	Buffalo Juniper	x	x	x	x	x	x	x	x	x	x	x										x
Juniperus sabina 'Skandia'	Skandia Juniper		x	x	x	x	x	x	x	x												x
Nepeta racemosa 'Walker's Low'	Walker's Low Catmint		x	x	x	x	x	x	x	x	x	x	x	x						x	x	
Nepeta sibirica 'Souvenir d' Andre Chaudron'	Souvenir d Andre Chaudron Catmint	x	x	x	x	x	x	x	x	x	x	x	x	x						x	x	x
Nepeta x faassenii 'Select Blue'	Select Blue Catmint		x	x	x	x	x	x	x	x	x	x	x	x						x	x	
Nepeta 'Psfike'	Little Trudy Catmint		x	x	x	x	x	x	x	x	x	x	x	x						x	x	
Teucrium chamaedrys 'Prostratum'	Compact Creeping Germander				x	x	x	x	x	x	x	x	x	x						x		
Veronica armeria	Thyme-leaf Speedwell		x	x	x	x	x	x	x	x	x	x	x	x						x		x
Veronica liwanensis	Turkish veronica	x	x	x	x	x	x	x	x	x	x	x	x	x						x		x
Veronica 'Reavis'	CRYSTAL RIVER® veronica	x	x	x	x	x	x	x	x	x										x		
Veronica x 'P018S'	SNOWMASS® blue-eyed veronica	x	x	x	x	x	x	x	x	x	x	x	x	x						x		

Plant Select, 2018; Conservation Garden Park, 2018; Charter Township of Canton, 2006; USDA-Natural Resources Conservation Service, 2000; Missouri Botanical Garden, 2018;

Plants For A Future, 2018; Monrovia, 2018; Growing Green Guide, 2018; Central Coast Low Impact Development Initiative; San Francisco Water Power Sewer, 2016

Plants		Zones													Best Management Practices (BMPs)							
Vines		3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	Basin Bottom	Basin Edge	Basin Upland	Swales	Strips	Bioretention Cells/ Rain Gardens	Tree Box Filters	Green Roofs
Aristolochia californica	Pipe Vine										x	x	x	x		x		x				
Campsis radicans f. flava	Yellow Trumpetvine				x	x	x	x	x	x	x	x	x	x						x		
Clematis ligusticifolia	Western White Clematis				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Vitis labrusca 'Concord'	Concord Grape				x	x	x	x	x	x	x	x					x	x	x	x		
Vistis labrusca 'Niagara'	Niagara Grape				x	x	x	x	x	x	x	x					x	x	x	x		
Vitis labrusca 'Niagara'	Niagara Grape				x	x	x	x	x	x	x	x					x	x	x	x		
Vitis 'Himrod'	Himrod Grape				x	x	x	x	x	x	x	x					x	x	x	x		
Vistis 'St. Theresa'	St. Theresa Grape				x	x	x	x	x	x	x	x					x	x	x	x		
Vitis x 'St. Theresa Seedless'	St. Theresa seedless grape		x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x		

Plant Select, 2018; Conservation Garden Park, 2018; Charter Township of Canton, 2006; USDA-Natural Resources Conservation Service, 2000; Missouri Botanical Garden, 2018;

Plants For A Future, 2018; Monrovia, 2018; Growing Green Guide, 2018; Central Coast Low Impact Development Initiative; San Francisco Water Power Sewer, 2016

Plants		Zones												Best Management Practices (BMPs)							
Cacti & Succulents		3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b	9a	9b	Basin Bottom	Basin Edge	Basin Upland	Swales	Strips	Bioretention Cells/ Rain Gardens	Tree Box Filters	Green Roofs
Aloe 'Carmine'	Retro Succulents Carmine Aloe												x	x								x
Aloe 'Donnie'	Retro Succulents Donnie Aloe												x	x								x
Aloe 'Guido'	Retro Succulents Guido Aloe												x	x								x
Aloe 'Pink Blush'	Pink Blush Aloe												x	x								x
Aloe 'Sal'	Retro Succulents Sal Aloe												x	x								x
Asclepias speciosa Torr.	Showy Milkweed				x	x	x	x	x	x	x	x	x	x	x	x		x		x	x	
Echeveria agavoides 'Lipstick'	Lipstick Echeveria												x	x								x
Echeveria elegans	Mexican Snowball												x	x								x
Echeveria imbricata	Blue Rose Echeveria												x	x								x
Echeveria setosa	Firecracker Echeveria												x	x								x
Echeveria shaviana	Mexican Hens Echeveria												x	x								x
Echeveria 'Black Prince'	Black Prince Echeveria												x	x								x
Echeveria 'Perle von Nurnberg'	Perle von Nurnberge Echeveria												x	x								x
Echeveria 'Ruffles'	Ruffles Echeveria												x	x								x
Hesperaloe parviflora	Red yucca				x	x	x	x	x	x	x	x	x	x								x
Hesperaloe parviflora 'Perpa'	Brakelights Red Yucca				x	x	x	x	x	x	x	x	x	x								x
Hesperaloe parviflora 'Yellow'	Yellow Yucca				x	x	x	x	x	x	x	x	x	x								x
Sempervivum arachnoideum 'Cebenese'	Cebenese Cobweb Houseleek		x	x	x	x	x	x	x	x	x	x	x	x								x
Sempervivum tectorum ssp. greenii	Greenii Hens and Chicks		x	x	x	x	x	x	x	x	x	x	x	x								x
Sempervivum 'Jade Rose'	Jade Rose Hens and Chicks		x	x	x	x	x	x	x	x	x	x	x	x								x
Sempervivum 'Royal Ruby'	Royal Ruby Hens and Chicks		x	x	x	x	x	x	x	x	x	x	x	x								x
Sempervivum ' Silver King'	Silver King Houseleek		x	x	x	x	x	x	x	x	x	x	x	x								x
Yucca filamentosa	Adam's Needle				x	x	x	x	x	x	x	x	x	x						X		
Yucca filamentosa 'Bright Edge'	Bright Edge Yucca		x	x	x	x	x	x	x	x	x	x	x	x						X		

Plant Select, 2018; Conservation Garden Park, 2018; Charter Township of Canton, 2006; USDA-Natural Resources Conservation Service, 2000; Missouri Botanical Garden, 2018;
Plants For A Future, 2018; Monrovia, 2018; Growing Green Guide, 2018; Central Coast Low Impact Development Initiative; San Francisco Water Power Sewer, 2016

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APPENDIX C – STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURES

Hooper City

Last Update: July 2026
Weber County Storm Water Coalition

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BUILDINGS – Dumpsters/Garbage Storage

1. Preparation.

a. Train employees on proper trash disposal.

b. Locate dumpsters and trash cans in convenient, easily observable areas.

c. Provide properly labeled recycling bins to reduce the amount of garbage disposed.

d. Install berms, curbing, or vegetation strips around storage areas to control water entering/ leaving storage areas.

e. Whenever possible store garbage containers beneath a covered structure or inside to prevent contact with storm water.

2. Process.

a. Inspect garbage bins for leaks regularly, and have repairs made immediately by responsible party.

b. Request/use dumpsters, and trash cans with lids and without drain holes.

c. Locate dumpsters on a flat, hard surface that does not slope or drain directly into the storm drain system.

3. Clean-up.

a. Keep areas around dumpsters clean of all garbage.

b. Have garbage bins emptied regularly to keep from overfilling.

c. Wash out bins or dumpsters as needed to keep odors from becoming a problem.

4. Documentation

a. Document training of employees.

BUILDINGS – Parking Lot Maintenance

1. Preparation.

a. Conduct regular employee training to reinforce proper housekeeping.

b. Restrict parking in areas to be swept prior to and during sweeping using regulations as necessary.

c. Perform regular maintenance and services in accordance with the recommended vehicle maintenance schedule on sweepers to increase and maintain efficiency.

2. Process.

a. Sweep parking areas, as needed, or as directed by the city's responsible official.

b. Hand sweep sections of gutter if soil and debris accumulate.

c. Pick-up litter as required to keep parking areas clean and orderly.

3. Clean-up.

a. Dispose of sweepings properly at the Ogden Transfer Station

b. Street sweepers to be cleaned out in a manner as instructed by the manufacturer and in a location that swept materials cannot be introduced into a stormdrain.

c. Swept materials will not be stored in locations where storm water could transport fines into the stormdrain system.

d. Vehicles need to be washed according to the **VEHICLES – Washing** SOP

4. Documentation.

e. Keep accurate logs to track swept parking areas and approximate quantities.

f. Document training of employees.

IDDE - Call-in Inspections

1. Preparation

a. Have a system in place to receive phone calls and collect information regarding suspected illicit discharges**.**

2. Process

a. Use the Incident Tracking Sheet to collect the appropriate information from the caller. Then, transfer the Incident Tracking Sheet to the proper authority following the IDDE flow chart (ie. department head, stormwater specialist, construction inspector, code enforcement officer, or other assigned personnel).

b. Promptly investigate reported incidents**.**

c. If an illicit discharge of unknown source is confirmed, follow the procedure of **SOP IDDE - Tracing Illicit Discharges.**

d. an illicit discharge known source is confirmed, follow the procedure of **SOP IDDE - Removing Illicit Discharges.**

3. Clean up

a. Clean catch basin, clean storm drain, or initiate spill response, as applicable. Follow relevant SOPs**.**

4. Documentation

a. File all completed forms (ie. incident tracking, catch basins cleaning, storm drain cleaning.

b. Document any further action taken.

c. Review incidents reported by citizens on an annual basis to look for patterns of illicit discharges and to evaluate the call-in inspection program.

IDDE - Opportunistic Illicit Discharge Observation

1. Preparation

a. Be alert for potential illicit discharges to the municipal storm water system while going about normal work activities.

2. Process

a. Call the appropriate authority (ie. department head, stormwater specialist, construction inspector, code enforcement officer or a supervisor) following the IDDE response flow chart if you see evidence of an illicit discharge.

b. Assess the general area of the illicit discharge to see if you can identify its source.

c. Whenever possible, take photographs of the suspected illicit discharge.

d. Responding stormwater department personnel or code enforcement officer will

e. complete the following:

i. Use the IDDE Incident Tracking database on field maps to document observations.

ii. Obtain sample for visual observation and complete an Outfall Inspection Form, if applicable.

iii. Follow the procedure of **SOP IDDE - Tracing Illicit Discharges**.

3. Clean-up

a. Clean catch basin, clean storm drain, or initiate spill response, as needed. Follow relevant SOPs.

4. Documentation

a. File all completed forms (ie. Incident Tracking Form, Outfall Inspection Form, Catch Basin Cleaning Form, and Storm Drain Cleaning Log).

b. Document any further action taken.

IDDE – Outfall/Discharge Inspection and Characterization

1. Preparation

a. Make sure you have the following supplies for the field work:

i. Camera, flashlight, nitrile gloves, waterproof boots or waders, tape measure, phone, watch (with stopwatch), GPS, and map(s) showing drainage system and outfalls in the area you plan to screen

ii. pH and ammonia testers, thermometer, clear sample bottle(s), ziplock bags, and caulk or plumbers' putty

b. Notify private property owners whose property you'll need to be crossing

2. Process

a. Upon arrival at each outfall/discharge, take photo(s), and gather information

b. Use the data and guideline observed, collected and recorded on *characterizing illicit discharge inspection form* to characterize the outfall/discharge as an "unlikely," "potential," "suspect," or "obvious" point of illicit discharge

i. if outfall is non-flowing and characterized as "obvious," "suspect," or "potential," place a caulk dam and schedule a return visit to attempt to collect a sample

ii. if characterized as "obvious," follow *spill incident response and reporting procedures* and assist responders in containing the discharge. Then initiate *SOP* ***IDDE - Tracing Illicit Discharges***

iii. if outfall is flowing and characterized as suspect, initiate *SOP* ***– IDDE - Tracing Illicit Discharges*** within two working days.

iv. Once Illicit discharge source is determined immediately initiate **IDDE - Removing Illicit Discharges** SOP.

3. Clean-up

a. Place used gloves and other waste in bag and carry-out for disposal into waste bin.

b. If any hazardous waste is produced (eg. used detergent/surfactant reagent), carry out and arrange for delivery to a hazardous waste facility.

4. Documentation

a. Record any further actions taken for potential, suspect, and obvious illicit discharges

b. Note any discrepancies in the storm drain system maps from what is found in the field. Make sure that the maps get updated to correctly reflect actual conditions

IDDE – Containing and Removing Illicit Discharges

1. Preparation

a. Notify Weber County Health Department (801) 399-7160 and seek their guidance on how to proceed

b. Obtain available property ownership information for the source of the illicit discharge.

2. Process

a. Determine the risk to human health following **IDDE – Outfall/Discharge Inspection and Characterization** and receiving guidance from the Weber County Health Department to determine what PPE will be needed to enter the site of a spill.

b. Stop the discharge source if possible

i. If it is determined safe to do so look for valves and pumps that could be shut off to stop the flow

ii. If feasible and safe to do so plug or patch any leaking containers or pipes

c. Block the flow

i. Use spill kits and/or sandbags to contain the spill

ii. Put additional attention to both artificial and natural waterway inlets. If an inlet is nearby put additional sandbags around those inlets to block and divert any possible discharge.

d. Coordinate with Weber County Health Department and Weber County Fire to clean up and dispose of spill. Document all actions taken, and any costs incurred.

e. Assist Weber County Health Department to determine who is financially responsible; and follow associated procedures as given below.

For Private Property Owner:

Contact Owner,

Issue Notice of Violation for violations of the municipal ordinance, and Determine schedule for removal.

For Municipal Facility:

Notify appropriate municipal authority or department head,

Schedule removal, and

Remove illicit connection.

f. Suspend access to storm drain if threats of serious physical harm to humans or the environment are possible.

g. Direct responsible party to initiate repairs/corrections/cleanup. Coordinate with Public Works Director for escalating penalties in accordance with the municipal ordinance.

h. Repair/correct cause of discharge if municipality is responsible. Schedule the work through the appropriate supervisor.

i. Seek technical assistance from the Weber County Health Department

j. Initiate **IDDE – Escalating Eforcement** SOP.

3. Clean up

a. Confirm illicit discharge is removed or eliminated by follow-up inspection.

b. Ensure all materials used to contain illicit discharge is disposed of correctly.

4. Documentation

a. Maintain records of notice of violation, penalties, and correspondence.

b. Document repairs, corrections, and any other actions required.

IDDE – Removing Illicit Discharges (not associated with construction activity)

1. Preparation

a. Make sure reporting has been done according to SOP *spill incident response and reporting procedures*

b. Begin completing a SOP *Discharge/Spill Inspection Report*

2. Process

a. If the discharge is due to a sewer cross connection:

i. Determine the responsible party for the discharge

ii. Initiate **IDDE – Escalating Eforcement** SOP.

b. For other discharges contact the Weber County Health Department - Environmental Division for removing the discharge and bringing enforcement action to violator

i. a. Assist county personnel as needed in determining the responsible party, providing utility information and providing other screening or investigation information gathered regarding the discharge

ii. Offer technical assistance to the violator; help them understand how to go about correcting the problem

iii. Follow-up as needed to ensure that the discharge has been removed. If violator fails to remove the discharge bring criminal enforcement action.

iv. If unable to immediately contain and/or cease the discharge, record the circumstances and submit a written rationale to the Division of Water Quality (see 2025 MS4 permit 4.2.3.6.3)

c. Initiate **IDDE – Escalating Eforcement** SOP.

3. Documentation

a. Complete *Discharge/Spill Inspection Report* and/or obtain a copy of the discharge report from the Weber County Health Department - Environmental Division

b. If unable to immediately contain and cease the discharge, write a rationale describing the circumstances and submit it to the Utah Division of Water Quality (e.g. for failing septic system).

IDDE – Escalating Eforcement

1. Preparation

a. Gather documentation from spill response which may include:

i. Inspection forms

ii. Health Department report

iii. Police Reports

iv. Pictures of the discharge

b. The enforcement official for Hooper City is the stormwater coordinator

2. Process

a. Issue a notice of violation in compliance with HCC 6-4-7 A notice of Violation will differ depending on the nature and severity of the spill. Listed below are the options that the city may require to be done.

i. Performance of monitoring analyses and reporting

ii. Elimination of illicit connections and discharges

iii. The violating discharges, practices, or operations to cease and desist

iv. The abatement or remediation of storm water pollution or contamination hazards and the restoration of any affected property

v. Payment to cover administrative, remediation, monitoring, analysis, and reporting costs

vi. Implementation of source control BMPs

b. All notices of violation require a response from the violator in no more than 1 week. The response needs to have deadlines that eliminate the discharge as soon as practicable to meet the requirements of the Notice of Violation. Responses are subject to City Council approval.

c. Any notice of violation is not to be lifted until full clean up of site is complete, proper disposal is documented, inspection is performed by city inspector and approved by the Public Works Director and preventative measures are in place if applicable.

d. If a notice of violation has been given and a problem persists past the deadline given the following options are available to escalate:

i. Press charges for a class C misdemeanor

ii. Issue a stop work order

iii. Install or maintain erosion and sediment control measures and send and bill for city time with a 25% additional penalty fee

iv. Require any damages to non-city property to be fixed

Documentation

a. Keep records of any communication between the violator and any city staff saved in the file server

b. Records of any notice of violation or stop work orders should be recorded on ArcGIS and any documents saved on the file server.

IDDE - Tracing Illicit Discharges

1. Preparation

a. Review / consider information collected when illicit discharge was initially identified and document using Incident Tracking Form or Outfall Inspection Form.

b. Obtain storm drain mapping for the area of the reported illicit discharge.

c. Gather all necessary equipment including: tape measure, clear container, clipboard with necessary forms, flashlight, and camera (optional).

2. Process

a. Survey the general area / surrounding properties to identify potential sources of the illicit discharge as a first step.

b. Trace illicit discharges using visual inspections of upstream points as a second step. Use available mapping to identify tributary pipes, catch basins, etc.

c. If the source of the illicit discharge cannot be determined by a survey of the area or observation of the storm drain system, then consider the following additional steps:

i. Use weirs, sandbags, dams, or optical brightener monitoring traps to collect or pool intermittent discharges during dry weather.

ii. Smoke test or televise the storm drain system to trace high priority, difficult to detect illicit discharges.

iii. Dye test individual discharge points within suspected buildings.

iv. Consider collecting bacterial samples of flowing discharges to confirm/refute illicit discharge.

d. If the source is located, follow SOP **IDDE - Removing Illicit Discharges**.

e. If the source cannot be found, add the location to a future inspection program.

3. Clean up

a. Clean catch basin, clean storm drain, or initiate spill response, as applicable. Follow relevant SOPs.

4. Documentation

a. Document tracing results for future reference.

PARKS – Chemical Application Pesticides, Herbicides, Fertilizers

1. Preparation

a. Make sure your state Chemical Handling Certification is complete and up-to-date before handling any chemicals that require it.

b. Calibrate fertilizer and pesticide application equipment to avoid excessive application.

c. Use pesticides only if there is an actual pest problem and periodically test soils for determining proper fertilizer use

d. Time and apply the application of fertilizers, herbicides or pesticides to coincide with the manufacturer's recommendation for best results ("Read the Label").

e. Know the weather conditions. Do not use pesticides if rain is expected. Apply pesticides only when wind speeds are low(less than 5 mph).

2. Process

a. Always follow the manufacturer's recommendations for mixing, application and disposal. ("Read the Label").

b. Do not mix or prepare pesticides for application near storm drains, preferably mix inside a protected area with impervious secondary containment (preferably indoors) so that spills or leaks will not contact soils.

c. Employ techniques to minimize off-target application (e.g. spray drift, over broadcasting.) of pesticides and fertilizers.

3. Clean-up

a. Sweep pavements or sidewalks where fertilizers or other solid chemicals have fallen, back onto grassy areas before applying irrigation water.

b. Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.

c. Always follow all federal and state regulations governing use, storage and disposal of fertilizers, herbicides or pesticides and their containers. ("Read the Label")

4. Documentation

a. Keep copies of MSDS sheets for all pesticides, fertilizers and other hazardous products used.

b. Record fertilizing and pesticide application activities, including date, individual who did the application, amount of product used and approximate area covered.

PARKS – Cleaning Equipment

1. Preparation

a. Review process with all Parks employees

2. Process

a. Wipe off dirt, dust and fluids with disposable towel

b. Wash larger equipment according to the **VEHICLES – Washing SOP.** Smaller Equipment is to be washed in a sink inside the public works facility which drains to the Sainitary Sewer.

3. Clean-up

a. Dispose of towels in proper trash receptacle

b. Sweep floor and dispose of debris.

PARKS – Mowing and Trimming

1. Preparation

a. Process overview with all employees

b. Check the oil and fuel levels of the mowers and other equipment; fill if needed in an approved area.

2. Process

a. Put on eye and hearing protection

b. Mow and trim the lawn

c. Sweep or blow clippings to grass areas

3. Clean-up

a. Mowers are to be scraped and brushed at shop – dry spoils are dry swept and disposed of

b. Wash equipment according to **VEHICLES – Washing** SOP

c. Clean up wash station after use

PARKS – Open Space Management

1. Preparation

a. Provide a regular observation and maintenance of parks, golf courses, and other pubic open spaces.

b. Identify public open spaces that are used for stormwater detention and verify that detention areas are included on the storm drain system mapping, inspection schedules, and maintenance schedules.

2. Process

a. Ensure that any storm drain or drainage system components on the property are properly maintained.

b. Avoid placing bark mulch (or other floatable landscaping materials) in stormwater detention areas or other areas where stormwater runoff can carry the mulch into the storm drainage system.

c. Follow all SOPs related to irrigation, mowing, landscaping, and pet waste management.

3. Clean Up

a. Keep all outdoor work areas neat and tidy. Clean by sweeping instead of washing whenever possible. If areas must be washed, ensure that wash water will enter a landscaped area rather than the storm drain. Do not use soap for outdoor washing.

b. Pick up trash on a regular basis.

4. Documentation

a. Document any observed deficiencies for correction or repair.

PARKS – Pet Waste

1. Preparation

a. Adopt and enforce ordinances that require pet owners to clean up pet wastes and use leashes in public areas. If public off-leash areas are designated, make sure they are clearly defined. Avoid designating public off-leash areas near streams and water bodies.

b. Whenever practical and cost effective, install dispensers for pet waste bags and provide disposal containers at locations such as trail heads or parks where pet waste has been a problem. Provide signs with instructions for proper cleanup and disposal.

2. Process

a. Check parks and trails for pet waste as needed .

b. Check public open space for pet waste prior to mowing and watering.

c. Provide ordinance enforcement as needed.

3. Clean up

a. Remove all pet waste, provide temporary storage in a covered waste container, and dispose of properly. Preferred method of disposal is at a solid waste disposal facility.

4. Documentation

a. Document problem areas for possible increased enforcement and/or public education signs.

PARKS – Planting Vegetation (Starters)

1. Preparation

a. Call the Blue Stakes Center of Utah at least 2 working days before any digging will be done, to reveal the location of any underground utilities.

b. Dial 811 or 1-800-662-4111

c. Decide where any spoils will be taken.

2. Process

a. Dig holes; place spoils near the hole where they may easily be placed back around roots. Avoid placing spoils in the gutter.

b. Bring each plant near the edge of the hole dug for it.

c. Check the depth of the hole, and adjust the depth if necessary. The depth of the hole for a tree should be as deep as the root ball, so that the top of the root ball is level with the top of the hole.

d. Carefully remove pot or burlap.

e. Place the plant in the hole.

f. Backfill the hole with existing spoils, compost, and a litte fertilizer if desired. Do not use excessive amendments.

g. Water the plant.

h. Stake the plant, if necessary, to stabilize it.

3. Clean-up

a. Move any extra spoils into truck or trailer. Place the spoils on a tarp if there is a likelihood that some of the dirt would be lost through openings in the bed.

b. Sweep dirt from surrounding pavement(s) into the planter area

c. Transport spoils to their designated fill or disposal area which will have all appropriate BMPs. The designated area varies so check with the Public Works Director before beginning.

PARKS – Planting Vegetation (Seeds)

1. Preparation

a. Call the Blue Stakes Center of Utah at least 2 working days before any digging will be done, to reveal the location of any underground utilities.

b. Dial 811 or 1-800-662-4111

c. Decide on the application rate, method, water source, and ensure adequate materials are on hand.

d. Grade and prepare the soil to receive the seed. Place any extra soil in a convenient location to collect.

2. Process

a. Place the seed and any cover using the pre-determined application method (and rate).

b. Lightly moisten the seed.

3. Clean-up

a. Move any extra spoils into truck or trailer. Place the spoils on a tarp if there is a likelihood that some of the dirt would be lost through openings in the bed. Cover load with tarp before transport.

b. Sweep dirt, seed, and any cover material from surrounding pavement(s) into the planter area

c. Transport spoils to their designated fill or disposal area which will have all appropriate BMPs. The designated area varies so check with the public works director before beginning.

PARKS – Transporting Equipment

1. Preparation

a. Determine equipment needed for transport and method (trailer, truck bed) needed to transport equipment.

b. Conduct pre- trip inspection of equipment

2. Process

a. Load and secure equipment on trailer or truck

b. Load and secure fuel containers for equipment usage

3. Clean-up

a. Off load equipment

b. Store equipment and trailer in proper locate on

c. Conduct post-trip inspection of equipment

d. Wash equipment, if needed, according to the SOP for Cleaning Equipment SOP

4. Documentation

e. Pre-trip and post trip inspection report

STREETS/STORM DRAIN – Catch Basin Cleaning

1. Preparation

a. Prioritize catch cleaning by the following:

i. Water Quality Concerns

1) Areas with High concentrations of pollutants i.e. gas stations

2) Areas with a high concentration of construction activity

ii. Most Recent Assessment of Receiving Water

1) Areas that discharge to Impaired water bodies

iii. Amount and Type of material that accumulates in an area

1) Areas that accumulate a lot of sediment

2) Areas that accumulate anything that isn't sediment

iv. Location Specific Factors

1) Areas that have storm drain inlets but no curb and gutter

b. Check the storm water map for high priority areas.

c. If employing a contractor ensure MOUs are up to date and specify the following items:

i. Dumping is only to be done in a pre-approved location that doesn't discharge to the storm drain

ii. Vehicles are to be washed at pre-approved locations that don't discharge to the storm drain

iii. If any evidence of a cross connection is found it is reported to the city

2. Schedule

a. Inspection frequency

i. All catch basins are to be inspected as needed

b. Maintenance frequency

i. Catch basins that are located in high priority areas are to be cleaned as needed

ii. Catch Basins that are not located in high priority areas are to be cleaned as needed

iii. If inspection shows that cleaning is needed

c. List of High priority areas

i. Commercial Area on 5500 W

ii. Old Park Area

iii. Weber River Drainage area

3. Process

a. Select a contractor from a list of contractors with MOUs in place with the city a list of them are:

i. TwinDD

4. Clean-up

a. Check area to make sure that work was completed and contracts were followed

5. Documentation

a. Keep logs of number of catch basins cleaned.

b. Record the amount of waste collected.

c. Keep any notes or comments of any problems.

STREETS/STORM DRAIN – Curb Painting

1. Preparation

a. Calculate the amount of paint required for the job

b. Use water based paints if possible.

c. Determine whether the wastes will be hazardous or not and the required proper disposal of said wastes

d. Determine locations of storm drain inlets and sewer inlets that may need to be protected

e. Prepare surfaces to be painted without generating wastewater by sandblasting and/or scraping.

f. Thoroughly sweep up all sand, blastings, and/or paint scrapings

g. If paint stripping is needed, use a citrus-based paint remover whenever possible, which is less toxic than chemical strippers

h. If wastewater will be generated, use curb, dyke, etc. around the activity to collect the filter and collect the debris.

2. Process

a. Paint curb.

b. Prevent over-spraying of paints and/or excessive sandblasting

c. Use drip pans and drop clothes in areas of mixing paints and painting

d. Store latex paint rollers and brushes in air tight bags to be reused later with the same color.

e. Have available absorbent material and other BMP's ready for an accidental paint spill.

3. Clean-up

a. Paint out brushes and rollers as much as possible. Squeeze excess paint from brushes and rollers back into the containers prior to cleaning them.

b. Pour excess paint from trays and buckets back into the paint can containers and wipe with cloth or paper towels. Dispose of the towels according to the recommendations on the paint being used.

c. Rinse water-based paint brushes in the sink after pre-cleaning. Never pour excess paint or wastewater from cleanup of paint in the storm drain.

d. Cleanup oil based paints with paint thinner. Never clean oil based brushes in a sink or over a storm drain. Filter solvents for reuse if possible and/or store in approved drum for recycling.

e. Dispose of waste collected by placing it in a garbage container. Left-over paint and solvents should be stored for later use (do not place these liquids in the garbage).

4. Documentation

a. Write-up/report of any discharges into storm drain system

STREETS/STORM DRAIN – Detention Pond Cleaning

1. Preparation:

a. Schedule the Pond cleaning work for a time when dry weather is expected.

b. Remove any sediment and trash from grates, placing it in a truck for disposal.

c. Do a visual inspection to make sure any grates, structures, manholes, boxes, and pipes are in good working order. Remove manhole covers and grates as necessary for inspecting.

2. Process

a. Provide outlet protection where feasible to minimize the amount of debris that might leave basin during cleaning process.

b. Start cleaning basin by removing debris and sediment with a shovel

c. Continue cleaning structures and pond bottom as necessary by sweeping and shoveling.

d. Put all material removed from the pond in the designated stock pile area in the public works yard

e. Some structures may require use of a vactor truck. If so use the same procedures described for cleaning catch basins.

3. Clean-up

a. After cleaning basins, clean off the concrete pads using dry methods (sweeping and shoveling).

b. Make sure they are swept up and clean.

c. Take the material that was removed to the landfill for final disposal.

4. Documentation

a. Keep a log of each detention basins/pond cleaned including date, individuals involved in cleaning, and a description of the type of debris removed.

b. Record the amount of waste collected.

c. Keep any notes or comments of any problems.

STREETS/STORM DRAIN – Creek Management

1. Preparation

a. Monitor natural waterways on a regular basis.

b. Check culverts and crossings after every storm.

c. Maintain access to stream channels wherever possible.

d. Identify areas requiring maintenance

e. Determine what manpower or equipment will be required.

f. Identify access and easements to area requiring maintenance.

g. Determine method of maintenance that will be least damaging to the channel.

h. Obtain Stream Alteration Permit.

2. Process

a. Remove unwanted material (debris, branches, soil) from the creek channel and place it in a truck to be hauled away

3. Clean-up

a. Stabilize all disturbed soils.

b. Remove all tracking from paved surfaces near maintenance site, if applicable.

c. Haul all debris or sediment removed from area to designated stock pile area in the public works yard for big loads, or for small loads loads into a dumpster.

a. Keep log of actions performed including date and individuals involved.

b. Record the amount of materials removed or imported.

c. Keep any notes or comments of any problems.

d. Use “before” and “after” photographs to document activities as applicable.

STREETS/STORM DRAIN – Ditch Management

4. Schedule

a. Inspect City owned ditches as needed.

b. Check culverts and crossings as needed.

5. Preparation

a. Maintain access to ditch channels wherever possible.

b. Contact affected property owners and utility owners.

6. Process

a. Identify areas requiring maintenance

b. Determine what manpower or equipment will be required.

c. Identify access and easements to area requiring maintenance.

d. Determine method of maintenance that will be least damaging to the channel and adjacent properties or utilities and the most effective.

7. Clean-up

a. Stabilize all disturbed soils.

b. Remove all tracking from paved surfaces near maintenance site, if applicable.

c. Haul all debris or sediment removed from area to designated stockpile area in public works yard.

8. Documentation

a. Keep log of actions performed including date and individuals involved.

b. Record the amount of materials removed or imported.

c. Keep any notes or comments of any problems.

d. Use “before” and “after” photographs to document activities as applicable.

STREETS/STORM DRAIN – Chip Seal

1. Preparation

a. Clean and dry areas where materials are to be applied.

b. Apply temporary covers to manholes and catch basins to prevent oil and materials from getting inside of them.

2. Process

a. Apply emulsion at recommended rate.

b. Spread chips closely behind emulsion distributor, slowly such that the chips do not roll when they hit the surface.

c. Roll chips. Rollers follow closely behind the chip spreader. Roll entire surface twice.

d. Maximum speed 5 mph.

3. Clean-up

a. All loose aggregate is removed from the roadway by sweeping it up (see SOP for Street Sweeping).

b. Excessive asphalt applications and spills are removed with shovels and scraping tools.

c. Remove the temporary covers from manholes and catch basins. If it appears that any chip seal materials have gotten into the inlet boxes, remove the material according to the SOP for inlet boxes.

d. Dispose of the waste material that has been swept and scraped up by taking it to Ogden City Transfer station

4. Documentation

a. Record location and date on the maintenance log

STREETS/STORM DRAIN – Green Waste Deposited in Street

1. Preparation

a. Identify specific locations designated for the deposition of green waste. Ensure these areas are away from storm drains.

b. Implement measures such as temporary barriers or other BMP's to contain green waste within the designated areas and prevent it from being washed into storm drains during rain events.

2. Process

a. Coordinate collection schedule to remove green waste from designated deposition points. Use appropriate equipment and vehicles for collection to minimize spillage.

b. Inspect containment measures regularly to ensure their integrity and effectiveness.

c. Monitor weather forecasts and prepare for storm events by securing loose green waste and reinforcing containment measures if necessary.

3. Clean Up

a. In the event of heavy rainfall or runoff from green waste deposition areas, implement measures to capture and contain contaminated stormwater. Use absorbent materials or barriers to prevent runoff from reaching storm drains.

b. Respond promptly to any spills or releases of green waste onto streets or adjacent areas. Follow SOP for documentation of spills and fill out Spill Response Form located in SOP or at the Public Works front desk.

c. After cleanup activities are completed, inspect the deposition area and surrounding streets to ensure that all green waste has been removed and any contamination has been addressed. Restore the area to its original condition by cleaning streets and repairing any damage caused by runoff or cleanup efforts.

STREETS/STORM DRAIN – Slurry Seal

1. Preparation

a. Remove weeds from the roads. Sweep areas where materials are to be applied, and allow to dry, if necessary. Verify that existing pavement has been inspected for detrimental effects of poor drainage.

b. Cover/protect catch basins and manholes.

2. Process

a. Apply materials in a smooth and uniform manner. Slurry material should not run onto adjacent pavement surface, curb and gutter or waterways.

3. Clean-up

a. If loose aggregate is remaining in street or curb, sweep it up.

b. Ensure that excess emulsion materials are removed from the site and stored for later use in an area or container that is not exposed to the weather.

c. Remove covers/protection from catch basins and manholes, and valves.

4. Documentation

a. Record location and date in maintenance log

STREETS/STORM DRAIN – Overlays and Patching

1. Preparation

a. Measure and mark locations of manholes and valves on the curb

b. Manholes and catch basins are covered as needed to prevent oil and materials from getting inside the structures or system.

c. Cracks should be properly sealed. Alligator cracks and potholes should be removed and patched. Rutting should be milled.

d. Surface should be clean and dry.

e. Uniform tack coat applied and cured prior to placement of overlay.

f. If milling is required, install inlet protection as needed.

2. Process

a. Check hot asphalt mix for proper temperature, percentage asphalt, gradation, air voids and any other agency requirements.

b. Raise manhole lids and valves to elevation of new asphalt surface with riser rings.

c. Surface texture should be uniform, no tearing or scuffing.

d. Rolling should be done to achieve proper in-place air void specification.

3. Clean-up

a. Covering should be removed as soon as the threat of imported materials entering the system is reduced and prior to a storm event.

b. After pavement has cooled, sweep gutters to remove loose aggregate.

4. Documentation

a. Record location and date in maintenance log

STREETS/STORM DRAIN – Crack Seal

1. Preparation

a. Cover Manholes and catch basins to prevent oil and materials from getting inside the structures or system.

b. Remove weeds from the road

c. Air-blast the cracks to remove sediments from the crack to allow for proper adhesion.

d. Ensure that surface is clean and dry.

2. Process

a. Proper temperature of material should be maintained.

b. Sufficient material is applied to form the specified configuration.

3. Clean-up

a. Excessive sealant application or spills are removed.

b. Sweep all loose debris from the pavement and dispose of it in the local landfill.

4. Documentation

a. Record location and date in maintenance log

STREETS/STORM DRAIN – Shouldering and Mowing

1. Preparation

a. Set up temporary traffic control devices according to part VI of the MUTCD.

2. Process

a. Place import material as needed and perform grading to achieve proper drainage.

b. Mulch clippings to help reduce the amount of supplemental fertilizer required

3. Clean-up

a. Clean any loose material off asphalt or gutter.

4. Documentation

Record location and date in maintenance log

STREETS/STORM DRAIN – Secondary Road Maintenance

1. Preparation

a. Determine length amount and type of roadbase or gravel that will be needed.

b. Determine proper equipment to be used and or any safety hazards.

c. Design proper drainage: slopes, berms etc.

2. Process

a. Have truck drivers follow a designated route for hauling in the soil (See SOP for transporting Soil and Gravel).

b. If soil is too dry to achieve compaction, loosen surface material and moisture condition.

c. Smooth or grade soil with the desired crown or cross-slope.

d. Compact soil.

3. Clean-up

a. Replace filter fabric with washed rock (if necessary) on monthly maintenance.

b. Clean up equipment according to the SOP for Cleaning Equipment

c. Clean up any debris on traveled roads, and dispose of it in the landfill.

4. Documentation

a. Fill out daily activity report in log book or journal. Include Date, time, personnel, and location.

STREETS/STORM DRAIN – Concrete Work

1. Preparation

a. Train employees and contractors in proper concrete waste management.

b. Store dry and wet materials under cover, away from drainage areas

c. Remove any damaged concrete that may need to be replaced.

d. Prepare and compact sub-base.

e. Set forms and place any reinforcing steel that may be required.

f. Determine how much new concrete will be needed.

g. Locate or construct approved concrete washout facility.

2. Process

a. Install inlet protection as needed.

b. Avoid mixing excess amounts of fresh concrete on-site.

c. Moisten subbase just prior to placing new concrete. This helps keep the soil from wicking moisture out of the concrete into the ground.

d. Place new concrete in forms.

e. Consolidate new concrete

f. Screed off surface

g. Let concrete obtain its initial set

h. Apply appropriate surface finish

i. Remove forms when concrete will not slump

3. Clean-up

a. Perform washout of concrete trucks and equipment in designated areas only

b. Do not washout concrete trucks or equipment into stormdrains, open ditches, streets or streams

c. Cement and concrete dust from grinding activities is swept up and removed from the site.

d. Remove dirt or debris from street and gutter.

STREETS/STORM DRAIN – Garbage Storage

1. Preparation

a. Locate dumpsters and trash cans with lids in convenient, easily observable areas.

b. Provide properly-labeled recycling bins to reduce the amount of garbage disposed.

c. Provide training to employees to prevent improper disposal of general trash.

2. Process

a. Inspect garbage bins for leaks regularly, and have repairs made immediately by responsible party.

b. Locate dumpsters on a flat, impervious surface that does not slope or drain directly into the storm drain system.

c. Install berms, curbing or vegetation strips around storage areas to control water entering/leaving storage areas.

d. Keep lids closed when not actively filling dumpster.

3. Clean-up

a. Keep areas around dumpsters clean of all garbage.

b. Have garbage bins emptied as often as needed to keep from overfilling.

c. Wash out bins or dumpsters as needed to keep odors from becoming a problem. Wash out in properly designated areas only.

STREETS/STORM DRAIN – Snow Removal and De-icing

1. Preparation

a. Understand city policy to keep roads open and free of snow or ice pack from any storm, in a way that uses a minimum amount of salt without compromising motorists' safety

b. Store de-icing material under covered storage area in the public works yard

c. Sweep loading area frequently to keep runoff away from storm drain inlets.

d. Inspect the truck for any fluid leaks and loose hose connections, and fix problems before starting work.

e. Clean the truck and other equipment as needed, following the procedures outlined in the **VEHICLES – WASHING** Standard Operating Procedure (SOP).

f. Calibrate spreaders to minimize amount of de-icing material used and still be effective

g. Train employees in spill cleanup procedures and proper handling and storage of de-icing materials

2. Process

a. Load material into trucks carefully to minimize spillage

b. Periodically sweep loading area to reduce the amount of de-icing materials exposed to runoff

c. Distribute the minimum amount of de-icing material to be effective on roads

d. Do not allow spreaders to idle while distributing de-icing materials.

e. Park trucks loaded with de-icing material inside when possible

3. Cleanup

a. Sweep up all spilled de-icing material around loading area

b. Clean the truck and other equipment as needed, following the procedures outlined in the **VEHICLES – WASHING** Standard Operating Procedure (SOP).

c. Provide maintenance for vehicles in covered area.

STREETS/STORM DRAIN – Snow Storage

1. Preparation

a. Understand city policy to keep roads open and free of snow or ice pack from any storm. Snow is not transported from one location to another. Snow is cleared from roads, parking lots. and sidewalks is piled in those areas.

b. Snowmelt is considered a stormwater discharge.

c. Identify suitable locations for snow storage. Consider factors such as:

   i) Pervious surfaces (preferably in areas with well-draining soils)

   ii) Shallow slopes (less than 6%)

   iii) Vegetated areas (preferably with salt resistant vegetation)

   iv) Above a stormwater treatment BMP (such as a vegetative strip, detention basin, swale, etc.)

d. Avoid Snow storage in the following locations:

   i) Areas with septic systems/leach/drain fields

   ii) Areas draining directly to impaired waterbodies

   iii) Areas within a floodplain

   iv) Areas on or directly adjacent to storm drains

   v) Areas that may block/restrict stormwater drainage

   vi) Areas upgradient of salt piles or other pollutant sources

   vii) Areas near roadways (where further contamination could be introduced)

e. Train personnel involved in snow removal and disposal on the importance of preventing contamination of snowmelt runoff and the proper use of BMPs.

2. Process

a. Snow plows push the snow into parkstrips on public streets where the snow fell. Snow is not loaded into trucks and hauled to piles

b. Where snowmelt is suspected to be heavily contaminated, temporary BMP's should be considered. Some examples include: downgradient sediment controls (i.e., berm, silt fence, straw wattle, etc.) to filter snowmelt water prior to discharging, berms/silt fence to

direct snowmelt to long-term stormwater controls (i.e., detention basins, vegetative strips, etc.), and velocity dissipation devices in areas that will receive channelized flow (to prevent erosion).

c. If permanent snow storage is necessary, then additional measures should be take to manage these locations. Factors to consider include: salt-resistant vegetation, large capacity for infiltration (shallow slope, convex shape, permeable soils), areas away from high ground water, and stormwater controls that treat potential pollutants of concern.

3. Cleanup

a. Sweep debris from areas of snow storage after snow melt. Dispose of debris following appropriate storage bins at the Public Works Facility.

STREETS/STORM DRAIN – Street Sweeping

1. Preparation

a. Prioritize cleaning routes to use at the highest frequency in areas with the highest pollutant loading. Prioritize sweeping by the following:

i. Water Quality Concerns

1) Areas with high concentrations of pollutants i.e. gas stations

2) Areas with a high concentration of construction activity

ii. Most Recent Assessment of Receiving Water

1) Areas that discharge to impaired waters

iii. Amount and Type of material that accumulates in an area

1) Areas that accumulate a lot of sediment

2) Areas that accumulate anything that isn't sediment

iv. Location Specific Factors

1) Areas that have storm drain inlets but no curb and gutter

2) Areas that have storm drain infrastructure

3) Areas that are more prone to flooding

b. Check the storm water map for locations of high priority areas

c. Increase sweeping frequency just before the rainy season and in the fall unless sweeping occurs continuously throughout the year.

d. Streets are to be swept as every other year if not specified as a priority area, or as needed whichever is more frequent.

e. Check MOUs with contractors to ensure they are up to date specific things to look for:

i. Dumping is only to be done in a pre-approved location that doesn't discharge to the storm drain

ii. Vehicles are to be washed at pre-approved locations that don't discharge to the storm drain

2. Schedule

f. Inspection frequency

i. All roads are to be inspected as needed

g. Maintenance frequency

i. Streets that are located in high priority areas are to be swept as needed

ii. Streets that are not located in high priority areas are to be swept as needed

h. List of High priority streets

i. 5500 W

3. Process

a. Select a contractor to complete the street sweeping from a list of contractors that have MOUs in place with the city a list of them are:

i. Sweep'in Utah

4. Clean-up

a. Check the area after sweeping is complete to verify sweeping was completed and contracts followed.

5. Documentation

a. Keep accurate logs to track streets swept and streets still requiring sweeping.

STREETS/STORM DRAIN – Transporting Soil and Gravel

1. Preparation

a. Dry out wet materials before transporting if possible.

b. Make sure you know and understand the SWPPP requirements for the site you will be working at.

c. Clean the truck and other equipment as needed, following the procedures outlined in the **VEHICLES – WASHING** Standard Operating Procedure (SOP).

d. Perform pre –trip inspection on truck before use.

2. Process

a. Use a stabilized construction entrance to access or leave the site where materials are being transported to/from.

b. Cover truck bed with a secured tarp before transporting.

c. Follow the SWPPP requirements for the specific site to/from which the materials are being hauled.

d. Make sure not to overfill materials when loading trucks.

e. It is the driver's responsibility to clean spilled material on truck before trip.

3. Clean up

a. Use sweeper to clean up any materials tracked out on the roads from site.

b. Clean the truck and other equipment as needed, following the procedures outlined in the **VEHICLES – WASHING** Standard Operating Procedure (SOP).

4. Clean up

a. Keep records of any material that is tracked out of site and what was done to clean it up and how long it took and what the weather conditions were at the time.

STREETS/STORM DRAIN – Municipality sponsored events & clean up (festivals, parades, etc.)

1. Preparation

a. Schedule crews to facilitate clean-up during and/or after an event.

b. Consider and plan for additional waste receptacles.

c. Consider and plan for any necessary portable toilets.

2. Process

a. Hand-collect loose trash material and animal waste.

b. Empty waste receptacles; remove extra receptacles.

c. Sweep streets, parking areas, and other areas impacted by the event according to SOP's.

d. Dispose of waste according to SOP's.

e. Ensure any portable toilets used for the event are promptly removed following the event.

3. Documentation

a. Document streets and parking areas that were swept in the storm drain maintenance log.

STREETS/STORM DRAIN – Graffiti Removal

1. Preparation

b. Notification of graffiti.

c. Choose appropriate cleaning materials and methods based on the surface type and the type of graffiti (e.g., spray paint, marker).

d. Provide personnel with the necessary PPE, such as gloves, goggles, and respiratory protection, to ensure their safety during graffiti removal activities.

e. Implement measures to contain runoff and prevent wash-off of graffiti paint into storm drains.

2. Process

a. Prepare the graffiti-affected surface by following cleaning product manufacturer's instructions.

b. Apply the selected graffiti removal product according to the manufacturer's instructions.

c. Ensure wash-off and runoff from the graffiti removal process is contained.

3. Clean Up

a. Inspect the cleaned surface to ensure that all traces of graffiti paint have been effectively removed.

b. Remove and properly dispose of any absorbent materials or barriers used to contain wash-off from the graffiti removal process.

INSPECTION, ENFORCEMENT AND COMPLIANCE– Inspections of Permitted Construction Sites

1. Introduction

a. This SOP was written for Utah MS4s to help them meet the requirements of their MS4 Permit and to provide guidance to abide by Utah Code 19-5-108.3. This SOP references the *Construction Site Storm Water Runoff Control* (4.2.4) section of the MS4 Permit. The overarching goal of this SOP is to standardize storm water construction program practices across all MS4s in the State of Utah.

b. From **Utah Code 19-5-108.3:**

i. *"*The applicant shall allow construction site inspections by the authority. Except as provided in Subsection (12), the authority shall conduct an oversight inspection 1 through an electronic site inspection"

ii. "The authority may conduct an on-site inspection if the authority: has a documented reason for justifying an on-site oversight inspection."

iii. To differentiate between the two types of oversight inspections, the terms "on-site oversight" and "electronic oversight" inspection are used.

iv. "On-site oversight inspection" is an inspection in which MS4 staff physically visit(s) a construction site to determine a site's compliance with construction storm water permits as has been done historically.

v. "Electronic oversight inspection" is an offsite inspection in which MS4 conducts a review of the operator's submitted electronic site inspection to determine a site's compliance with construction storm water permits. Each of these types of oversight inspections will be described in the During Construction portion within the Process section of this SOP.

c. Each of these types of oversight inspections will be described in the *During Construction* portion within the *Process* section of this SOP.

2. Purpose:

a. The purpose of this SOP is to describe how all MS4s will conduct inspections for construction sites that require storm water pollution control measures. For purposes of this SOP, "operator" means the person responsible for the Storm Water Pollution Prevention Plan (SWPPP) implementation on an applicable construction site.

3. Responsibilities:

a. Each MS4's storm water staff are responsible for implementing the requirements and may not defer from this SOP. The operator is responsible for abiding by all requirements of the UPDES Storm Water General Permit or Common Plan Permits for Construction Activities and the MS4 is responsible for oversight.

b. The position responsible for oversight inspections is the Storm water Manager.

c. The position(s) who has authority to implement enforcement procedures is Storm water inspector, Storm water Manager, and Public Works Director, as well as the Division of Water Quality (DWQ).

d. This SOP is to be followed and updated according to State and municipal requirements.

e. This SOP also applies to city owned projects where the work is contracted out. The operator of city owned projects will be responsible for creation and implementation of a SWPPP. The city does not currently have capacity to do projects that require CPP or CGP coverage. In the event the city does require coverage under a CPP or CGP they will be treated like any other site with the exception of fines.

4. MS4 Permit Requirements:

a. Oversight Inspection

i. Required to be completed by the MS4 on any construction site that is greater than or equal to one acre or is part of a common plan of development or sale which collectively disturbs land greater than or equal to one acre.

ii. MS4 must inspect all phases of construction, including prior to land disturbance, during active construction, and following active construction.

iii. Oversight inspections are required to be completed monthly for non-priority construction sites and biweekly for priority construction sites.

b. Qualified Personnel

i. The oversight inspection must be performed by a “qualified person” as described in the DWQ MS4 Permit.

ii. Anyone having a job duty related to implementing the construction storm water program must receive annual training. New hires must be trained within 60 days of hire.

c. Record Retention

i. All MS4s must maintain records for at least five years of all applicable construction project documents which could include:

4) Site plan reviews

5) SWPPPs

6) Inspections

7) Enforcement Actions (notices of violation, stop work orders)

5. Process:

a. Pre-construction

i. The MS4 will perform a pre-construction SWPPP review and meeting which at minimum will include:

1) A review of the site design

2) Planned operations at the construction site

3) Planned Best Management Practice(s) (BMPs) during the construction phase

4) Planned long-term storm water run-off BMPs

5) Documentation: Signed SWPPP review and meeting agenda stored on file server

6) SWPPP Review Checklist: Document the SWPPP Review Checklist stored on file server

7) Pre-construction Meeting: Document the meeting and put form signed by operator and stormwater manager and store on file server

ii. The MS4 will determine whether the construction site will be identified as priority and receive bi-weekly MS4 oversight inspections.

iii. The MS4 must provide the operator the procedure for notifying the MS4 of their completion of active construction.

iv. The MS4 will perform a pre-construction electronic oversight inspection or onsite oversight inspection with the operator(s).

1) This pre-construction inspection must occur before land disturbance and will verify that the operator has placed all site specific construction BMPs prescribed by the SWPPP.

2) Documentation: Pre-construction Inspection Form stored on arcGIS

3) Pre-construction inspection: Document the inspection through arcGIS

4) The operator will submit a Notice of Intent (NOI) through the NeT NPDES eReporting Tool online (NeT) before earth disturbing activities.

b. During Construction

i. Electronic Oversight Inspection

1) The MS4 will perform their required electronic oversight inspections (at the intervals mentioned in 2.1.c) through access to the Operator's SWPPP and electronic site inspection(s).

2) The operator’s report must use geo-located and time-stamped photos of all BMPs implemented at the construction site.

3) All photos must be sufficient to depict that the BMP(s) is meeting its proper function to eliminate or control pollutants on site.

4) The operator’s report should show compliance with the Construction General Permit (CGP), Common Plan Permit (CPP) if applicable, and the site specific SWPPP.

5) This includes all documentation regarding corrections taken as a result of the operator's self inspection.

ii. Onsite Oversight Inspection

1) An onsite oversight inspection may be warranted under the following conditions:

2) Compliance with the CGP, CPP if applicable, and site specific SWPPP cannot be reasonably determined during an electronic oversight inspection.

3) A perceived or reported threat to water quality that is immediate3 and/or imminent4. Or a reported complaint.

4) Failure to install BMPs prior to land disturbance.

5) Illicit discharge, unknown/unidentified non-storm water discharge, or prohibited discharge per CGP/CPP permits.

6) The operator requests that oversight inspections be performed onsite.

7) Any other oversight inspection step listed below that cannot be fulfilled.

iii. An oversight inspection, both electronic and onsite, is performed by following these steps:

1) Review the SWPPP

2) Review the SWPPP signage for compliance with the CGP or CPP

3) SWPPP Placed in a safe, conspicuous, and publicly accessible location near the entrance

4) SWPPP Includes UPDES permit tracking number, contact information, and method of SWPPP access

5) Review the operator self SWPPP inspection reports

6) Review the entire perimeter and any downgradient areas

7) Review points of vehicle/equipment exit

8) Review any discharge points (keep in mind that these are not always piped inlets)

9) Review all BMPs installed to mitigate or prevent sediment, erosion, and pollution

10) Review all stabilizing areas (especially steep slopes)

11) Review all pollutant generating activities such as fueling areas, washout areas, etc.

12) Observe all discharges (if prohibited or unauthorized this is an immediate and/or imminent threat to water quality)

13) Observe all conditions that could result in polluted storm water discharge (including sediment in the street/gutter)

14) Determine if any additional sediment, erosion, and/or pollution prevention controls are needed

15) Verify that all above activities are accounted for and updated in the site's SWPPP and Map

16) Any deficiencies must be noted in the oversight inspection form

iv. For oversight inspections, MS4 staff must use the *Oversight Construction Inspection Form* provided by the Division of Water Quality.

1) MS4 staff sends a copy of the oversight inspection to the operator.

2) MS4 staff maintains record of all oversight inspections through arcGIS

v. If the storm water BMPs on a construction site are found to be deficient by the MS4 inspector, steps will be taken to address the deficiencies as outlined in the *Enforcement for Construction Sites SOP*.

vi. Violations could include:

1) Failure to maintain BMPs

2) Failure to install BMPs

3) An illicit discharge

4) Failure to conduct inspections

5) Failure to update SWPPP

6) Any other CGP and/or CPP requirements that are deficient

c. After Construction

i. The operator will request through NeT, a Notice of Termination (NOT) once these conditions have been met:

1) All temporary storm water control measures have been removed

2) The site has achieved final stabilization

3) All construction materials, waste, and equipment have been removed

4) All potential pollutants and pollution-generating activities have been removed

5) If landscaping will be completed by the homeowner, have temporary sediment and erosion controls been installed

ii. MS4 staff who have 'MS4 Authority' will be notified of the request to approve the operator's NOT via an email notification from NeT.

iii. MS4 staff will verify through an electronic oversight inspection (or on-site oversight inspection if applicable described in the *Enforcement for Construction Sites SOP*) if all NOT requirements have been met and approve or deny the NOT submission via NeT.

iv. MS4 staff will document the NOT inspection through the State's Storm Water NOT Inspection Form and maintain a record of it through City Inspect/arcGIS

v. All documents related to each applicable construction site must be retained for five years or until construction is completed, whichever is longer.

INSPECTION, ENFORCEMENT AND COMPLIANCE – Enforcement for Construction Sites and City Owned Sites

Last Reviewed: May 13, 2025

1. Introduction

a. This SOP was written for Utah MS4s to help them meet the requirements of their MS4 Permit and to provide guidance to abide by Utah State Code. This SOP references the Construction Site Storm Water Runoff Control section of the MS4 Permit. The overarching goal of this SOP is to standardize storm water construction program practices across all MS4s in the State of Utah.

b. From **Utah Code 19-5-108.3:**

"The authority may conduct an on-site inspection if the authority has a documented reason for justifying an on-site oversight inspection." (Utah Code 19-5-108.3)

2. Purpose:

a. The purpose of this SOP is to describe how MS4s will implement standards from the MS4 Permit in conjunction with Utah State Code 19-5-108.3 in regard to sites that do not comply with their SWPPP and state issued Construction General Permit (CGP) or Common Plan Permit (CPP) if applicable. For purposes of this SOP, "operator" means the person responsible for SWPPP implementation.

3. MS4 Responsibilities:

a. Each MS4's permit staff are responsible for implementing the requirements and may not differ from this SOP. The operator is responsible for abiding by all requirements of the CGP or CPP and the MS4 is responsible for oversight.

i. The position responsible for oversight inspections is Stormwater Coordinator

ii. The position(s) who has authority to implement enforcement procedures is the Stormwater Coordinator, Public works Director, and City Planner, as well as the Division of Water Quality (DWQ).

b. This SOP is to be followed and updated according to State and municipal requirements.

c. This SOP also applies to city owned projects where the work is contracted out. The operator of city owned projects will be responsible for creation and implementation of a SWPPP. The city does not currently have capacity to do projects that require CPP or CGP coverage. In the event the city does require coverage under a CPP or CGP they will be treated like any other site with the exception of fines.

4. MS4 Permit Requirements:

a. Enforcement procedures and regulatory authority must be written and documented in the SWMP of each MS4.

i. The procedures of this SOP should be summarized or referenced in the MS4's SWMP which is accessible by the public. Regulatory authority is described in the Inspections of Permitted Construction Sites SOP.

b. Each MS4 permit staff with responsibility over the SWPPP program must be trained in proper documentation of inspections, follow-up, and enforcement actions.

i. Documentation of routine maintenance, corrective action, follow-up inspections, and enforcement actions should all be included with citations in the Oversight Construction Inspection Form provided by the DWQ.

1) Any communication between the operator and the MS4 should be recorded and retained through outlook data file

2) Outlook data files at the time of termination are to be exported to an outlook data file and stored in the file server

3) Verbal communication alone is not advised. If important communication does occur verbally (such as agreement on BMP improvement, corrective action deadline, etc) between the operator and the MS4, restating the conversation afterwards via email to the operator is advised so that a record can be retained.

c. For construction sites that have been issued multiple escalating enforcement actions , the construction site could now be designated as a “priority construction site”. Oversight inspection frequency would then increase to at least biweekly due to the past record of non-compliance by the operator and potential to threaten water quality.

5. Process:

a. Oversight Inspections

If violations of the CGP/CPP are determined after conducting an inspection (electronic or on-site) as identified in the Oversight Inspections SOP, the MS4 must document each violation as part of completing the Oversight Construction Inspection Form provided by DWQ. *If the inspection was conducted on-site, justification for an on-site oversight inspection must be documented on the inspection form.*

b. Violation and Follow-up Procedures

c. First Notice of Violation (NOV 1)

ii. The MS4 must notify the operator of the violation(s) in writing as part of completing the Oversight Construction Inspection Form. The violation notation at minimum must include:

iii. Explanation/Identification of each violation

iv. Associated citation from the CGP/CPP

v. Deadline to correct each violation.

vi. The deadline to correct violations should be no sooner than one business day.

d. Reinspection

i. The MS4 shall verify (i.e., reinspection photos, documentation) that each violation has been corrected as soon as is practicable after the deadline given by the MS4.

1) If the follow up electronic inspection submitted by the operator is not sufficient for MS4 staff to determine that the specific violation has been corrected, an on-site oversight inspection may be conducted to determine that each violation has been corrected. If the inspection was conducted on-site, justification for an on-site oversight inspection must be documented on the inspection form.

2) The MS4 should describe to the operator how and when verification of correction will be performed.

ii. If the operator has not corrected the violation(s), the MS4 will notify the operator that the violation hasn't been corrected in writing as described in NOV 2.

iii. If the operator has corrected the violation(s), the operator will be notified by the MS4 that the project is in compliance.

e. Second Notice of Violation (NOV 2)

i. The MS4 must notify the operator of the violation(s) in writing as part of completing the Construction Oversight Inspection Form. The violation notation at minimum must include:

1) Explanation/Identification of each remaining violation

2) Associated citation from the CGP/CPP

3) Written warning that fines can be issued if the violation is not corrected within the new time period specified by the MS4.

4) The deadline to correct each violation should be no sooner than one business day.

f. Reinspection

ii. The MS4 shall verify (i.e., reinspection photos, documentation) that each violation has been corrected as soon as is practicable after the deadline within the time period given by the MS4.

5) If the follow up is conducted as an electronic inspection submitted by the operator and is not sufficient for MS4 staff to determine that the violation has been corrected, an on-site oversight inspection may be conducted. If the inspection was conducted on-site, justification for an on-site oversight inspection must be documented on the inspection form.

6) The MS4 should describe to the operator how and when verification of correction will be performed.

i. If the operator has not corrected the violation(s), the MS4 will notify the operator that the violation hasn't been corrected in writing as described in NOV 3.

ii. If the operator has corrected the violation(s), the operator will be notified by the MS4 that the project is in compliance.

g. Third Notice of Violation (NOV 3)

i. The MS4 may issue a fine as outlined in Utah Code 19-5-108.3 until the MS4 performs an oversight inspection to verify that the violation has been corrected or the operator shows the violation has been corrected through photos or documentation.

h. Documentation:

i. The results of all enforcement notices, communications, and inspections including follow-up or reinspections, must be documented through arcGIS, and Outlook correspondence.

i. Administrative Fines

i. If the operator does not correct the specific violation within the timeline set by the MS4 indicated in NOV 2, the MS4 shall notify the operator in writing that the specific violation has not been corrected and may impose an administrative fine for each occurrence* as follows:

1) $500 per occurrence for working without an approved storm water permit;

2) $300 per occurrence for tracking mud on road;

3) $250 per occurrence for failure to clean up or report spills;

4) $100 per occurrence for failure to conduct storm water inspections;

5) $100 per occurrence for failure to maintain storm water records; and

6) $500 per site, per occurrence, for failure to use general best management practices, as determined by the authority;

* “each occurrence” i.e. “per occurrence” means that for each specific violation there is a separate fine associated with that violation each time that it occurs. For example, with two separate spills in different areas of the site, after the violation and follow up process has been exhausted for each spill, the MS4 could impose an administrative fine on the operator at $250 for each spill.

j. The MS4 may impose the administrative fine:

i. for each business day the specific violation continues beginning on the day after the day on which the authority issues the administrative fine;

ii. and within 30 days after the day on which the applicant corrects the violation.

k. When the MS4 issues an administrative fine, the MS4 shall:

i. impose each fine in writing and clearly document the specific violation in the writing; and

ii. deposit collected fines into a restricted account for education and outreach under a program.

l. Special Cases

i. The MS4 may issue a stop work order if the MS4 has clear documentation of an immediate threat to water quality.

ii. The MS4 can correct a specific violation for the operator, and recoup the costs associated, if the operator refuses to correct the violation after the enforcement process and there is imminent threat of significant harm to water quality or the stormwater system.

iii. Except in cases of immediate threats to water quality the MS4 cannot issue a stop work order if the violation is a result of a properly installed and maintained BMP per specifications for the site conditions from the preferred BMP list.

6. Communication:

a. Each MS4 will utilize a method of communication for enforcement (such as a notice of violation, fines, stop work orders) to the operator.

iv. The method used for this MS4 is email.

1) NOV 1 – Automated email sent to construction site operator using standard template

2) NOV 2 – Automated email sent to construction site operator using standard template

3) NOV 3 – Automated email sent to construction site operator using standard template

4) Calls – Calls are not to be used as an official enforcement action. However, calls may be used as construction site operator education.

[1]Immediate threat means contaminants are entering a river, a stream, or a lake.

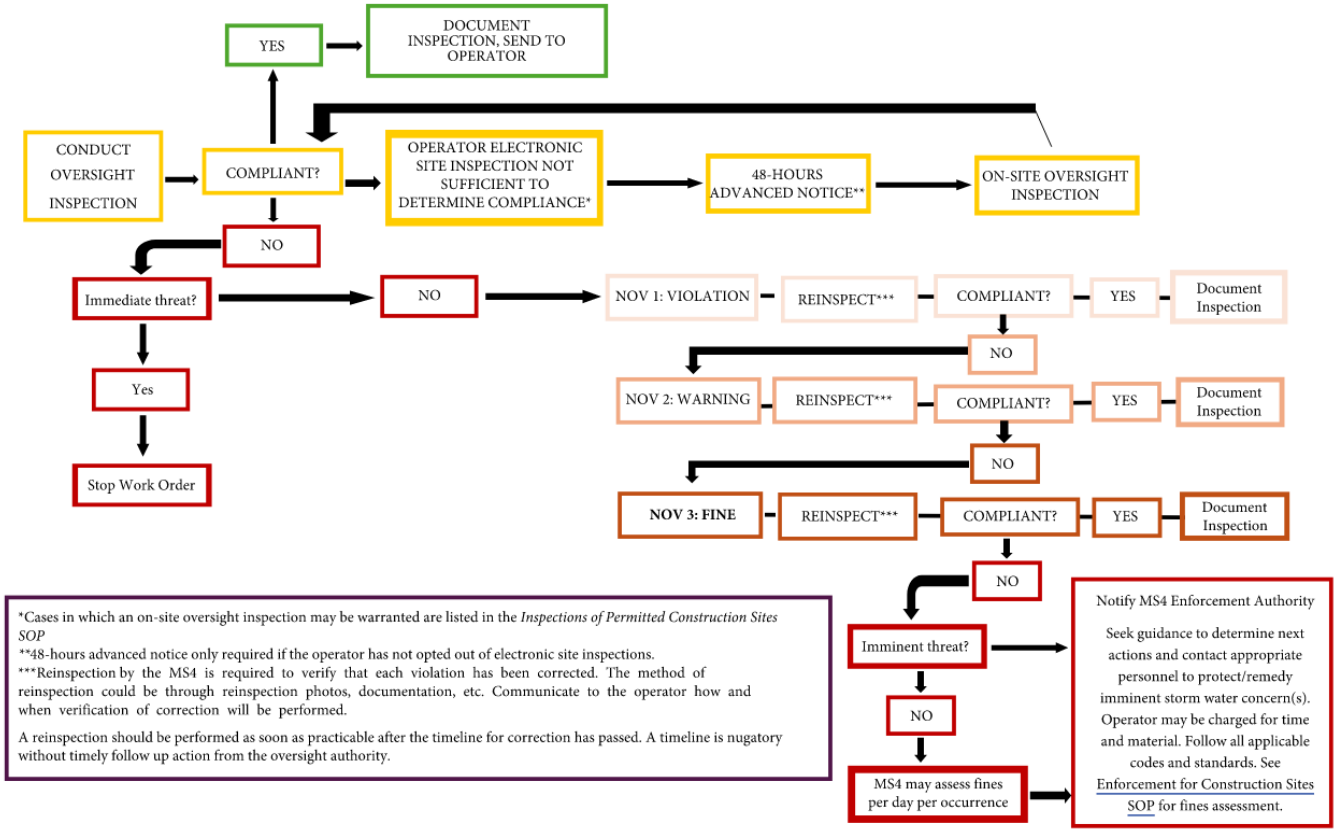
[2]Imminent threat means contaminants are anticipated to be discharged into a river, a stream, or a lake within 48-hours.

7. Flow Chart attached.

Enforcement for Construction Sites

Flow Chart

This Flow Chart is based on UAC 19-5-108.3



*Cases in which an on-site oversight inspection may be warranted are listed in the *Inspections of Permitted Construction Sites SOP*

**48-hours advanced notice only required if the operator has not opted out of electronic site inspections.

***Reinspection by the MS4 is required to verify that each violation has been corrected. The method of reinspection could be through reinspection photos, documentation, etc. Communicate to the operator how and when verification of correction will be performed.

A reinspection should be performed as soon as practicable after the timeline for correction has passed. A timeline is nugatory without timely follow up action from the oversight authority.

INSPECTION, ENFORCEMENT AND COMPLIANCE – Enforcing Long-Term Stormwater Controls

1. Preparation

a. Ensure any problems needing corrective action have been documented

b. Review maintenance agreement, previous inspections, warnings given, and other enforcement actions taken

c. Person who has enforcement authority is the Public Works Director

2. Process

a. Use these escalating enforcement actions pursuant to HCC 6-4-17 & HCC 6-4-20 for Stormwater controls with a maintenance agreement in place give a date to complete that gives the minimum time practicable to clean up discharge:

i. Issue a written notice of violation that requires any of the following methods

1. Performance of monitoring, analysis and reporting
2. Elimination of illicit discharge or connection
3. Cease and desist of discharge or practices
4. Abatement of storm water pollution or contamination hazards and restoration of affected property
5. Payment to cover administrative, remediation, monitoring, analysis, and reporting costs
6. Implementation of source control and/or treatment BMPs

b. Follow-up on notice of violation and if illicit discharge or connection is still present use enforcement actions pursuant to HCC 6-4-20 that may include

1. Criminal charges
2. Stop work orders
3. Have city crews install mitigation BMPs and charge for the work with a 25% penalty charge
4. Require repairs to be made to affected parties and include civil fines and penalties
5. Prosecute until obligations are met

c. For city owned stormwater controls

i. Give notice to city crews to correct problems at a minimum before the next storm event.

ii. If problems are not corrected notify the city crews again as well as the Stormwater coordinator. Give another deadline before the next storm event to complete the work.

3. Follow-Up

a. Return to check corrective action items no less than 24 hours after the given deadline and no more than 48 hours after any deadline given to the owner or city crews.

b. Take photos

c. Implement further escalating enforcement action as needed to ensure compliance

4. Documentation

a. File photos and inspection reports

b. Document enforcement actions taken

INSPECTION, ENFORCEMENT AND COMPLIANCE – Inspecting Long-Term Stormwater Controls

1. Preparation

a. Have the long-term stormwater inspection form on hand which is located in Field maps or appendix D of the SWMP

b. Have some method to take photos

c. The Storm water coordinator is responsible for inspections

2. Process

a. Complete inspections at least once during installation, once after installation during NOT inspection, and at a minimum every other year thereafter

b. Complete inspection form that is located on field maps

c. If any deficiencies are reported:

i. For a city owned stormwater control notify the public works director and give them a deadline before the next storm for to be completed.

ii. For a privately owned stormwater control initiate the **INSPECTION, ENFORCEMENT AND COMPLIANCE – Enforcing Long-Term Stormwater Controls** SOP.

3. Follow-up

a. Perform a follow-up inspection one business day after the deadline and follow any other procedeures in the **INSPECTION, ENFORCEMENT AND COMPLIANCE – Enforcing Long-Term Stormwater Controls** SOP.

4. Documentation

a. Document inspections in arcGIS

INSPECTION, ENFORCEMENT AND COMPLIANCE – Annual SWMP Review and annual report

1. Preparation

a. Gather Documentation

i. Illicit discharge documentation

ii. SWPPP review and inspection/enforcement documentation

iii. Current SWMP

iv. Training records

v. Education Material

b. Obtain most recent Annual SWMP review checklist

c. Plan to review SWMP before the end of August

2. Process

a. Fill out the checklist

i. Only mark an item as compliant if there is documentation that it occurred

b. Organize documentation into file server with files separated for each MCM

c. Review and update Minimum Control Measure goals in the SWMP

d. After June 30th begin filling out DWQ annual report on CDX with the information gathered from the SWMP review.

e. Submit Annual report to DWQ by the end of August each year, and archive the previous years data to avoid confusion with old inspection forms. Delete data that is older than five years.

3. Follow-up

a. For any items that were not marked as being non-compliant work to remedy that whether that is by acquiring the required documentation, scheduling trainings, make updates to documents, or schedule inspections.

b. If there is no way to fix a deficiency by June 30th, create a plan with responsible parties to be compliant with state requirements for the next planning period.

4. Documentation

a. Signed Annual SWMP review checklist

b. Documentation from the organized in the file server

c. Updated SWMP

d. Annual report submitted to the state by <Deadline for annual report>.

INSPECTION, ENFORCEMENT AND COMPLIANCE– Determining High Priority Areas.

1. Preparation

a. Map on ArcGIS that shows

i. Construction sites and their compliance status

ii. Illicit discharge history

iii. Areas with older or unknown storm infrastructure

iv. Areas discharging to impaired water ways

v. Land use

b. Complete this process anytime a new project that will be owned and operated by the city is completed.

2. Process

c. When determining the high priority areas and high priority construction sites consider the following

i. Density of construction site activity

ii. Areas with a history of illicit discharges

iii. Areas with onsite sewage disposal systems

iv. Industrial, commercial, or mixed-use areas

v. Areas with older sewer infrastructure or has a history of sewer overflows or cross connections

vi. Areas with older or unknown storm infrastructure

1) Unknown infrastructure anywhere in a stormwater catchment area needs to be considered in the high priority area assessment

2) Infrastructure that is older than 1970 will be considered in the high priority assessment

vii. Discharge areas to impaired waters

1) Reference the ArcGIS map to see the areas that drain to an impaired water.

2) Stormwater systems that discharge to an impaired water that have a possibility to contain the pollutants causing the impairment will be considered high priority.

d. High priority areas are to be updated annually every year

3. Documentation

a. Map on ArcGIS that shows all high priority areas, city facilities, and construction sites

b. High priority facility checklist stored on ArcGIS

INSPECTION, ENFORCEMENT AND COMPLIANCE– Determining High Priority Facilities.

1. Preparation

a. Map on ArcGIS that shows

i. Storm Drain infrastructure

ii. All city owned facilities

iii. Possible pollutants at each facility

iv. Waterways and their impairment status

b. Complete this process anytime a new project that will be owned and operated by the city is completed.

2. Process

a. High priority city facilities will be determined by filling out the city facility form on ArcGIS

b. When the high priority areas and high priority construction sites consider the following

i. Pollutants stored on site

ii. Improperly stored materials

iii. Potential pollutant-generating activities performed outside

iv. Proximity to fresh water and water bodies

v. Potential to discharge pollutants of concern to impaired waterway

3. Documentation

c. Map on ArcGIS that shows all high priority areas, city facilities, and construction sites

d. High priority facility checklist stored on ArcGIS

e. List of High priority facilities in SWMP

INSPECTION, ENFORCEMENT AND COMPLIANCE– Determining High Priority Construction Sites.

1. Preparation

a. SWPPP completed by construction site operator

b. Complete this process anytime a SWPPP is reviewed, or a site is having issues with compliance.

2. Process

a. High priority construction sites will consider the following

i. Compliance history

1) Operators that have on average for a six month period more than 2 NOV2 issued for violations related to Spills will be considered high priority

2) Operators that receive an NOV 3 will be considered high priority until all violations are remedied before they escalate to NOV 1 for 3 months

ii. On-site pollutants

1) Sites that have highly concentrated pollutants (i.e. Fuel Stations, onsite chemical storage, etc.)

2) Sites that contain pollutants that discharge to a waterbody impaired with that pollutant

iii. Proximity

1) Sites where the property being developed has access to a waterway

iv. Areas with older or unknown storm infrastructure

2) Unknown infrastructure anywhere in a stormwater catchment area needs to be considered in the high priority area assessment

3) Infrastructure that is older than 1970 will be considered in the high priority assessment

3. Documentation

a. Map on ArcGIS that shows all high priority construction sites

b. High priority facility checklist stored on ArcGIS

INSPECTION, ENFORCEMENT AND COMPLIANCE– Monthly High Priority Facility Inspection

1. Preparation

a. Plan to inspect sites once per month;.

b. Review information about previous monthly inspections. Notice any previous corrective action needed that has not been documented as complete.

c. Inspection form can be found on the ArcGIS inspection map

2. Process

a. Use the Monthly Stormwater Inspection Form as a guide;

b. Inspect each item listed on the inspection form according to the standards as described on the form;

c. Complete the report; note any corrective actions needed.

d. Send update email to public works director using automatic email generator tool

3. Follow-Up

a. Schedule any necessary corrective actions to be completed as soon as practicable, and at a minimum before the next storm event;

4. Documentation

a. Submit report to ArcGIS to be stored on survey123

b. Note and date all corrective actions performed on the Monthly Stormwater Inspection Form.

INSPECTION, ENFORCEMENT AND COMPLIANCE– Semi-Annual High Priority facility Inspection

1. Preparation

a. Plan to inspect sites twice per calendar year and schedule each inspection accordingly;

b. Review information about previous monthly inspections, semi-annual comprehensive inspections, and annual visual monitoring events. Notice any previous corrective action needed that has not been documented as complete.

c. Review SWPPPs, make and changes necessary

d. Inspection form can be found on the ArcGIS inspection map

2. Process

a. Use the Semi-Annual Inspection Form as a guide;

b. Inspect each item listed on the inspection form according to the standards as described on the form;

c. Complete the report; note any corrective actions needed.

d. Send update email to public work director using automatic email generator tool

3. Follow-Up

a. Schedule any necessary corrective actions to be completed as soon as practicable, and at a minimum before the next storm event;

4. Documentation

a. Submit report to ArcGIS to be stored on survey123

b. Note and date all corrective actions performed on the Drainage System Inspection Form.

INSPECTION, ENFORCEMENT AND COMPLIANCE– Annual High Priority Facility Inspection

5. Preparation

a. Plan to conduct visual monitoring once per calendar year;

b. Watch the weather; visual monitoring should be done within the first 30 minutes of when a storm event (> 0.1” precipitation) produces runoff, yet not within 72 hours of a previous storm that produced runoff; plan to perform the visual monitoring from these storms that occur during regular working hours.

c. Know the sampling locations which are shown in the SWPPP

d. Inspection form can be found on the ArcGIS inspection map

6. Process

a. Use the Visual Monitoring Requirements form as a guide;

b. Collect enough of a sample into an open, clear container to get a good identification of color, clarity, odor, and other parameters on the form;

c. Complete the report including the assessment portion.

d. Send update email to public works director using automatic email generator tool

7. Follow-Up

a. Schedule any necessary corrective actions to be completed as soon as practicable, and at a **minimum** before the next forecasted storm event.

8. Documentation

b. Submit report to ArcGIS to be stored on survey123

c. Note and date all corrective actions performed in the Assessment portion of the visual

VEHICLES – Fueling

1. Preparation

a. Train employees on proper fueling methods and spill cleanup techniques.

b. Install a canopy or roof over aboveground storage tanks and fuel transfer areas.

c. Absorbent spill clean-up materials and spill kits shall be available in fueling areas and on

d. mobile fueling vehicles and shall be disposed of properly after use.

2. Process

a. Shut off the engine.

b. Ensure that the fuel is the proper type of fuel for the vehicle.

c. Nozzles used in vehicle and equipment fueling shall be equipped with an automatic shut off to prevent overfill.

d. Fuel vehicle carefully to minimize drips to the ground.

e. Fuel tanks shall not be 'topped off'.

f. Mobile fueling shall be minimized. Whenever practical, vehicles and equipment shall be transported to the designated fueling area in the Facilities area.

g. When fueling small equipment from portable containers, fuel in an area away from storm drains and water bodies.

3. Clean Up

a. Immediately clean up spills using dry absorbent (e.g., kitty litter, sawdust, etc.) sweep up

b. absorbent material and properly dispose of contaminated clean up materials.

c. Large spills shall be contained as best as possible and the HazMat team should be notified ASAP.

4. Documentation

a. Comply with underground storage tank records and monitoring requirements.

b. Document training of employees.

VEHICLES – Vehicle and Equipment Storage

1. Preparation

a. Inspect parking areas for stains/leaks on a regular basis.

b. Provide drip pans or adsorbents for leaking vehicles.

2. Process

a. Whenever possible, store vehicles inside where floor drains have been connected to sanitary sewer system.

b. When inside storage is not available, Vehicles and equipment will be parked in the approved designated areas.

c. Maintain vehicles to prevent leaks as much as possible.

d. Address any known leaks or drips as soon as possible. When a leak is detected a drip pan will be placed under the leaking vehicle to collect the drip.

e. The shop will provide a labeled location to empty and store drip pans.

f. If any leaks are discovered, a drip pan will be used to collect the fluids and vehicle will be scheduled for repairs.

g. Clean up all spills using dry methods.

h. Never store leaking vehicles over a storm drain.

3. Clean Up

a. Any leaks that are spilled on the asphalt will be cleaned up with dry absorbent;

b. the dry absorbent will be swept up and disposed to the dumpster in the public works yard

c. The paved surfaces around the building will be swept every two weeks, weather permitting.

VEHICLES – Washing

1. Preparation

a. Provide wash areas for small vehicles inside the maintenance building that has a drain system which is separate from the Storm Drain.

b. No vehicle washing will be done where the drain system is connected to the storm sewer system.

2. Process

a. Utilize the UDOT facility on 5500 S 5600 W

b. Minimize water and soap use when washing vehicles inside the UDOT facility

c. Use hoses with automatic shut off nozzles to minimize water usage.

d. Never wash vehicles over or a storm drain.

3. Clean Up

a. Sweep wash areas after every washing to collect what solids can be collected to prevent them from washing down the drain system.

WATER – Planned Waterline Excavation Repair/Replacement

1. Preparation

a. Determine where discharge flow will go

b. Place inlet protection at nearest downstream storm drain inlet

c. Clean Gutters leading to inlet

d. Isolate waterline to be worked on

e. Neutralize any chlorine residual before discharging water

2. Process

a. Make efforts to keep water from pipeline from entering the excavation

b. Direct any discharge to pre-determined area

c. Backfill and compact excavation

d. Haul of excavated material or stock pile nearby

3. Clean up

a. Clear gutter/waterway where water flowed

b. Clean up all areas around excavation

c. Clean up travel path of trucked material

4. Documentation

a. Complete paperwork

WATER – Unplanned Waterline Excavation Repair/Replacement

1. Preparation

a. Make sure service trucks have <BMP for inlet protection>

2. Process

a. Slow the discharge.

b. Inspect flow path of discharged water

c. Protect water inlet areas

d. Follow planned repair procedures.

e. Haul off spoils of excavation

f. Consider use of silt filter bags on pumps

3. Clean-up

a. Repair eroded areas as needed

b. Follow planned repair procedures

c. Clean up the travel path of trucked excavated material

WATER – Transporting Dry Excavated Materials & Spoils

1. Preparation

a. Utilize truck with proper containment of materials

b. Determine disposal site of excavated materials

2. Process

a. Load

b. Check truck after loading for possible spillage

c. Transport in manner to eliminate spillage & tracking

d. Utilize one route for transporting

3. Clean-up

a. Clean loading area

b. Clean transporting route

c. Wash off truck and other equipment in a designated equipment cleaning area

WATER – Transporting Wet Excavated Materials & Spoils

1. Preparation

a. Utilize truck with containment for material

b. Determine disposal site of excavated material

2. Process

a. Load and Transport in manner to minimize spillage & tracking of material

b. Check truck for spillage

c. Utilize one route of transport

3. Clean-up

a. Clean route of transport to provide cleaning of any spilled material

b. Wash out equipment truck and other equipment in designated wash area

WATER – Waterline Flushing for Routine Maintenance

1. Preparation

a. Determine flow path of discharge to inlet of waterway.

b. Determine chlorine residual

c. Neutralize chlorine residual

2. Process

a. Clean flow path.

b. Protect inlet structures.

c. Use diffuser to dissipate pressure to reduce erosion possibilities.

3. Clean-up

a. Clean flow path

b. Remove inlet protection.

4. Documentation

a. Residual tests of discharge water.

WATER – Waterline Flushing after Construction/System Disinfection with Discharge to Storm Drain

1. Preparation

a. Determine chlorine content of discharged water, and select de-chlorination equipment to be used.

b. Determine flow path of discharge.

2. Process

a. Protect inlets in flow path

b. Install de-chlorination equipment

c. Sweep and clean flow path

d. Use diffuser to reduce velocities

3. Clean-up

a. Pick up inlet protection

b. Clean flow paths

c. Remove equipment from flush point

4. Documentation

a. Residual test of discharged water

WATER – Waterline Flushing after Construction/System Disinfection with Discharge with Haul Off (Used for Dust Control/Compaction)

1. Preparation

a. Determine chlorine content of discharged water

b. Determine appropriate construction activity for treatment

2. Process

a. Flush to tanker for disposal on unpaved construction activity for dust control or compaction

b. Conform that application of water is in appropriate location

3. Clean-up

a. Remove equipment from flush point

4. Documentation

a. Residual test of discharged water

b. Location of water discharged

APPENDIX D – PROGRAM DOCUMENTATION AND TEMPLATES

MCM 3 - IDDE

High Priority Area Inspection

High Priority Area/facility Inspected:

Location of Inspection:

Date of Inspection:

Type of Facility inspected:

Yes	No	
☐	☐	Does Facility Have Water in it
☐	☐	Is there any evidence of illicit discharge (oil sheen, foam, smell, residue, color)

***If Illicit Discharge is found initiate illicit discharge spill response**

Inspector Name:_____

Inspector Signature:_____

Date:_____

Hooper City
Website: Hoopercity.gov
Phone: 801-732-1064

IDDE INCOMING CALL REPORT FORM

(For Phone Operator)

Date of Illicit Discharge:_____Time:_____

Address of Discharge:_____

Name of individual or company discharging:_____

Name and phone number of person reporting discharge:_____

Chemical name or identity of any substance involved in the release: _____

_____

Is it a hazardous substance?_____

Estimate of Quantity spilled:_____

Did the illicit discharge enter a water body? _____

Did the illicit discharge enter the into the Storm Drain system? _____

Follow the Incident Response Flow Chart to determine who to contact.

Was this spill reported to the storm drain department?_____

If so, date reported_____

Additional Items Reported:_____

Follow Up Comments:_____

_____

MS4—DISCHARGE/SPILL INSPECTION REPORT

REPORTED INFORMATION

Reported by_____ Date _____

Location of Discharge _____

_____ Description of Discharge _____

_____

Amount of Discharge (Gallons) (estimated)_____

Report Taken by _____

INVESTIGATION INFORMATION
Complete and attach ***Visual Inspection Form***

Any Discharge to Storm Drain? □ Yes □

No Was Source of Discharge Found? □

Yes □ No

Date Investigation Began _____

Method(s) Used to Discover Source of Discharge

_____

_____

_____

Agencies Discharge was Reported To: _____Date _____

ILLICIT DISCHARGE REMOVAL INFORMATION

Description of Actions Taken to Cease and Remove the Discharge

_____

_____

_____

Has Illicit Discharge Been Eliminated? □ Yes Date _____□ No

ENFORCEMENT INFORMATION

List Enforcement Action(s) Taken

Date:_____Enforcement Action _____

Date:_____Enforcement Action _____

MCM - 4 Construction Site Runoff Control

Construction Oversight Inspection Form

Project Name		**UPDES Permit #**			**Expiration Date**		
Address					**Date**		
Owner		**Operator**			**Start Time**		
Site Contact		**Phone**			**Stop Time**		
Weather		**Date of last rain event**		**Approximate Rainfall (in)**			
Inspector(s)		**MS4/City**		**Receiving Waters**			
Project Area		**Disturbed Area**		**Project Type**			
Inspection reason	Scheduled☐	Complaint/Tip:☐	Random☐	**Inspector Code**	State☐	Local☐	
Inspection Code	SW Sampling ☐	SW non-Sampling ☐	**Inspection Type**	Onsite ☐	Electronic ☐	Reason (please list):	

Part 1: Onsite Storm Water Controls (BMPs) *(Utah Code § 19-5-108.3 part 7(c)(ii)(F))*	**List:** Yes, No, N/A
Arrival and Initial Checks: *(Track-Out Control)*	
1. Are roadways free of mud and sediment accumulation? *(CGP 2.2.4.e; CPP 2.1.4, 3.2.2; Utah Code § 19-5-108.3 part 7(c)(ii)(B))*	
2. Are effective track-out controls, such as stabilized construction entrances or wheel wash systems, installed and maintained at all egress points? *(CGP 2.2.4; CPP 2.1.4)*	
Perimeter Inspection: *(Perimeter Controls; Natural Buffer Areas; Discharge Points)*	
3. Are perimeter controls (e.g., silt fences, wattles, berms) properly installed and maintained, effectively preventing sediment from leaving the site, with no visible evidence of sediment discharges beyond the site boundary? *(CGP 2.2.3; CPP 2.1.2)*	
4. For disturbances located within 50 feet of waters of the state, are natural buffers (or equivalent controls), properly installed, maintained and effective at minimizing sediment discharges? *(CGP 2.2.1; CPP 2.1.6)*	
5. Are velocity dissipation devices installed at outfalls, along drainage channels, or at other locations to slow down runoff and prevent erosion? *(CGP 2.2.11; CPP 2.1.5.d)*	
Interior Site Inspection: *(BMPs: Inlet Protection; Stockpiles and Construction Materials; Erosion Controls / Pollution Prevention Controls; Chemical Storage and Fueling Areas; Sanitation and Waste Management; Concrete and Paint Washout)*	
6. Are storm drain inlets within and downslope of the construction site properly protected with appropriate BMPs (See SWPPP for installation specifications)? Has accumulated sediment in and around the inlet been removed? *(CGP 2.2.10; CPP 2.1.3)*	
7. Are soil and material stockpiles adequately protected from erosion and sediment transport using covers, silt fences, or other appropriate BMPs, and are they located away from stormwater conveyances and inlets? (*CGP 2.2.5; CPP 2.1.1)*	
8. Are effective suppression measures, such as water spraying or mulching, implemented on exposed soil areas to prevent excessive dust generation? *(CGP 2.2.6; CPP N/A)*	
9. Are erosion control measures (e.g., stabilization, mulching, erosion blankets) implemented effectively on slopes, disturbed areas, and other vulnerable areas, including any areas with no construction activities for 30 days? *(CGP 2.2.14; CPP 2.1.7)*	
10. Is vegetation preservation, slope disturbances, top-soil management, and soil compaction being effectively managed to prevent potential impacts on water quality? *(CGP 2.2.2, 2.2.7-2.2.9, 2.11; CPP 2.1.5)*	
11. Are effective spill prevention, containment, and pollutant discharge minimization measures in place for all equipment fueling, maintenance, and washing activities? *(CGP 2.3.1, 2.3.2; CPP 2.2.1, 2.2.3)*	
12. Are construction material storage, chemical storage and hazardous waste areas properly managed, minimizing exposure to precipitation, and are secondary containment and spill prevention measures in place? *(CGP 2.3.3.a-d; CPP 2.2.2, 2.2.3)*	
13. Are all areas free from spills or leaks? Has all evidence of a pollutant spill been properly contained and cleaned? *(CGP 2.3; CPP 2.2.3; Utah Code § 19-5-108.3 part 7(c)(ii)(C))*	
14. Are waste management practices effective, with all debris and blowable waste properly contained, and disposed of to prevent exposure to storm water and overflow? (CGP 2.3.3. e; CPP 2.2.4)	
15. Are portable sanitation facilities (e.g., port-o-potties) positioned securely, away from drainage features, and maintained to prevent leaks or spills? *(CGP 2.3.3.f; CPP 2.2.5)*	
16. Are designated areas for concrete, paint, and other construction material washouts properly managed to prevent contamination of stormwater? *(CGP 2.3.4; CPP 2.2.6)*	
17. Is the operator preventing any visible pollutants, prohibited discharges, or sediment from reaching unprotected storm drains or waters of the state? If an immediate threat is observed (See *Utah Code § 19-5-108.3 part 1(g))*, call the Environmental Incident Response Line (801) 536-4123. *(CGP 1.3, 3.1; CPP 1.3, 1.4)*	

Comments *(Summarize key observations from the inspection, including any violations, corrective actions needed, and any discussions with the site operator)*:

Part 2: Storm Water Records Review *(Utah Code § 19-5-108.3 part 7(c)(ii)(E))* *(Ensure all information is accurate and up to date)*	**List:** Yes, No, N/A
1. Is the SWPPP signage posted at the site entrance clearly visible, and does it include the required information (e.g., UPDES tracking number and site operator contact information)? (CGP 1.5; CPP 1.7)	
2. Is a copy of the SWPPP available onsite, or is its location clearly indicated on the posted signage and accessible within a reasonable time? *(CGP 7.4.1; CPP 4.1.2)*?	
3. Does the CGP SWPPP identify Storm Water Team personnel information including names, positions and responsibilities? Does the CPP SWPPP contain name, address, telephone and email information for general contractor, owner, and any other party implementing SWPPP? *(CGP 7.3.1; CPP 4.2.1)*	
4. Is there documentation verifying that all key personnel have received appropriate training as required by the CGP/CPP, and are these records included in the SWPPP? *(CGP 6.2, 6.3, 2.2.13.f, 7.3.1; CPP 4.2.9)*	
5. In the CGP SWPPP, is the construction activity described in detail, including an estimate of the area to be disturbed, the sequence of construction activities, and a description of all on-site and off-site construction activity support areas? In the CPP SWPPP, are sequences and construction activities listed including estimated dates for activities, landscaping, and any cessations of earth disturbing activities? *(CGP 7.3.2; CPP 4.2.2)*	
6. Does the SWPPP include a detailed site map showing storm drains, slopes, surface drainage patterns, stream buffer zones, stormwater discharge points, construction boundaries, limits of disturbance, surface waters (including the name of receiving waters), and the placement of both structural and non-structural controls? *(CGP 7.3.3; CPP 4.2.3)*	
7. Does the SWPPP include accurate discharge information, including receiving waters, impaired waters, and high-quality waters? Are there specific measures outlined to prevent the discharge of pollutants into these waters? *(CGP 3.2; CPP 1.5; 4.2.5)*	
8. Does the SWPPP identify all pollution-generating activities (e.g., concrete washout, solid waste disposal) that could affect storm water discharges from the site? *(CGP 7.3.2.f; CPP 4.2.6)*	
9. Are all authorized non-storm water discharges (e.g., fire hydrant flushing, uncontaminated groundwater) identified in the SWPPP? *(CGP 7.3.4; CPP N/A)*	
10. Does the SWPPP describe natural buffers and/or equivalent sediment controls (i.e., compliance alternatives)? *(CGP 7.3.5.b(1), Appendix A; CPP 4.2.4)*	
11. Does the SWPPP include detailed specifications for the placement and installation of all required erosion and sediment control measures (e.g., silt fences, sediment basins, check dams, inlet protection)? *(CGP 7.3.5.a; CPP 4.2.7)*	
12. Have specific stabilization measures, including both vegetative and non-vegetative practices, as well as the stabilization deadline, been provided in the SWPPP? *(CGP 7.3.5.b(6); CPP N/A)*	
13. Does the SWPPP include comprehensive spill prevention and response procedures, including personnel responsibilities, cleanup steps, and emergency contact information? *(CGP 7.3.5.b(7); CPP N/A)*	
14. Does the SWPPP include detailed specifications for the placement and installation of all required pollution prevention control measures, (e.g., material storage, construction waste management, sanitary waste management, and spill prevention measures) *(CGP 7.3.5.a; CPP 4.2.7)*	
15. Does the SWPPP show the inspection frequency selected for the site, the rain-gauge/weather station location (if applicable), any reduced frequency periods (e.g., frozen or stabilized areas), and the checklists/forms that will be used? *(CGP 7.3.6; CPP N/A)*	
16. Are routine site inspections being conducted at the selected frequency (i.e., every 7 or 14 days + within 24 hours of a 0.50-inch rainfall)? (CGP 4.2, 4.3, 4.4; CPP 3.2.1; *Utah Code § 19-5-108.3 part 7(c)(ii)(D))*	
17. Do the inspection reports document all areas and items required for inspection, including any BMP problems found or non-compliance observed? *(CGP 4.5, 4.6; CPP 3.3.1, 3.3.2, 3.3.3)*	
18. Are corrective actions from previous inspections entered in the corrective-action log within 24 hours (CGP only). Are corrective actions resolved or scheduled within 7 days, with the SWPPP and site map updated accordingly? *(CGP 5.2, 5.4, 7.5.a; CPP 3.4.1, 3.4.2, 4.3.1, 4.3.2)*	
19. Does the SWPPP include the Notice of Intent (CGP only), a copy of the CGP or CPP, and the Authorization to Discharge Letter? *(CGP 7.3.9; CPP 4.2.10)*	
20. Has the SWPPP been signed by the appropriate responsible corporate officer or duly authorized representative? *(CGP 9.9.2; CPP 4.2.11)*	
21. Has the operator submitted a complete and accurate NOI, signed by a responsible corporate officer? (CGP 1.4, 9.9.1; CPP 1.6, 5.9.1)	

Comments:

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

Inspector				
	Print Name	Title	Signature	Date

STORM WATER POLLUTION PREVENTION PLAN (SWPPP) COMPLIANCE EVALUATION FORM for UPDES CONSTRUCTION GENERAL PERMIT (CGP) UTRC00000

Site Name: _____ UPDES Permit #: _____

SECTION 1: Instructions for SWPPP Evaluations

1) The SWPPPs being reviewed with this document are evaluated for their compliance with the corresponding UPDES construction storm water discharge permit; for additional information on those permits, go to the DWQ construction storm water permitting webpage: https://deq.utah.gov/water-quality/general-construction-storm-water-updes-permits.
2) The appropriate permit is identified by the applicant during permitting but must be confirmed by evaluation in Section 2 of this form (see below), to demonstrate applicability of coverage under either of the UPDES construction storm water permits:
   a) Construction General Permit (CGP), UTRC00000 (viewable through this link)
   b) Common Plan Permit (CPP), UTRH00000 (viewable through this link)
3) If the appropriate UPDES permit has been selected for coverage and the SWPPP has been submitted for review with a complete application, then the SWPPP evaluation must move forward; use the "SWPPP Review #" field to document whether it is the 1st, 2nd (or more) evaluation, and use the "Review Start Date" and "Review Complete Date" fields in Section 3 to document the timeliness of reviews.
4) Per Utah Code Title19-Chapter5-Section108.3(6)(b), the SWPPP reviewer shall complete the first review of the SWPPP within 14 business days after the day on which the applicant submits a complete SWPPP and application for local storm water permit coverage (if local permit coverage is required).
5) A "No" answer for any questions in the following SWPPP Evaluation will amount to an incomplete SWPPP and will be returned for modification. UPDES Permit citations are provided in (**parenthesis**). Questions answered "N/A" (not applicable) do not affect the approval of the SWPPP. The final question on both forms is an internal question for MS4s and does not affect approval.
6) Per Utah Code Title19-Chapter5-Section108.3(6)(c), any non-compliance in the SWPPP (which requires modification to bring the SWPPP into compliance) requires a specific request for modification to be provided to the applicant; such requests must be thorough such that they will bring the SWPPP into compliance upon correction, and must include citations to local ordinances or state/federal law that require the modification. Furthermore, these requested modifications must be logged in an index of requested modifications. Space is provided for listing modifications or can be attached separately.
7) Per Utah Code Title19-Chapter5-Section108.3(6)(d), the SWPPP reviewer has 5 business days after the day on which the operator submits the modified SWPPP to complete the review of the SWPPP. Once the review of the plan is complete, the reviewer must notify the applicant, in writing, whether the authorization to discharge is granted.

NOTE: Pre-Construction SWPPP Review Checklists are a requirement of all UPDES MS4 Permits (Part 4.2.4.3). As such, utilizing these SWPPP Evaluation forms will meet that requirement. Operators and SWPPP Developers can utilize these forms to ensure compliance prior to submitting.

SECTION 2: Confirmation of Appropriate UPDES Construction Storm Water Permit Coverage

1) Will the project disturb at least 1-acre of land? **(CGP Part 1.1.2 and CPP Part 1.1)** **Yes** ☐ | **No** ☐

2) Is the project part of a Common Plan of Development or Sale (CPoD) that will collectively disturb at least 1-acre of land? **(CGP Part 1.1.2 and CPP Part 1.1)** **Yes** ☐ | **No** ☐

3) If CPoD, is the lot a single residential lot no more than 1-acre of disturbance? **(CPP Part 1.1)** **Yes** ☐ | **No** ☐ **N/A** ☐

How to determine appropriate UPDES construction storm water permit coverage:

- If "**No**" to both questions **#1** and **#2,** then **no UPDES construction storm water permit is required.**
- If "**Yes**" to question **#1** and "**No**" to question **#2**, then the project **must obtain CGP (UTRC00000) coverage** and **Section 3** of this evaluation form would be applicable for SWPPP review.
- If "**Yes**" to both questions **#1** and **#2,** and "**No**" to question **#3,** then the project **must obtain CGP (UTRC00000) coverage** and **Section 3** of this evaluation form would be most applicable for SWPPP review.
- If "**Yes**" or "**No**" to question **#1** (the threshold for **CPP** coverage is 1-acre or less) and "**Yes**" to both questions **#2** and **#3**, then the project **may obtain CPP (UTRH00000) coverage** and the **CPP SWPPP Evaluation form** would be applicable for SWPPP review; **however** the CPP allows only one lot per permit, so if multiple lots in the CPoD will be developed, the operator **may choose to obtain separate CPP coverage for each lot or cover multiple lots under one CGP (UTRC00000) permit,** in which case **Section 3** of this form would be applicable for SWPPP review.
  - **NOTE: Commercial Common Plans of Development or Sale must be covered under the CGP (UTRC00000).**
- As such, if "**No**" to question **#1**, "**Yes**" to question **#2,** and "**No**" to question **#3** (**or the project desires to cover multiple 1-acre or less residential lots under a single permit**), then the **CPP (UTRH00000) is not valid** and the project **must obtain CGP (UTRC00000) coverage** and **Section 3** of this evaluation form would be applicable for SWPPP review.

4) At the completion of Section 2, has the appropriate UPDES Construction Storm Water Permit coverage been verified? **NOTE:** If "**No**", then the SWPPP must be resubmitted with the appropriate permit coverage selected, incorporated into the plan, and obtained (unless reviewing prior to obtaining permit coverage, in which case coverage must be obtained prior to beginning land disturbance). **Yes** ☐ | **No** ☐

If "**Yes**" to question **#4, complete the review of the submitted SWPPP for the appropriate UPDES Construction Storm Water Permit coverage** using the **Section 3 of this evaluation form (for CGP)** or **the CPP Evaluation form (for CPP), respectively. Always fill out a new form for each review cycle, and retain previous forms to document progression.**

Signatures fields are included in the respective SWPPP review sections of this document; always sign and date to ensure timeliness of reviews.

UPDES CONSTRUCTION GENERAL PERMIT (CGP) UTRC00000
STORM WATER POLLUTION PREVENTION PLAN (SWPPP) EVALUATION FORM
SECTION 3

SWPPP Review # (1st, 2nd, 3rd, etc.): _____ Review Start Date: _____ Review End Date: _____

Site Name: _____ UPDES Permit #: _____

Site Address: _____

Local Jurisdiction or County: _____ Total Project Area (acres): _____ Total Disturbed Area (acres): _____

Permit Effective Date: _____ Permit Expiration Date: _____

Project Type: Residential/Subdivision ☐ Commercial ☐ Industrial ☐ Linear (Road/Pipe/Power) ☐ Land Disturbance ☐

OPERATOR CONTACT INFORMATION

Operator: _____ Phone: _____ E-mail: _____

On-site Facility Contact: _____ Phone: _____ E-mail: _____

Important Contact: _____ Phone: _____ E-mail: _____

Owner: _____ Phone: _____ E-mail: _____

CONSTRUCTION GENERAL PERMIT (CGP) SWPPP EVALUATION (with Citations)

1) Is the Storm Water Team (including other site Operators) identified by name and position in the SWPPP, including their SWPPP responsibilities and trainings? (**CGP Part 7.3.1**) **NOTE:** Storm Water Team responsibilities that must be included (CGP Part 6.1): **(1)** design, installation, maintenance, and/or repair of storm water controls (including pollution prevention controls); **(2)** application and storage of treatment chemicals (if applicable); **(3)** conducting inspections (CGP Part 4.1); and **(4)** taking corrective actions (CGP Part 5) — **Yes** ☐ **No** ☐

2) For any Storm Water Team member identified as being responsible for conducting inspections (CGP Part 4), has the SWPPP detailed their training/qualifications for conducting inspections in compliance with CGP Part 6.3? (**CGP Part 7.3.1**) — **Yes** ☐ **No** ☐

3) Are estimates provided for the size of the property (in acres, or length in miles if a linear site) and the total area to be disturbed by construction (including on-site and off-site support activity areas) to the nearest 1/4 acre (or 1/4 mile if linear)? (**CGP Part 7.3.2.b-c**) — **Yes** ☐ **No** ☐ **N/A** ☐

4) Does the plan describe the nature of construction activities, including the age or dates of past renovations for structures undergoing demolition (CGP Part 7.3.2.a) — **Yes** ☐ **No** ☐

5) Does the plan describe any on-site and off-site construction support activities areas (CGP Part 1.2.1.b)? (**CGP Part 7.3.2.d**) — **Yes** ☐ **No** ☐ **N/A** ☐

6) Is there a description of the construction schedule for: **(1)** commencement of activities, **(2)** temporary/permanent cessation of construction activities, **(3)** temporary/final stabilization of exposed areas of the site, and **(4)** removal of temporary storm water controls and construction equipment or vehicles and the cessation of construction related pollutant-generating activities. (**CGP Part 7.3.2.e(1-4)**) — **Yes** ☐ **No** ☐

7) Are the business days and hours for the project identified in the SWPPP? (**CGP Part 7.3.2.g**) — **Yes** ☐ **No** ☐

8) Is a legible Site Map (or maps) included (in an attachment of the SWPPP) which shows the permit-required features of the site? (**CGP Part 7.3.3.a-i**) **NOTE**: Required map features include: (**a**) boundaries of the property; (**b**) locations where construction activities will occur, including: **i)** earth-disturbing and demolition activities (phasing noted), **ii)** approximate slopes before and after grading (steep slopes noted), **iii)** stockpile locations (sediment, soil, materials, etc.), **iv)** any Waters of the State crossings, **v)** designated vehicle exit points (onto paved roads), **vi)** structures and other impervious surfaces upon completion of construction, **vii)** on-site and off-site construction support activity; (**c**) all Waters of the State within 1-mile of the site's discharge point (and the impairment/high-quality status of the water body); (**d**) type and extent of pre-construction ground cover; (**e**) drainage patterns of storm water and authorized non-storm water before and after grading; (**f**) storm water and authorized non-storm water discharge locations (including discharges to storm sewer inlets and outfalls to Waters of the State); (**g**) pollutant-generating activities (CGP Part 7.3.2.f); (**h**) storm water controls (including natural buffers and shared controls); (**i**) storage of polymers, flocculants, or other treatment chemicals. — **Yes** ☐ **No** ☐

9) Are the first downstream receiving waters of the state listed in the SWPPP, NOI, or the Site Map identifying the impairment (and TMDL status) or high-quality (Category 1 or 2) status of the water body? (**CGP Part 3.2 and 7.3.3.c**) — **Yes** ☐ **No** ☐ **N/A** ☐

10) If the receiving water is identified as impaired (particularly for sediment or nutrients, and especially if it has an EPA-approved TMDL), does the SWPPP list the impairment causing pollutants for the water body, and does it address the control of those impairment causing pollutants in the plan (if those pollutants are anticipated to be present on-site)? (**CGP Part 3.2**) — **Yes** ☐ **No** ☐ **N/A** ☐

11) If the receiving water is identified as high-quality, does the plan describe precautions taken to minimize pollution effects in the water body? (**CGP Part 3.2**) — **Yes** ☐ **No** ☐ **N/A** ☐

12) Are all potential pollutant-generating activities listed, with the pollutants/constituents listed and their locations identified either by description or reference to the site map? (**CGP Part 7.3.2.f**) — **Yes** ☐ **No** ☐

CONSTRUCTION GENERAL PERMIT (CGP) SWPPP EVALUATION (continued)

13) For each potential pollutant and/or pollutant-generating activity listed, does the SWPPP include: a description of the specific controls to meet requirements of the CGP (CGP Part 2.2 and 2.3), the design specifications (with reference to manufacturer or BMP manuals/ ordinances being followed), routine maintenance specifications, and the projected schedule for installation/implementation? (**CGP Part 7.3.5.a**) — Yes ☐ | No ☐

14) Are the presence/absence of all authorized non-stormwater discharges (CGP Part 1.2.2) identified, with a description of measures used to reduce them or prevent them from contributing pollutants to discharges (CGP Part 2) ? (**CGP Part 7.3.4**) — Yes ☐ | No ☐

15) If the project identifies dewatering as a pollutant-generating activity, does the plan describe the scope of dewatering and the BMPs used to manage those practices? (**CGP Part 7.3.2.f**) **NOTE**: UPDES Permit coverage for dewatering (and approval from local authorities) must be obtained prior to discharging from dewatering; can be obtained after SWPPP approval. (**CGP Part 1.2.4 and 2.3.7**) — Yes ☐ | No ☐ | N/A ☐

16) If the project is within 50 feet of a Water of the State (CGP Part 2.2.1 and A.1), was the selected natural buffers compliance alternative (CGP Part A.2.1), or exception (CGP Part A.2.2) identified, and were the required descriptions of equivalent sediment controls, alternatives, and/or infeasibility provided? (**CGP Part 7.3.5.b.(1) and A.2.3.**) — Yes ☐ | No ☐ | N/A ☐

17) Are the selected BMPs for erosion and sediment control (per CGP Part 2.2) identified and described with design specifications and instructions for installation, maintenance, and the projected schedule for implementation either in the main body of the SWPPP or as an attachment? (**CGP Part 7.3.5.a**) **NOTE**: CGP requires the following elements to be addressed in the SWPPP: **(a)** Preserve vegetation where possible (**CGP Part 2.2.2**); (**b**) Install sediment controls along downslope perimeter areas (**CGP Part 2.2.3**); (**c**) Minimize sediment track-out (**CGP Part 2.2.4 and 7.3.5.b.(3)**); (**d**) Manage stockpiles with perimeter controls and locate away from storm water conveyances (**CGP Part 2.2.5**); (**e**) Minimize dust (**CGP Part 2.2.6**); (**f**) Minimize steep slope disturbances (**CGP Part 2.2.7**); (**g**) Preserve topsoil (**CGP Part 2.2.8**); (**h**) Minimize soil compaction where final cover is vegetation (**CGP Part 2.2.9**); (**i**) Protect storm drain inlets (**CGP Part 2.2.10**); (**j**) Slow down runoff with erosion controls and velocity dissipation devices (**CGP Part 2.2.11**); (**k**) Appropriately design any sediment basins or impoundments (**CGP Part 2.2.12 and 7.3.5.b.(4)**); (**l**) Follow requirements for any treatment chemicals (**CGP Part 2.2.13**); (**m**) Stabilize exposed portions of site with 30-days of inactivity (**CGP Part 2.2.14**) — Yes ☐ | No ☐

18) If the project is linear (per CGP Part 2.2.3), are the areas where perimeter controls are not feasible documented (to support the determination) and are the other practices being implemented to minimize pollutant discharges described? (**CGP Part 7.3.5.b.(2)**) — Yes ☐ | No ☐ | N/A ☐

19) Are the specific vegetative/non-vegetative final stabilization measures (CGP Part 2.2.14) described, including location information and deadlines for implementation in accordance with CGP Part 2.2.14.a.? (**CGP Part 7.3.5.b.(6)(i-ii)**) — Yes ☐ | No ☐

20) Are spill prevention and response procedures (CGP Part 1.3.5 and 2.3.6) included that have procedures and responsible parties identified for stopping, containing, cleaning, and reporting spills, leaks and other releases (including notification of appropriate parties if the release contains a hazardous substance or reportable quantity)? (**CGP Part 7.3.5.b.(7)(i-iii)**) — Yes ☐ | No ☐

21) Are the selected BMPs for pollution prevention control (per CGP Part 2.3) identified and described with design specifications and instructions for installation, maintenance, and the projected schedule for implementation? (**CGP Part 7.3.5.a**) **NOTE**: CGP requires the following to be described in the SWPPP: **(a)** Equipment and vehicle fueling (**CGP Part 2.3.1**); **(b)** Equipment and vehicle washing (**CGP Part 2.3.2**); **(c)** Storage, handling, disposal of building products and wastes (**CGP Part 2.3.3**); **(d)** Washing of stucco, paint, concrete, form release oils, curing compounds, etc. (**CGP Part 2.3.4**); **(e)** Properly applying fertilizers (**CGP Part 2.3.5**) — Yes ☐ | No ☐

22) Are waste management procedures (CGP Part 2.3.3) described for handling, storing, and disposing of wastes generated on-site, including documented infeasibility and alternative practice statements for violating setback requirements (CGP Part 2.3.3.c(2)(ii)) or claims of exceptions from CGP Part 2.3.3.e? (**CGP Part 7.3.5.b.(8)(i-ii)**) — Yes ☐ | No ☐

23) If the project is claiming to be an "Emergency-Related construction activity" for the special condition allowing for work to begin prior to permit issuance, does the plan include a description of the nature of the public emergency and why immediate authorization was necessary? (**CGP Part 1.4.1.b**) — Yes ☐ | No ☐ | N/A ☐

24) If treatment chemicals (CGP Part 2.2.13) are planned for the project, are the required elements described [soil types on-site and from fill materials, list of treatment chemicals planned and justification that they are suitable for the site's soil characteristics, dosage of treatment chemicals or the methodology used to determine dosage, information from Safety Data Sheets (SDS), schematic drawings of enhanced controls or treatment systems, description of storage of chemicals (CGP Part 2.2.13.c), references to applicable local requirements for the use of these chemicals, copies of manufacturers specifications regarding their use, and any training that personnel who handle and apply chemicals have received prior to use of those chemicals? (**CGP Part 7.3.5.b.(5)(i-ix)**) — Yes ☐ | No ☐ | N/A ☐

25) Are the inspection, maintenance, and corrective actions procedures detailed in the plan (per CGP Part 2.1.4, Part 4, and Part 5), including the inspection schedule (CGP Part 4.2, Part 4.3, or Part 4.4), the location of the rain gauge or address of the weather station for rainfall monitoring (if applicable to the schedule), and any maintenance or inspection checklists or forms? (**CGP Part 7.3.6.a-d**) — Yes ☐ | No ☐

26) If the project discharges to a water body that is either impaired (for sediment or nutrients) or high-quality (CGP Part 3.2), is the increased inspections frequency of every 7 calendar days and within 24-hours of a 0.5-inch storm event selected? (**CGP Part 7.3.6.a and Part 4.3**) — Yes ☐ | No ☐ | N/A ☐

27) Is the reduced inspections frequency for stabilized areas, arid/semi-arid/drought-stricken areas, or frozen conditions selected with appropriate description and documentation of the applicability of that frequency? (**CGP Part 7.3.6.c and Part 4.4**) — Yes ☐ | No ☐ | N/A ☐

28) Was the SWPPP certified by the duly authorized signatory of the operator ? (**CGP Part 7.3.8 and Part 9.9.2**) — Yes ☐ | No ☐

CONSTRUCTION GENERAL PERMIT (CGP) SWPPP EVALUATION (continued)

29) If the project is >5-acres in disturbance, has a perennial surface water within 50 feet of the project, or has a steep slope (70% or 35 degrees, or more), was the SWPPP certified by a "qualified" SWPPP writer? (**CGP Part 7.2 and 7.2.1.a-e**) **Yes** ☐ **No** ☐ **N/A** ☐

30) Is a copy of the NOI that was submitted via the CDX NeTCGP for this project included in the SWPPP? (**CGP Part 7.3.9.a.**) **NOTE:** This would not be applicable if the SWPPP is being reviewed prior to the operator obtaining permit coverage. **Yes** ☐ **No** ☐ **N/A** ☐

31) Is a copy of the Authorization to Discharge Letter received from NeT (with the assigned NPDES ID) included in the SWPPP? (**CGP Part 7.3.9.b.**) **NOTE**: This would not be applicable if the SWPPP is being reviewed prior to the operator obtaining permit coverage. **Yes** ☐ **No** ☐ **N/A** ☐

32) Is a copy of the UPDES Construction General Permit (UTRC00000) included in the SWPPP, or a link by which the permit can be easily accessed by the storm water team if managing the SWPPP electronically? (CGP Part 7.3.9.c.) **Yes** ☐ **No** ☐

33) At the completion of this review, is the SWPPP approved and accepted as being in compliance with storm water regulations? NOTE: If not, specific comments will be provided below (or attached on a separate sheet if corrections are longer than the space provided) to clearly state why the SWPPP is non-compliant and logged in an index of modifications that includes citations to the permit requirements, local ordinances, state law, or federal law that require the modification. (Utah Code 19-5-108.3(6)(c)) **Yes** ☐ **No** ☐

34) Is this site designated by the MS4 as "Priority" based on the following factors: Soil erosion potential; Site slope; Project size and type; Sensitivity of receiving water bodies (impaired or high-quality waters); Proximity to receiving water bodies; or, Non-storm water discharges and past record of non-compliance by the operators of the construction site? **NOTE:** This is an internal question for MS4s to meet MS4 Permit requirements for prioritizing certain construction sites for increased inspections and does not affect the approval of the SWPPP. (**MS4 Permit Part 4.2.4.3.5**) List the applicable prioritizing factors: _____ **Yes** ☐ **No** ☐ **N/A** ☐

INDEX OF COMMENTS AND CORRECTIONS (WITH CITATIONS) FOR ACHIEVING SWPPP COMPLIANCE
(attach an additional comments page if more space is needed)

Reviewer (*Print Name*): _____ Title: _____ Signature: _____ Date: _____

STORM WATER POLLUTION PREVENTION PLAN (SWPPP) COMPLIANCE EVALUATION FORM for UPDES COMMON PLAN PERMIT (CPP) UTRH00000

Site Name: _____ UPDES Permit #: _____

SECTION 1: Instructions for SWPPP Evaluations

1) The SWPPPs being reviewed with this document are evaluated for their compliance with the corresponding UPDES construction storm water discharge permit; for additional information on those permits, go to the DWQ construction storm water permitting webpage: https://deq.utah.gov/water-quality/general-construction-storm-water-updes-permits.

2) The appropriate permit is identified by the applicant during permitting but must be confirmed by evaluation in Section 2 of this form (see below), to demonstrate applicability of coverage under either of the UPDES construction storm water permits:

a) Construction General Permit (CGP), UTRC00000 (viewable through this link)
b) Common Plan Permit (CPP), UTRH00000 (viewable through this link)

3) If the appropriate UPDES permit has been selected for coverage and the SWPPP has been submitted for review with a complete application, then the SWPPP evaluation must move forward; use the "SWPPP Review #" field to document whether it is the 1st, 2nd (or more) evaluation, and use the "Review Start Date" and "Review Complete Date" fields in Section 3 to track the timeliness of reviews.

4) Per Utah Code Title19-Chapter5-Section108.3(6)(b), the SWPPP reviewer shall complete the first review of the SWPPP within 14 business days after the day on which the applicant submits a complete SWPPP and application for local storm water permit coverage (if local permit coverage is required).

5) A "No" answer for any questions in the following SWPPP Evaluation will amount to an incomplete SWPPP and will be returned for modification. UPDES Permit citations are provided in (**parenthesis**). Questions answered "N/A" (not applicable) do not affect the approval of the SWPPP. The final question on both forms is an internal question (regarding priority status) for MS4s and does not affect approval.

6) Per Utah Code Title19-Chapter5-Section108.3(6)(c), any non-compliance in the SWPPP (which requires modification to bring the SWPPP into compliance) requires a specific request for modification to be provided to the applicant; such requests must be thorough such that they will bring the SWPPP into compliance upon correction, and must include citations to local ordinances or state/federal law that require the modification. Furthermore, these requested modifications must be logged in an index of requested modifications. Space is provided for listing modifications or can be attached separately.

7) Per Utah Code Title19-Chapter5-Section108.3(6)(d), the SWPPP reviewer has 5 business days after the day on which the operator submits the modified SWPPP to complete the review of the SWPPP. Once the review of the plan is complete, the reviewer must notify the applicant, in writing, whether the authorization to discharge is granted.

NOTE: Pre-Construction SWPPP Review Checklists are a requirement of all UPDES MS4 Permits (Part 4.2.4.3). As such, utilizing this SWPPP Evaluation forms will meet that requirement. Operators and SWPPP Developers can utilize this form to ensure compliance prior to submitting.

SECTION 2: Confirmation of Appropriate UPDES Construction Storm Water Permit Coverage

1) Will the project disturb at least 1-acre of land? **(CGP Part 1.1.2 and CPP Part 1.1)** **Yes** ☐ **No** ☐

2) Is the project part of a Common Plan of Development or Sale (CPoD) that will collectively disturb at least 1-acre of land? **(CGP Part 1.1.2 and CPP Part 1.1)** **Yes** ☐ **No** ☐

3) If CPoD, is the lot a single residential lot no more than 1-acre of disturbance? **(CPP Part 1.1)** **Yes** ☐ **No** ☐ **N/A** ☐

How to determine appropriate UPDES construction storm water permit coverage:

- If "**No**" to both questions **#1** and **#2,** then **no UPDES construction storm water permit is required.**
- If "**Yes**" to question **#1** and "**No**" to question **#2**, then the project **must obtain CGP (UTRC00000) coverage** and the **CGP SWPPP Evaluation form** would be applicable for SWPPP review.
- If "**Yes**" to both questions **#1** and **#2,** and "**No**" to question **#3,** then the project **must obtain CGP (UTRC00000) coverage** and the **CGP SWPPP Evaluation form** would be most applicable for SWPPP review.
- If "**Yes**" or "**No**" to question **#1** (the threshold for CPP coverage is 1-acre or less) and "**Yes**" to both questions **#2** and **#3**, then the project **may obtain CPP (UTRH00000) coverage** and **Section 3** of this evaluation form would be applicable for SWPPP review; **however** the CPP allows only one lot per permit, so if multiple lots in the CPoD will be developed, the operator **may choose to obtain separate CPP coverage for each lot or cover multiple lots under one CGP (UTRC00000) permit,** in which case the **CGP SWPPP Evaluation form** would be applicable for SWPPP review.
  - **NOTE: Commercial Common Plans of Development or Sale must be covered under the CGP (UTRC00000).**
- As such, if "**No**" to question **#1**, "**Yes**" to question **#2,** and "**No**" to question **#3** (**or the project desires to cover multiple 1-acre or less residential lots under a single permit**), then the **CPP (UTRH00000) is not valid** and the project **must obtain CGP (UTRC00000) coverage** and the **CGP SWPPP Evaluation form** would be applicable for SWPPP review.
  - **NOTE:** Due to **CPP Part 1.1.5 (*High Risk Sites*)**, local/state permitting authorities **may** choose to require a site to obtain **CGP (UTRC00000)** coverage **instead of CPP (UTRH00000)** if the project is (**1**) located within 50 feet of a perennial surface water, or (**2**) if the site has a steep slope (70% or 35 degrees, or more) with an elevation change from the slope of 10 feet or more (at any point during the time of construction -not including stockpiles). **If that is the case, the SWPPP evaluator should identify the site conditions that warrant that distinction/decision:**

_____

4) At the completion of Section 2, has the appropriate UPDES Construction Storm Water Permit coverage been verified? **NOTE:** If "**No**", then the SWPPP must be resubmitted with the appropriate permit coverage selected, incorporated into the plan, and obtained (unless reviewing prior to obtaining permit coverage, in which case coverage must be obtained prior to beginning land disturbance). **Yes** ☐ **No** ☐

If "**Yes**" to question **#4, complete the review of the submitted SWPPP for the appropriate UPDES Construction Storm Water Permit coverage** using **the CGP SWPPP Evaluation form (for CGP)** or **Section 3 of this form (for CPP), respectively. Always fill out a new form for each review cycle, and retain previous forms to document progression.**

Signatures fields are included in the respective SWPPP review sections of this document; always sign and date to ensure timeliness of reviews.

UPDES COMMON PLAN PERMIT (CPP) UTRH00000
STORM WATER POLLUTION PREVENTION PLAN (SWPPP) EVALUATION FORM
SECTION 3

SWPPP Review # (1st, 2nd, 3rd, etc.): _____ Review Start Date: _____ Review End Date: _____

Site Name: _____ UPDES Permit #: _____

Site Address: _____

Local Jurisdiction or County: _____ Total Project Area (acres):_____ Total Disturbed Area (acres): _____

Permit Effective Date: _____ Permit Expiration Date: _____

OPERATOR CONTACT INFORMATION

Operator: _____ Phone: _____ E-mail: _____

On-site Facility Contact: _____ Phone: _____ E-mail: _____

Important Contacts: _____ Phone: _____ E-mail: _____

Owner: Phone: _____ E-mail: _____

COMMON PLAN PERMIT (CPP) SWPPP EVALUATION (with Citations)

1) Does the project meet eligibility criteria for the Common Plan Permit, including the 1-acre maximum disturbance, residential land-use stipulation, multiple site coverage applications (requiring a different permit number for each lot), high-risk sites (as determined by the MS4, if applicable), and limitations of the CPoD (common plan purpose not yet achieved)? (**CPP Part 1.1.1.a-d**) **Yes** ☐ **No** ☐

2) Are the SWPPP contacts listed in the plan, with contact information (name, address, telephone number, email address) for owner, general contractor, or any other party that affects implementation of the SWPPP or has SWPPP responsibilities? (**CPP Part 4.2.1**) **Yes** ☐ **No** ☐

3) Does the SWPPP list all the anticipated allowable non-storm water discharges at the site, and describe control methods to be utilized to manage those discharges in a manner that will minimize the discharge of pollutants? **(CPP Part 1.2.2)** **Yes** ☐ **No** ☐

4) Does the SWPPP identify which perimeter sediment control BMPs will be used to prevent sediment from leaving the site? (**CPP Part 2.1.2**) **Yes** ☐ **No** ☐

5) If the project is within 50-feet of a waterbody, does the SWPPP contain descriptions of the dimensions of the 50-foot natural buffer, the alternative control measures (if less than 50-feet), and detailed explanations if either could not be applied? (**CPP Part 2.1.6 and 4.2.4**) **Yes** ☐ **No** ☐ **N/A** ☐

6) Does the SWPPP describe what track out controls (structural or non-structural) will be used to prevent dirt from being tracked on streets as vehicles leave the site?(**CPP Part 2.1.4**) **Yes** ☐ **No** ☐

7) Does the SWPPP identify whether any storm drain inlets are down gradient of (and receive discharges from) the site and describe what inlet protection BMPs will be used (if inlets are present)? (**CPP Part 2.1.3**) **Yes** ☐ **No** ☐

8) Does the plan have a BMP identified for stockpiles or spoil piles placement and/or containment to prevent interaction with concentrated flows and to prevent runoff from those piles and keep them from entering storm drains or water bodies? (**CPP Part 2.1.1**) **Yes** ☐ **No** ☐ **N/A** ☐

9) Does the project have a BMP identified to contain, dry, and dispose of any wash water from concrete, masonry, stucco, or paint (water-based)? (**CPP Part 2.2.6**) **Yes** ☐ **No** ☐

10) Does the SWPPP include waste management procedures for soil removal, clearing debris removal, demolition removal, trash disposal, construction-waste disposal, liquid waste disposal and/or sanitary waste disposal? **(CPP Part 2.2.4 and 4.2.8)** **Yes** ☐ **No** ☐

11) Does the SWPPP describe methods for the storage of construction materials that minimize exposure of materials with a pollution risk (certain building and landscaping materials, pesticides, herbicides, detergents, etc.)? (**CPP Part 2.2.2**) **Yes** ☐ **No** ☐

12) If the site has steep slopes (>70%), does the plan include measures to either stabilize those slopes using an appropriate BMP or to avoid disturbing those steeper areas? **(CPP Part 2.1.5.c and 2.1.7.c)** **Yes** ☐ **No** ☐ **N/A** ☐

13) If the site has conditions that can cause stormwater flows with highly erosive velocities, does the plan describe BMPs to control those flows and minimize sediment transport? (**CPP Part 2.1.5.d**) **Yes** ☐ **No** ☐ **N/A** ☐

14) If there are disturbed areas that will be left inactive for 30-days, does the plan provide a method of temporary/permanent stabilization for those areas? (**CPP Part 2.1.7.a**) **Yes** ☐ **No** ☐ **N/A** ☐

15) If the site is planned to be sold without landscaping, does the SWPPP include the installation of downslope erosion and sediment controls for the lot, prior to sale? (**CPP Part 1.6.7.b**) **Yes** ☐ **No** ☐ **N/A** ☐

16) Are the sequence and estimated dates of construction activities listed, which include the start and end of excavation activities, initial excavation, backfill excavation, and final grading, any temporary or permanent cessation of earth-disturbing activities, and the start and end of landscaping if it is done as part of the construction activity before the home is sold? (**CPP Part 4.2.2.a-c**) **Yes** ☐ **No** ☐

COMMON PLAN PERMIT (CPP) SWPPP EVALUATION (continued)

17) Is a site map or chart (may be hand drawn) included in the SWPPP which shows the permit required features? (**CPP Part 4.2.3.a-h**) **NOTE**: Permit required map features include: **a)** Boundaries of property (**CPP Part 4.2.3.a**); **b)** Boundaries of soil surface disturbances, including any outside of the property boundaries (**CPP Part 4.2.3.b**); **c)** Slopes, including areas of steep slopes (**CPP Part 4.2.3.c**); **d)** Locations of stockpiles of soils, storage of construction materials, portable toilets, trash containers, concrete washout pits or containers, egress points, and track out pads (**CPP Part 4.2.3.d**); **e)** Water bodies, wetlands, and natural buffer areas (**CPP Part 4.2.3.e**); **f)** Locations and types of BMPs (or storm water control measures) for the control and/or treatment of storm water flowing onto, through, and/or off-site (**CPP Part 4.2.3.f**); **g)** Locations of storm water inlets and/or storm water discharge points going off-site (**CPP Part 4.2.3.g**); **h)** Areas that will be temporarily or permanently stabilized during the construction period (**CPP Part 4.2.3.h**) **Yes** ☐ **No** ☐

18) Does the SWPPP include a list of the construction site pollutants that are anticipated on-site, including the pollutant-generating activities and an inventory of pollutants for each pollutant-generating activity? (**CPP Part 4.2.6**) **Yes** ☐ **No** ☐

19) Is a plan included in the SWPPP which prevents the discharge of pollutants from spills and leaks by implementing procedures for preventing and responding to chemical leaks and spills (e.g., spill kits or absorbent materials).? (**CPP Part 2.2.3**) **Yes** ☐ **No** ☐

20) Does the SWPPP include BMP specifications and/or details that ensure effectiveness and compliance with permit requirements for all structural or non-structural sediment, erosion, and pollution prevention BMPs? (**CPP Part 4.2.7**) **Yes** ☐ **No** ☐

21) Does the SWPPP identify the first receiving water that the site discharges into, whether the water is impaired, and if so, what the impairment is for? (**CPP Part 4.2.5**) **Yes** ☐ **No** ☐

22) If the receiving water identified in the SWPPP is impaired for sediment or nutrients, does the SWPPP identify BMPs to minimize and prevent the discharge of those pollutants? (**CPP 1.5**) **Yes** ☐ **No** ☐ **N/A** ☐

23) If the permit, SWPPP, and/or inspections signatory obligations will be handled by a duly authorized signatory (**CPP Part 5.9.2**), is there a written and signed delegation of authority included in the SWPPP that shows this person/position was delegated signatory responsibilities? (**CPP Part 5.9.3.a-b**) **Yes** ☐ **No** ☐ **N/A** ☐

24) Is the SWPPP signed and certified by an authorized person in accordance with signatory requirements of CPP Part 5.9? (**CPP Part 4.2.11**) **Yes** ☐ **No** ☐

25) Does the SWPPP include a copy of the Notice of Intent (NOI) that was submitted to DWQ to obtain coverage under the Common Plan Permit UTRH00000 (CPP Part 1.6) and a copy of the Authorization to Discharge Letter from DWQ? (**CPP Part 4.2.10**) **NOTE**: This would not be applicable for this review if the SWPPP is being reviewed prior to the operator obtaining permit coverage. **Yes** ☐ **No** ☐ **N/A** ☐

26) At the completion of this review, is the SWPPP approved and accepted as being in compliance with storm water regulations? NOTE: If not, specific comments will be provided below (or attached on a separate sheet if corrections are longer than the space provided) to clearly state why the SWPPP is non-compliant and logged in an index of modifications that includes citations to the permit requirements, local ordinances, state law, or federal law that require the modification. (Utah Code 19-5-108.3(6)(c)) **Yes** ☐ **No** ☐

27) Is this site designated by the MS4 as "Priority" based on the following factors: Soil erosion potential; Site slope; Project size and type; Sensitivity of receiving waterbodies (impaired or high-quality waters); Proximity to receiving waterbodies; or non-storm water discharges and past record of non-compliance by the operators of the construction site? **NOTE:** This is an internal question for MS4s to meet MS4 Permit requirements for prioritizing certain construction sites for increased inspections and does not affect the approval of the SWPPP. (**MS4 Permit Part 4.2.4.3.5**) List the applicable prioritization factors: _____ **Yes** ☐ **No** ☐ **N/A** ☐

INDEX OF COMMENTS AND CORRECTIONS (WITH CITATIONS) FOR ACHIEVING SWPPP COMPLIANCE (attach an additional comments page if more space is needed)

Reviewer (*Print Name*): _____ Title: _____ Signature: _____ Date: _____

Construction Oversight Notice of Termination Form

BACKGROUND INFORMATION

Site Name:	UPDES Permit #:
Site Address:	
Local Jurisdiction or County:	
Permit Effective Date:	Permit Expiration Date:
Total Project Area:	Total Disturbed Area:

Project Type: (circle) *Subdivision* *Commercial* *Industrial* *Linear (Road/Pipe/Power)* *Land Disturbance*

OPERATOR CONTACT INFORMATION

	NAMES	PHONE NUMBERS	E-MAIL
Operator:			
Onsite Facility Contact:			
Important Contacts:			
Important Contacts:			

NOTICE OF TERMINATION (NOT) INSPECTION

Inspected By:	Date of Evaluation:
Title\Organization:	

	List: Yes, No, N/A
1. Has the site achieved final stabilization? (>70% vegetative and/or non-vegetative cover for all disturbed areas) (CGP 8.2.1.a, 2.2.14.b; CPP 1.7.1)*	
2. Have all construction materials, waste and waste handling devices been removed? (CGP 8.2.1.b; CPP 2.4)	
3. Have all temporary storm water controls been removed? (CGP 8.2.1.c)	
4. Have all pollutants and pollutant-generating activities been removed? (CGP 8.2.1.d; CPP 2.8, 2.9)	
5. If landscaping will be completed by the homeowner, have temporary sediment and erosion controls been installed? (CGP 8.2.4; CPP 1.7.2)	

***Provide comments for exceptions under CGP 2.2.14.b(3) (arid conditions, restored ag. land, or areas to remain disturbed).**

COMMENTS:

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

Inspector:

(Print Name) (Title) (Signature) (Date)

Operator:

(Print Name) (Title) (Signature) (Date)

modified 04/25

Template for Close-out and Compliance status on their site.

This email serves as Notice of Inspection under the Utah Pollutant Discharge Elimination System (UPDES) Construction General Permit (<Permit Number>) or Common Plan Permit, as applicable to your project located at:

Project Name: <Project Name>
Site Address: <Site Address>
UPDES Permit Tracking Number: <Permit Number>

Your site was in compliance with the Construction General Permit or Common Plan Permit requirements at the time of inspection. A more detailed report is available upon request.

Resources:
Utah DEQ Construction Stormwater Page
Utah Construction General Permit (CGP)
Utah Common Plan Permit (CPP)

If you have any questions or need assistance, please contact me directly at amackliet@jub.com.

Template for NOV 1

This email serves as Notice of Violation 1 (NOV 1) for noncompliance with the Stormwater Pollution Prevention Plan (SWPPP) requirements under the Utah Pollutant Discharge Elimination System (UPDES) Construction General Permit (UTRC00000) or Common Plan Permit (UTRH00000), as applicable to your project located at:

Project Name: **<Project Name>**

Site Address: **<Site Address>**
UPDES Permit Tracking Number: **<Permit Number>**

Violation Summary:
During a site inspection conducted on <Inspection Date> , the following SWPPP-related violations were observed:

<Questions on form that were answered no, include Permit reference>

These findings constitute a violation of the conditions outlined in Part 2 and Part 3 of the Utah Construction General Permit and/or Common Plan Permit, which require implementation and maintenance of Best Management Practices (BMPs), proper documentation, and site stabilization.

Required Corrective Actions:

Please address the listed violations by completing the following actions before **<Reinspect Date>**:

<Action Items from Inspection Report>

Photos of corrected action items may be sent to amackliet@gmail.com

Failure to respond or correct these deficiencies may result in escalation to Notice of Violation 2 (NOV 2), and further escalating enforcement actions.

Resources:
Utah DEQ Construction Stormwater Page
Utah Construction General Permit (CGP)
Utah Common Plan Permit (CPP)

If you have any questions or need assistance, please contact me directly at amackliet@jub.com.

NOV 2 Template

This email serves as Notice of Violation 2 (NOV 2) for noncompliance with the Stormwater Pollution Prevention Plan (SWPPP) requirements under the Utah Pollutant Discharge Elimination System (UPDES) Construction General Permit (UTRC00000) or Common Plan Permit (UTRH00000), as applicable to your project located at:

Project Name: **<Project Name>**

Site Address**: <Site Address>**

UPDES Permit Tracking Number: **<Permit Number>**

Violation Summary:

During a site inspection conducted on **<Inspection Date>** , the following SWPPP-related violations were observed a more detailed inspection report is available upon request:

<Questions on form that were answered no, include Permit reference>

These findings constitute a violation of the conditions outlined in Part 2 and Part 3 of the Utah Construction General Permit and/or Common Plan Permit, which require implementation and maintenance of Best Management Practices (BMPs), proper documentation, and site stabilization.

The following action items need to be resolved before **<Reinspection Date>**:

<Open Action Items>

Photos of corrected action items may be sent to amackliet@gmail.com

Failure to respond by the deadline will result in escalation to Notice of Violation 3 (NOV 3) which includes fines according to the following fine schedule which may be imposed each business day.

1. $500 per occurrence for working without an approved storm water permit;
2. $300 per occurrence for tracking mud on road;
3. $250 per occurrence for failure to clean up or report spills;
4. $100 per occurrence for failure to conduct storm water inspections;
5. $100 per occurrence for failure to maintain storm water records; and

6. $500 per site, per occurrence, for failure to use general best management practices, as determined by the authority;

Resources:
Utah DEQ Construction Stormwater Page
Utah Construction General Permit (CGP)
Utah Common Plan Permit (CPP)

If you have any questions or need assistance, please contact me directly at amackliet@jub.com.

NOV 3 Template:

This email serves as Notice of Violation 3 (NOV 3) for noncompliance with the Stormwater Pollution Prevention Plan (SWPPP) requirements under the Utah Pollutant Discharge Elimination System (UPDES) Construction General Permit (UTRC00000) or Common Plan Permit (UTRH00000), as applicable to your project located at:

Project Name: **<Project Name>**

Site Address**: <Site Address>**

UPDES Permit Tracking Number: **<Permit Number>**

Violation Summary:

During a site inspection conducted on **<Inspection Date>** , the following SWPPP-related violations were observed; a more detailed inspection report is available upon request:

<Questions on form that were answered no, include Permit reference>

These findings constitute a violation of the conditions outlined in Part 2 and Part 3 of the Utah Construction General Permit and/or Common Plan Permit, which require implementation and maintenance of Best Management Practices (BMPs), proper documentation, and site stabilization.

The following action items need to be resolved immediately to avoid further fines.

Action Items

<Open Action Items>

Photos of corrected action items may be sent to amackliet@gmail.com

Failure to complete action items will result in further fines which may be imposed each business day.

1. $500 per occurrence for working without an approved storm water permit;
2. $300 per occurrence for tracking mud on road;
3. $250 per occurrence for failure to clean up or report spills;
4. $100 per occurrence for failure to conduct storm water inspections;
5. $100 per occurrence for failure to maintain storm water records; and
6. $500 per site, per occurrence, for failure to use general best management practices, as determined by the authority;

*“each occurrence” i.e. “per occurrence” means that for each specific violation there is a separate fine associated with that violation each time that it occurs. For example, with two separate spills in different areas of the site, after the violation and follow up process has been exhausted for each spill, the MS4 could impose an administrative fine on the operator at $250 for each spill.

Resources:
Utah DEQ Construction Stormwater Page
Utah Construction General Permit (CGP)
Utah Common Plan Permit (CPP)

If you have any questions or need assistance, please contact me directly at amackliet@jub.com.

Template for Maintenance Actions Required

This email serves as a Notice of Maintenance deficiencies under the Utah Pollutant Discharge Elimination System (UPDES) Construction General Permit (UTRC00000) or Common Plan Permit (UTRH00000), as applicable to your project located at:

Project Name: <Project Name
Site Address: <Site Address>
UPDES Permit Tracking Number: <Permit Number>

Inspection Summary:

During a site inspection conducted on <Inspection Date>, found the following maintenance deficiencies.

<Questions on form that were answered no, include Permit reference>

Required Maintenance Actions:

Please address the listed maintenance items by completing the following actions no later than **<Reinspection Date>**:

<Action Items>

Photos of corrected maintenance items may be sent to amackliet@gmail.com

Failure to resolve the required maintenance may result in escalation to a Notice of Violation 1 (NOV 1).

Resources:
Utah DEQ Construction Stormwater Page
Utah Construction General Permit (CGP)
Utah Common Plan Permit (CPP)

If you have any questions or need assistance, please contact me directly at amackliet@jub.com.

A more detailed report is available upon request.

MCM - 5 Long Term Stormwater Controls

Long-Term Stormwater Control Inspection Checklist

General Information

Inspector_____ **Signature**_____ **Date**_____

Project Address_____ **City**_____ **State**_____

Current Ownership Information: ☐ **Private** ☐ **City**

Current Owner Name if Privately owned _____

Maintenance Agreement in place (Privately owned): ☐ **YES** ☐ **NO**

Storm water control ID _____

Visual and Structural Assessment

Yes	No	
☐	☐	Is vegetation healthy and preventing erosion
☐	☐	Are there signs of erosion or bare soil

Inlet and Outlet Channels and Structures

Yes	No	
☐	☐	Are inlets, Outlets, channels and structures free of obstructions
☐	☐	Is there any structural damage visible on any structures?

Spillways and Weirs

Yes	No	
☐	☐	Are spillways and weirs structurally sound
☐	☐	Are there any signs of overflow or erosion
☐	☐	Are spillways and weirs free of obstructions

Other Control Structures

Yes	No	
☐	☐	Are Control Structures functioning as designed
☐	☐	Is there any visible damage or wear on control structures

Sediment and Debris Accumulation

Yes	No	
☐	☐	Is there minimal accumulation in storage areas?
☐	☐	Are inlets and outlets clear of sediment accumulation
☐	☐	Are there any signs of illicit Discharge

Issues and Follow-Up

Responsible Party For Maintenance

_____

Describe Required Maintenance actions

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Deadline for Resolution_____

Re-inspection Date_____

Preparer Instructions

for the Storm Water System Operations & Maintenance Plan

Please review the following information to aid in completing the Storm Water System Operations & Maintenance Plan (Plan) for the existing or proposed site:

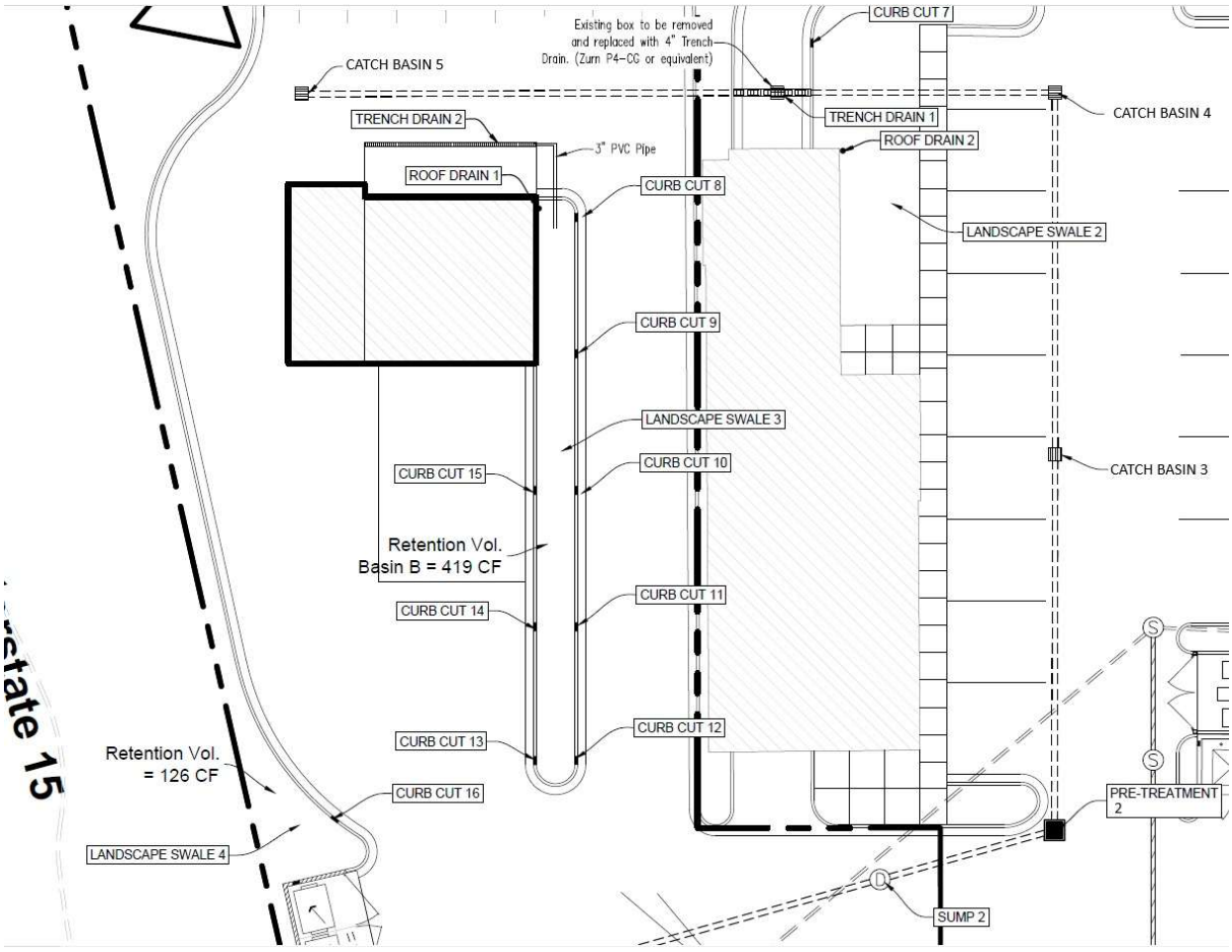
1. Complete the Contact Information prompts on the Title Page for the Plan.
   (If contact information changes, notify the City immediately)
2. Review the Background, Purpose and Responsibility sections.
3. Provide a Storm Water Maintenance Map
   a. This map must show the storm water system with each item labeled with a specific name, for example: Sump #1, Pretreatment Catch Basin #1, Inlet #2...
   b. The map should be simplistic so that it can be used by any owner or maintenance personnel. See Example Map on next page.
4. Review Section 2: Maintenance Schedules
   a. Update *Storm System Controls Table*: **Remove** any irrelevant controls not installed at the completed site. If the site has controls that are not included in the table, **add** a maintenance schedule for that specific control. If the frequency and indicator for maintenance is more specific or restrictive than described, modify the table as directed by the manufacturer or engineer.
   b. Update *Procedures for Pollutant Reduction Table*: **Remove** any irrelevant maintenance operations not performed at the completed site. If the site has maintenance operations that could produce or transport pollutants that are not included in the table, you must **add** a maintenance schedule for that specific maintenance operation.
5. Prepare a site specific *Owner Inspection and Maintenance Report* using the provided template for the maintenance team.
   a. Copy all storm system controls from the table into the *Owner Inspection and Maintenance Report Template*.
   b. Copy all operations from the *Procedures for Pollutant Reduction Table* into the *Owner Inspection and Maintenance Report Template*.
   c. If the person preparing the plan is using software that is compatible with forms in .pdf format, the *Owner Inspection and Maintenance Report* will auto populate.
6. Review Section 3: Standard Operating Procedures (SOPs)
   a. The SOPs provided are adequate for typical development. **Remove** any SOPs that would not be utilized for this site.
   b. **Add** any site specific SOPs not addressed by the SOPs provided. (For example, company specific SOPs that are more stringent or a specialized storm water control) Attach any necessary proprietary literature or

diagrams of storm water controls into the Plan in the Appendix or within the SOPs such as grease storage devices or hydrodynamic separators.

c. The "Storm Water System Maintenance SOP" describes how to maintain all typical control types in a storm system. **Remove** control types that are not utilized and **add** any storm system controls not listed in the SOP.

7. Attach in the Appendix:
   a. All documentation needed to perform storm water system maintenance inspections such as "as-built"- structure details, cross sections, landscape plans, drainage report, or grading and drainage sheets.
   b. The accepted and recorded Storm Water Maintenance Agreement, if provided by the municipality.

Example Storm Water Maintenance Map:



Storm Water System Operations & Maintenance Plan

For:

DEVELOPMENT NAME

Address
City, State, Zip Code

Last Modified: Date

COMPANY NAME

Owner Name (at time of occupancy)
Address 2
City, State, Zip Code 2
Phone
Email

PROPERTY MANAGER

Name/Company
Phone 2
Email 2

Contents

REGULATION

BACKGROUND

PURPOSE AND RESPONSIBILITY

SECTION 1: STORM WATER MAINTENANCE MAP

SECTION 2: MAINTENANCE SCHEDULES

STORM SYSTEM CONTROLS TABLE

PROCEDURES FOR POLLUTANT REDUCTION

INSPECTION & MAINTENANCE REPORT

SECTION 3: STANDARD OPERATING PROCEDURES (SOPs)

APPENDIX

(RECORDED MAINTENANCE AGREEMENT)

(TECHNICAL DOCUMENTS)

Background

The Environmental Protection Agency has delegated authority to the State of Utah to administer water quality regulatory programs. One of these is the storm water program that complies with the Federal Clean Water Act (CWA). To assist with this management, the Department of Environmental Quality, Division of Water Quality (DWQ) has designated municipalities and other entities to oversee their own storm water programs through a Municipal Separate Storm Sewer System (MS4) Permit. See the Utah Permitted MS4 Operator List at: MS4 Permit (Municipal Separate Storm Sewer System) - Utah Department of Environmental Quality

The Utah Storm Water Advisory Committee (USWAC), comprised of representatives from MS4s statewide, assists DWQ in developing practical storm water programs that protect water resources and promote consistency across the State.

This Storm Water System Operations and Maintenance Plan template was developed by USWAC and is intended to be completed to satisfy local requirements for establishing a maintenance plan for private storm water systems.

Purpose and Responsibility

The purpose of this **Storm Water System Operations and Maintenance Plan** (Plan) is to guide landowners and maintenance personnel on how to protect storm water quality and protect the integrity of the storm water systems. This Plan is written specifically for the site. Adherence to this Plan will help increase the longevity and effectiveness of storm water controls, reduce flood risks, and improve water quality for all.

The current Property Owner of Record is legally responsible for ensuring compliance, since the Storm Water Agreement runs with the land and was recorded as an Agreement with the MS4 (City). If the landowner has leased out the building or hired a property management company, then the owner is responsible for ensuring that the property manager adheres to this Plan. Notify the City if the property is sold or contact information changed as shown on the front page.

The summary of responsibilities for each property with an established Plan are:

- Provide an inspection report of the property to the MS4 (City) biennially (every other year) and include annual maintenance records.
- Inspect the storm water system annually at a minimum or as described in the Plan.
- Manage storm water runoff to minimize the discharge of pollutants.
- Maintain each storm water control as described in the Plan to perform its designed function.
- Document all maintenance activities that reduce onsite pollutants above and below-ground.
- Train staff and service contractors on how to maintain the property infrastructure to minimize pollution in storm runoff.
- Update the Plan when changes to business standards or regulations occur.

SECTION 1: STORM WATER MAINTENANCE MAP

The map(s) show the location of all the storm water controls for the site. Use this map to identify each control for inspection and maintenance.
For more detailed information such as structure details, grading and drainage sheets, or landscape plans see the appendix or request documentation from the City.

SECTION 2: MAINTENANCE SCHEDULES

STORM SYSTEM CONTROLS TABLE

Each of the storm water controls, their type, inspection frequency, and maintenance indicators are described in the Storm System Maintenance SOP. Below is a visual summary. Inspection frequency may increase if nuisance flooding or pollutant discharge is apparent.

Control Name	Type of Control	Inspection Frequency	Indicator for Maintenance
Above ground infiltration system	Infiltration	Biannually	Debris has decreased design infiltration rates or decreased volume capacity
Bioswale, rain gardens	Infiltration	Biannually	Debris has decreased design infiltration rates or decreased volume capacity
Catch basin inlet	Conveyance	Biannually	Debris has reached flow line
Curb Cut and outfall	Infiltration	Quarterly	Debris has impeded flow into designed area
Dry well (sump)	Infiltration	Annually	Debris has decreased design infiltration rates
Manufactured treatment device	Pretreatment Device	Biannually	Visual evidence of pollutants and refer to manufacturer's specifications
Non-infiltration detention system	Temporary Storage	Biannually	Debris has blocked the outlet causing long term storage of water
Orifice	Flow reduction	Biannually	Debris has blocked the opening
Pretreatment hood or elbow	Pretreatment Device	Quarterly	Debris from sump to flow line has reached 33%
Underground infiltration chamber system	Infiltration	Biannually	Debris has decreased design infiltration rates
Weep hole/wall drainage	Conveyance	Quarterly	Openings should be unobstructed and convey water to the designed location

PROCEDURES FOR POLLUTANT REDUCTION TABLE

Each of these Standard Operating Procedures (SOPs) are described more fully in Section 3. Below is a visual summary of the frequency the activity should occur according to best practices to reduce pollutants in storm water.

SOP	Frequency	Notes
Pavement Sweeping	Monthly	Most critical operation that helps keep the storm system clean
Landscape Maintenance	Weekly	All residual plant matter, fertilizer, pesticides etc. removed from hard surfaces after each event
Waste Management	Daily/Weekly	Ensure dumpster lids stay closed and dumpsters have no leaks (drain plug is in place). Immediately dispose of any loose debris/trash around the site.
Pavement Washing	Biannually	Strict requirements for pavement washing, refer to SOP
Snow and Ice Management	Seasonally	Snow becomes storm runoff, ensure it is pollutant free and does not obstruct drain inlets
Spill Control	At Occurrence	Clean using dry clean up methods, look for evidence of spills on hard surfaces
Pool, Spa, & Pond Drainage	Seasonally	Only clean water should be discharged, prepare for drainage ahead of time
Grease Storage/Recycling	Daily/Monthly	Contact local wastewater personnel. Outdoor grease storage check daily. Commercial grease traps check monthly dependent on business practices.

O&M Plan

Owner Inspection & Maintenance Report

See local municipality for submission process

This form is a tool to record inspections and maintenance according to the O&M Plan for the site. Send a copy of this report and/or any other maintenance records to the City or other regulatory agency every other year

Property Information			
Facility Name:		Inspection Date:	
Facility Address:		Phone Number:	
Current Owner:		Email Address:	

Description of changes such as business operation changes, O&M Plan changes, or drainage system modifications:

*Notify the City of any modifications to the O&M plan

Storm System Controls and SOPs [List all control types from the PLAN]	**Controls:** Is maintenance required for any structure? If yes, list the structure # and the plan of action or the maintenance completed. If no maintenance is required, explain why. **SOPs:** Review SOPs in the Plan, describe observations and any plans for improvement.
[List all SOPs from the PLAN]	

Insert photos of site conditions and attach any applicable maintenance records	
Notes:	Notes:
Notes:	Notes:
Notes:	Notes:

Will reinspection be necessary to ensure required actions have been completed?	☐ *Yes	☐ No	If "Yes", when will the reinspection occur? Date: _____
Inspector *(Print Name)*:	Signature:	_____	

*See next page for reinspection

Owner Inspection & Maintenance Report
REINSPECTION

Property Information			
Facility Name:		Follow Up Date:	

Inspection Report:		
Items Verified	Yes / No	Notes:
Have all items from the initial inspection report been addressed?		
Has all records of maintenance been kept for future reference?		

Comments:

Insert photos here	
Notes:	Notes:
Notes:	Notes:

Inspector (Print Name): Signature:

SECTION 3: STANDARD OPERATING PROCEDURES (SOPs)

It is the property owner's and maintenance team's responsibility to ensure the following SOPs are adequate for managing runoff impacts.

IMPORTANT: It is not realistic for each SOP to cover all necessary procedure operations. Owners or maintenance personnel, in good judgment, should take action to effectively contain and prevent the discharge of pollutants on site. Any operation changes that are more effective at protecting storm water quality should be documented and adopted as standard.

PAVEMENT SWEEPING

1. Purpose:

a) One of the primary contaminates in local water bodies is decaying organic material (sediment, plant matter).

b) Organic material as well as trash on parking areas and sidewalks could be transported via runoff to the drainage system, increasing maintenance cost. Utilizing pavement sweeping can be far more efficient than removing these debris after they have washed into the drainage system.

2. Procedure:

a) Regularly sweep surfaces and remove organic materials to prevent accumulations.

b) Remain aware of minor sediment/debris and hand sweep or remove material by other means as needed. Significant deposits will likely collect in autumn with leaf fall and early spring after winter thaw. Sweeping machinery is often the best tool for this application.

c) Remove materials that collect on top of storm inlets to improve run off flows and reduce pollutants washing into the storm system.

d) During pavement maintenance, regularly remove fugitive debris that can be carried offsite or to the storm system.

3. Disposal Procedure:

a) Dispose of hand collected material in dumpster

b) Use licensed facilities when haul off is necessary

4. Training:

a) Annually and at hire

b) If incorrect SOP implementation is observed, reinstruct staff or service contractors of proper SOP.

LANDSCAPE MAINTENANCE

1. Purpose:

a) To reduce storm water pollution and maintenance costs, debris from landscape maintenance operations should be removed immediately.
b) Primary contaminates in local water bodies include plant material, sediment, nutrients, and pesticides.

2. Procedure:

a) Maintain healthy vegetation root systems. Healthy root systems will help maintain more desirable infiltration rates of landscape areas receiving runoff.
b) Groundskeeping
   - Lawn Mowing – Immediately remove grass clippings to a dumpster or sweep/blow clippings back into the lawn for nutrient recycling.
   - Fertilizer and Pesticide Operations – Prevent overspray onto pavements for liquid applications. For granular application, sweep or blow any overspread back into the intended treatment area.
   - Trash and Debris – Remove and dispose of any trash and debris collected on the site.
c) Light weight debris and landscape materials need to be removed or contained when wind or rain is expected.
d) Landscape materials and waste can usually be contained or controlled by operational best management practices including but not limited to:
   - Strategic staging of materials eliminating exposure
   - Avoiding multiple day staging of backfill and spoil material on pavements
   - Haul off material as generated
   - Schedule work when clear weather is forecasted.
e) Erosion Control: maintain good working sprinkler systems, broken sprinklers or overwatering can cause erosion. Install down spout splash pads or rip rap to control erosion.
f) Cleanup: Use dry cleanup methods, e.g. square nose shovel and broom. Conditions are usually sufficient when no more material can be swept onto the square nosed shovel.

3. Disposal Procedure:

a) Dispose of waste according to General Waste Management SOP, unless this SOP states otherwise.

4. Training:

a) Annually and at hire
b) If incorrect SOP implementation is observed, reinstruct staff or service contractors of proper SOP.
c) Landscape Service Contractors use equal or better SOPs.

WASTE MANAGEMENT

1. Purpose:

a) To prevent pollution from waste mixing with storm water from improper handling of waste and maintenance of waste receptacles.

2. Procedure:

a) Keep dumpster lids closed, when not in use to prevent storm water entering the container.
b) Inspect dumpster or waste receptacle for leaks regularly and minimize disposal of liquids. The dumpster bottom should be watertight and if there is a drain hole, a plug should be in place. Contact the dumpster company if a plug is needed.
c) Beware of dumpster capacity, solve any recurring capacity issues that are observed. Do not leave bags outside of a dumpster.
d) Maintain outside storage, place items that could cause pollutants under a cover/roof.

3. Disposal Procedure:

Dispose of waste through a licensed service provider or haul waste to the local landfill facility. Review facility regulations for restrictions on certain hazardous materials. Liquid paints, chemicals, or solvents should be dried out before disposal and avoid dumping anything down a storm drain.

4. Training:

a) Annually and at hire
b) If incorrect SOP implementation is observed, reinstruct staff or service contractors of proper SOPs.

STORM WATER SYSTEM MAINTENANCE

1. Purpose:

a) Regular inspection and maintenance of the storm water system can ensure that the system meets its designed purpose.
b) Removing pollutants/debris prior to a rain or storm event, is far more cost effective than after they have washed into the drainage system.
c) During very intense storm events, pollutants stored in an unmaintained storm system may bypass the system and risk contaminating groundwater and local water bodies.

2. Inspections and Maintenance:

Follow the more restrictive inspection and maintenance requirements of this SOP and the proprietary literature.

Control Types

a) **Above ground infiltration system:**
Remove any debris observed and remove sediment accumulation when volume capacities drop below 90% or design infiltration rates are compromised due to silting in.
b) **Bioswales, rain gardens, and similar:**
Regularly remove trash and debris from landscaping areas. Inspect sediment accumulations and remove accumulations when volumes within the swales, rain gardens and landscape areas drop below 90%.
    - Poor drainage can be improved by maintaining healthy plant root systems.
c) **Catch basin inlets:**
Look into the grate for any debris accumulation. If safe to do so, remove any floating trash at each inspection interval with a rake or other means. Remove oil sheen with absorbent materials. Remove accumulated sediments once sediment has reached the flowline of the lowest pipe in the structure. This can be performed by hand or by an industry trained company with hydro-vacuum machinery.
d) **Curb cuts and outfalls:**
Inspect areas where storm water will enter infiltration areas such as from curb cuts, end of pipe, etc into landscaped areas. Remove any landscaping that will impede flow and any sediment accumulation. Ideally, the final grade of landscaping will be 2” below the flowline of storm water discharge.
e) **Dry well (sump):**
Access the manhole and look for standing water or debris accumulation. The dry well should be free of pollutants and the inspector should see a gravel bottom. If sediment and debris accumulation has reduced the storm water volume capacity of the sump by more than 10% or if grease/debris have impacted the design infiltration of the sump causing standing water, maintenance is required. Hydro-vacuum machinery will be required to restore the dry well to working order.
    - Identify the source of pollution and modify the Plan or retrofit the storm water system to prevent pollutants from entering the dry well.
f) **Manufactured treatment device (hydrodynamic separator variety):**
Inspect at the frequencies from storm water systems controls table. Remove floating debris and sediment accumulation when floating debris covers 50% of the surface and the sump is 50% full of sediment. Keep records of sediment depths and floating debris

amounts. You may adjust inspection frequencies that satisfy the minimum maintenance level amounts indicated.

g) Non-infiltration detention system:
Refer to manufacturer's literature on how to inspect and maintain. Typically storm water is heavily pretreated prior to entering the temporary holding area. Ensure orifice or other flow restriction structures remain unobstructed.

h) **Orifice and other flow restriction device:**
These openings must be free of debris so storm water draining from the site is not impeded. Remove any debris observed by hand or machinery.

i) **Pretreatment hood or elbow:**
Remove any floating trash at each inspection interval with rake or other means. Remove oil sheen with absorbent materials. Remove sediments once capacity below pipe flowline is reduced by 33%. This will usually require hydro-vacuum machinery.

- Contact mosquito abatement if mosquito larvae are observed unless all the water is removed with the maintenance operation.

j) **Underground infiltration chamber system:**
Access manhole or inspection ports and look for oils, sediment, or debris accumulation that can pollute subsurface soils and reduce the longevity of the system. Identify the source(s) of pollution and modify the Plan to prevent pollution from entering the subsurface system.

- If debris accumulation has reduced the storm water volume capacity of the infiltration system below 90%, hydro-vacuum machinery will be required to restore volume capacity.

k) **Weep holes or other wall drainage:**
These openings must be free of debris, remove any debris observed.

After Heavy Precipitation Events

a) Inspect water levels throughout the storm water system following significant storm events. The retention and detention depths should not exceed the depths shown on the plans for the respective storm event volumes. Contact a professional as needed.
b) Inspect surface water ponding. Water should not remain for longer than local requirements allow. Contact an engineer when the system is not draining.
c) Inspect the storm water system for damage and tampering.

3. Disposal Procedure:

a) Dispose of dry sediment and debris removed from the storm water system in a dumpster that will be serviced by a licensed facility.
b) Disposal of hazardous and liquid waste: contact your local landfill or disposal dealer.
c) Dispose of hazardous waste and/or liquid waste at regulated disposal facilities. Follow SDS Sheets. Also see Waste Management and Spill Control SOP

4. Training:

a) Annually and at hire
b) If incorrect SOP implementation is observed, reinstruct staff or service contractors of proper SOPs

PAVEMENT WASHING

1. Purpose:

a) Pavement washing should be avoided wherever possible. However, when it is necessary, a strict SOP must be used.
b) Pavement washing can fill necessary void space in storm controls that utilize infiltration and increase storm system maintenance costs. Removing these debris before they are washed to the storm system is imperative.

2. Procedure:

a) Sweep up debris and use dry clean up methods to absorb any liquid waste as described in the Spill Control SOP. After all dry clean up methods have been exhausted and pavement washing is necessary, follow this SOP to avoid the potential for polluting drainage ways and groundwater.
b) Prevent wash waters and any detergents if used from entering the storm drain system. The following methods are acceptable for this operation.
    - Dam any nearby inlets using material that seals itself to the pavement and remove wastewater with shop-vacuum or absorbent materials.
    - Collect wastewater with a vacuum simultaneously with the washing/power washing operation.

c) Prevent un-authorized non-storm water discharges which could include AC condensation, broken sprinklers, etc. If a discharge is observed, repair it as soon as practicable.

3. Disposal Procedure:

a) Small volumes of wash water (20 gallons or less) can be drained into onsite vegetation if non-hazardous.
b) Large volumes must be disposed of at regulated facilities.

4. Training:

a) Annually and at hire
b) If incorrect SOP implementation is observed, reinstruct staff or service contractors of proper SOPs

SNOW AND ICE MANAGEMENT

1. Purpose:

a) To preserve storm water quality by minimizing salt residue that enters the storm system.

2. Procedure:

a) Do not store salt outdoors uncovered.
b) Salt can be stored outside when covered and contained or on a pallet or other effective means.
c) Inspect salt pile or pallet regularly to ensure runoff cannot mix with salt.
d) Minimize salt use by varying salt amounts relative to hazard potential.
e) Minimize salt use when storm runoff is routed through vegetated storm water retention areas to maintain healthy root systems.

3. Training:

a) Annually and at hire.
b) If incorrect SOP implementation is observed, reinstruct staff or service contractors of proper SOPs.
c) Require snow and ice service contractors to follow the stronger of this SOP or their company SOPs and industry standard practices.

SPILL CONTROL

1. Purpose:

It is vital to contain all spills on the surface. Spills reaching the storm system below and/or above ground can result in expensive spill mitigation, including removal and replacement of drainage systems.

2. Procedure:

a) STOP the source of the spill and contain flowing spills.
b) Stop the flow from entering a storm drain system by using a **spill kit**, booms or any material available to stop flowing liquids; including, nearby sand, dirt, landscaping materials, etc.
c) Sweep up the absorbed material and dispose of according to the MSDS sheets of the spilled material. Most times, this waste can be disposed of in an existing waste container.
d) CRITICAL EMERGENCY constitutes large quantities of hazardous or unknown waste material flowing uncontained liquid that reach storm drain systems or may pose a safety risk.
e) **Generally, burst or tipped tanks and containment is critical. Call HAZMAT.** Check with the Hazmat team and your local Storm Water Manager to determine if you need to call the DWQ, the local health department, and site risk manager which may need to be involved. Also report spills to DWQ of quantities of 25 gallons and more and when the spill of lesser quantity causes a sheen on downstream water bodies.
f) Minor emergency constitutes a spill that is no longer flowing but has reached a storm drain and adequate cleanup is still critical. Call the Local Health Department and the City Storm water or Public Works.
g) Spills that are contained on the surface, typically do not meet the criteria for Critical and Minor Emergencies and may be managed by the responsible implementation of this SOP.

3. Contacts:

Municipal 24 hr Storm Water Hotline – [Hotline #]
Local County Health Department – [Hotline #]
HAZMAT – 911
DWQ General Information – 801-536-4300
DWQ 24 hr. Hotline – 801-536-4123
National Response Center (NRC) – 800-424-8802

4. Cleanup Procedure:

a) NEVER WASH SPILLS TO THE STORM DRAIN SYSTEMS.
b) Clean per SDS requirements but generally most spills can be cleaned up according to the following:

- Absorb liquid spills with spill kit absorbent material, sand or dirt until liquid is sufficiently converted to solid material.
- Remove immediately using dry cleanup methods, e.g. broom and shovel, or vacuum operations.
- Cleanup with water and detergents may also be necessary depending on the spilled material. However, the wash waters from this operation must be vacuumed or removed by dry methods. See Pavement Washing SOP.
- Repeat the process until minimal material remains.

5. Disposal:

Follow SDS requirements but usually most spills can be disposed per the following:

a) Generally, most spills absorbed into a solid form, can be disposed of in the dumpster and receptacle. Follow the Waste Management SOP.

b) Generally, liquid waste from surface cleansing processes may be disposed to the sanitary sewer system after the following conditions have been met:
   - Dry cleanup methods have been used to remove the bulk of the spill and disposed per the Waste Management SOP.
   - The liquid waste amounts are small and diluted with water. This is intended for spill cleanup waste only and never for the disposal of unused or spent liquids.

7. Training:

a) Annually and at hire.

b) If incorrect SOP implementation is observed, reinstruct staff or service contractors of proper SOP.

POOL, SPA AND POND DRAINAGE

1. Purpose:

a) To prevent chemicals and algae from entering the storm drain system.
b) There are state regulations for drainage of chemically treated water from public use pools- State Regulation R392-302-7- that the owner should be aware of.
c) This SOP applies to all chemically treated bodies of water (pools, spas, ponds, etc)

2. Procedure:

a) Contact the city prior to draining any pool or pond to verify local rules and regulations for discharge, a permit may be required.
b) Dechlorinate the water until chlorine or bromine content is <1 ppm and pH level is between 6.5 and 8.5.
c) Discharge water temperature should NOT exceed 100 degrees Fahrenheit.
d) Provide documentation verifying that the water is free of all algaecides, cleaning agents and any other water conditioning chemicals.
e) Salt-laden wastewater and filter backwash are not allowed to discharge to storm drain systems.
f) All contaminants collecting or growing in pools, organic and manmade must be collected and removed, dried out and disposed of in the trash receptacle.
g) Discharges should be made on private property where possible into lawns, gardens, or other spaces in which water can infiltrate before reaching property boundaries. Discharge water must not reach streams, creeks, irrigation ditches and other private drainage systems.
h) Where discharge is made to the storm system or sanitary sewer ensure it is clean water free of contaminants as described.

3. Training:

a) Annually and at hire.
b) If incorrect SOP implementation is observed, reinstruct staff or service contractors of proper SOP.

GREASE STORAGE/RECYCLING

1. Purpose:

a) For facilities that generate grease and store it onsite, storm water quality must be protected.
b) One of the more common sources of damage and risk to the storm system are related to grease storage overflows.

2. Procedure:

- Underground storage:
    a. Identify the location of all floor drains at the facility. Floor drains must be routed to the sanitary sewer. Grease must not be dumped into floor drains.
    b. When grease is stored underground and it is difficult to access the maintenance threshold, regular scheduled maintenance of the system by a third party is critical to avoid risk of overflow.
- Outdoor grease recycling containers:
    a. Extra precautions must be taken to avoid overflows and spillage during use.
    b. Keep the containers covered and provide secondary containment (ex: double walled) where feasible.
    c. Regular scheduled maintenance of the system by a third party is critical to avoid risk of overflow.
- Call the local wastewater treatment facility for more information on how and when to service grease storage systems.
- Follow proprietary literature for maintenance intervals of the specific grease storage device (attach as applicable).
- Inspect grease storage areas weekly to ensure this SOP is being followed by all staff.
- If a grease spill or overflow does occur, refer to the Pavement Washing SOP for proper clean-up procedures.

3. Training:

a) Annually and at hire.
b) If incorrect SOP implementation is observed, reinstruct staff or service contractors of proper SOP.

APPENDIX

When recorded, mail to:

Insert Address

Affects Parcel No(s): _____

STORM WATER SYSTEM OPERATIONS AND MAINTENANCE AGREEMENT

This Storm Water System Operations and Maintenance Agreement ("Agreement") is made and entered into by and between [List the CITY], a Utah municipal corporation (CITY), and [List the landowner] (OWNER). The effective date of this Agreement is [the date of execution].

RECITALS

WHEREAS, the CITY is authorized and required to regulate and control the disposition of storm and surface waters within the CITY, as set forth in the [INSERT MUNICIPALITY] Storm Water Ordinance, as amended ("Ordinance"), adopted pursuant to the Utah Water Quality Act, as set forth in *Utah Code Ann*. §§ 19-5-101, *et seq*., as amended ("Act"); and

WHEREAS, the OWNER hereby represents and acknowledges that it is the owner in fee simple of certain real property ("Property") located in [entity or municipality], Utah [and more particularly described in Exhibit "A" attached hereto and incorporated herein as part of this Agreement]; and

WHEREAS, the OWNER desires to build or develop the Property and/or to conduct certain regulated construction activities on the Property which will alter existing storm and surface water conditions on the Property and/or adjacent lands; and

Optional addition:

(**WHEREAS**, OWNER recognizes that post construction storm water facilities ("Storm Water Facilities"), defined as property infrastructure installed to carry storm runoff, remove pollutants and control the flow of water, and shall be installed or were installed pursuant to CITY-approved construction drawings and any amendments thereto ("Construction Drawings") for the Property and shall be properly maintained; and

WHEREAS, in order to accommodate and regulate these anticipated changes in existing storm and surface water flow conditions, the OWNER is required to build and maintain at the OWNER's expense a storm and surface water management facility (Storm Water Facilities); and

WHEREAS, the Storm Water Facilities in the final site plan or subdivision approved for the Property and related engineering drawings and any City approved amendments to the engineered drawings thereto, which plans and drawings are on file with the City, are fully hereby incorporated herein for all purposes; and

WHEREAS, OWNER has submitted to the CITY a description of all Storm Water Facilities, and establishes the standard operation and routine maintenance procedures for the Storm Water Facilities and control measures installed on the Property ("Storm Water Operations and Maintenance Plan" or "O&M Plan") on file with the CITY; and

WHEREAS, a condition of development approval, and as required as part of the CITY's Small MS4 UPDES General Permit from the State of Utah, OWNER is required to enter into this Agreement establishing a means of documenting the execution of the O&M Plan; and

NOW, THEREFORE, in consideration of the benefits received and to be received by the OWNER, its successors and assigns, as a result of the CITY's approval of the O&M Plan, and the mutual covenants contained herein, the parties agree as follows:

AGREEMENT

Section 1

Construction of Storm Water Facilities. The OWNER shall, at its sole cost and expense, construct the Storm Water Facilities in accordance with the plans and specifications, and any amendments thereto which have been approved by the CITY.

Optional addition:
If OWNER has acquired the property from a prior OWNER, the current OWNER agrees to maintain the Storm Water Facilities in accordance with the terms of this Agreement.

Section 2

Maintenance of Storm Water Facilities. The OWNER shall, at its sole cost and expense, adequately maintain the Storm Water Facilities in accordance with the O&M Plan. The OWNER's maintenance obligations shall include all system and appurtenance built to convey storm water, as well as all structures, improvements, and vegetation provided to control the quantity and quality of the storm water. Adequate maintenance, for purposes of this Agreement, is defined as good working condition so that the Storm Water Facilities are performing their design functions.

Section 3

Record of Inspection and Maintenance. The OWNER, its successors and assigns, shall, at its sole cost and expense, inspect the Storm Water Facilities according to the O&M Plan and submit written record evidencing this action to the CITY every other year. The purpose of the record submission is to assure safe and proper functioning of the Storm Water Facilities. The inspection submitted shall cover all aspects of the

Storm Water Facilities, including, but not limited to, the parking lots, structural improvements, berms, channels, outlet structure, pond areas, access roads, vegetation, landscaping, etc. Deficiencies and resolutions shall be noted in the inspection record. The record shall also contain evidence as to whether adequate maintenance has been performed and whether the structural controls are operating as designed to protect water quality. Written record of inspections performed shall be submitted to the CITY every other year by [provide language of date due per your municipality].

Section 4

Access and Inspections. The OWNER, its successors and assigns, hereby grants permission to the CITY, its authorized agents and employees, to enter upon the Property and to inspect the Storm Water Facilities whenever the CITY deems necessary. Such inspections shall be conducted in a reasonable manner and at reasonable times, as determined appropriate by the CITY. The purpose of the inspection shall be to determine and ensure that the Storm Water Facilities are being adequately maintained, are continuing to perform in an adequate manner, and are in compliance with the Act, the Ordinance, and the OWNER's O&M Plan.

Section 5

Notice of Deficiencies. If the CITY finds that the Storm Water Facilities contain any defects or are not being maintained adequately, the CITY shall send the OWNER written notice of the defects or deficiencies and provide the OWNER with a reasonable time to cure the defects or deficiencies. Such notice shall be confirmed delivery to the OWNER or sent certified mail to the OWNER at the address listed on the County Tax Assessor.

Section 6

Owner to Make Repairs. The OWNER shall, at its sole cost and expense, make such repairs, changes or modifications to the Storm Water Facilities as may be determined as reasonably necessary by the CITY within a risk specific determined cure period to ensure that the Storm Water Facilities are adequately maintained and continue to operate as designed and approved. The OWNER acknowledges any damage resulting from such defects and deficiencies is their cost liability.

Section 7

City's Corrective Action Authority. In the event the OWNER fails to adequately maintain the Storm Water Facilities in good working condition acceptable to the CITY, after due notice of deficiencies as provided in Section 5 and failure to cure, then, upon the OWNER's failure to cure or correct within thirty days following a second notice delivered to the OWNER, the CITY may [state your CITY's reconciliation process. Ex: issue a Citation punishable as a Misdemeanor in addition to any State or EPA fine]. It is expressly understood and agreed that the CITY is under no obligation to maintain or repair the Storm Water Facilities, and in no event shall this Agreement be construed to impose any such obligation on the CITY. The actions described in this Section are in addition to and not in lieu of any and all equitable remedies available to the CITY as

provided by law for the OWNER's failure to remedy deficiencies or any other failure to perform under the terms and conditions of this Agreement.

Section 8

Reimbursement of Costs. In the event the CITY, pursuant to this Agreement, incurs any costs, or expends any funds resulting from enforcement or cost for labor, use of equipment, supplies, materials, and the like related to storm drain maintenance or repair deemed necessary, the OWNER shall reimburse the CITY upon demand, within thirty (30) days of receipt thereof for all actual costs incurred by the CITY. After said thirty (30) days, such amount shall be deemed delinquent and shall be subject to interest at the rate of ten percent (10%) per annum. The OWNER shall also be liable for any collection costs, including attorneys' fees and court costs, incurred by the CITY in collection of delinquent payments.

Section 9

Successor and Assigns. This Agreement shall be recorded in the County Recorder's Office and the covenants and agreements contained herein shall run with the land and whenever the Property shall be held, sold, conveyed or otherwise transferred, it shall be subject to the covenants, stipulations, agreements and provisions of this Agreement which shall apply to, bind and be obligatory upon the OWNER hereto, its successors and assigns, and shall bind all present and subsequent owners of the Property described herein.

Section 10

Utah Law and Venue. This Agreement shall be interpreted under the laws of the State of Utah. Any and all suits for any claims or for any and every breach or dispute arising out of this Agreement shall be maintained in the appropriate court of competent jurisdiction.

Section 11

Indemnification. This Agreement imposes no liability of any kind whatsoever on the CITY, and the OWNER agrees to hold the CITY harmless from any liability in the event the Storm Water Facilities fail to operate properly. The OWNER shall indemnify and hold the CITY harmless for any and all damages, accidents, casualties, occurrences, or claims which might arise or be asserted against the CITY from failure of the OWNER to comply with its obligations under this agreement relating to the Storm Water Facilities.

Section 12

Amendments. This Agreement shall not be modified except by written instrument executed by the CITY and the OWNER of the Property at the time of modification, and no modification shall be effective until recorded in the County Recorder's Office.

Section 13

Subordination Requirement. If there is a lien, trust deed or other property interest recorded against the Property, the trustee, lien holder, etc., shall be required to execute

a subordination agreement or other acceptable recorded document agreeing to subordinate their interest to the Agreement.

Section 14

Changes to the O&M Plan. The O&M Plan shall adapt to change in good judgment when site conditions and operations change and when existing programs are ineffective. Revisions shall be submitted to the CITY for approval and amended into the O&M Plan on file with the CITY.

Section 15

Authority of Parties. The parties executing this Agreement hereby warrant and represent that they are duly authorized to do so in the capacity stated.

IN WITNESS WHEREOF, the parties have executed this Agreement as of the dates set below. The effective date of this Agreement is [the date that is recorded with the local County Recorder's office].

REMAINDER OF PAGE INTENTIONALLY BLANK

SIGNATURE PAGE FOLLOWS

STORM WATER SYSTEM OPERATIONS AND MAINTENANCE AGREEMENT

PROPERTY OWNER

By:_____

Name, Title_____

STATE OF UTAH)
ss.
COUNTY OF _____)

On the _____ day of _____ 20____, before me, _____, a notary public, personally appeared _____ proved based on satisfactory evidence to be the person whose name is subscribed to in this document and acknowledged he/she executed the same voluntarily for its stated purpose.

_____
Notary Public

PROPERTY OWNER

By:_____

Name, Title_____

STATE OF UTAH)
ss.
COUNTY OF _____)

On the _____ day of _____ 20____, before me, _____, a notary public, personally appeared _____ proved on the basis of satisfactory evidence to be the person whose name is subscribed to in this document and acknowledged he/she executed the same voluntarily for its stated purpose.

_____
Notary Public

CITY:

_____
, [Title]
Date:_____

APPROVED AS TO FORM:

_____
[Title of City principal executive]

ATTESTED:

_____
Print Name, [Title]

Exhibit A

Legal Description(s) & Boundary Exhibit

Parcel ID: _____

LEGAL DESCRIPTION -

(optional to add a Visual of property boundary next page) –

EXHIBIT A

PROPERTY BOUNDARIES Include a visual drawing depicting the Property Boundaries at the time of the Agreement, showing the metes and bounds survey if possible.

MCM 6 - Pollution Prevention and Good Housekeeping

High Priority monthly facility Inspection

High Priority Area/facility Inspected:

Location of Inspection:

Date of Inspection:

Type of Facility inspected:

Yes	No	
☐	☐	Does Facility Have Water in it
☐	☐	Is there any evidence of illicit discharge (oil sheen, foam, smell, residue, color)
☐	☐	Is there any evidence of spills?
☐	☐	Are materials (chemicals, salt, stockpiles) stored in their designated area
☐	☐	Are any spill kits stocked and easily accessible

Required Corrective actions

_____

_____

Deadline to complete corrective actions:_____

Inspector Name:_____

Inspector Signature:_____

Date:_____

High Priority Semi-Annual facility Inspection

High Priority Area/facility Inspected:

Location of Inspection:

Date of Inspection:

Type of Facility inspected:

Part 1 SWPPP Review

Yes	No	
☐	☐	Is SWPPP accessible in the facility?
☐	☐	Are there any needed updates to the SWPPP due to changes facility operation?
☐	☐	Are BMPs listed in SWPPP effective?
☐	☐	Is the site map accurate?
☐	☐	Is contact information in the SWPPP accurate?

Yes	No	
☐	☐	Do Storm Drains have water in them?
☐	☐	Is there any evidence of illicit discharge (oil sheen, foam, smell, residue, color)?
☐	☐	Is there any evidence of spills?
☐	☐	Is the chemical storage in good condition and have enough storage space?
☐	☐	Are spill kits stocked and easily accessible
☐	☐	Is salt storage in the designated covered area?
☐	☐	Are stockpiles stored in their designated area

Required Corrective actions

_____

_____

Deadline to complete corrective actions:_____

Inspector Name:_____

Inspector Signature:_____

Date:_____

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

MS4 High-Priority Facilities
Annual Visual Assessment of Storm Water Discharges

Sample and Data Collection Instructions: Visual examinations shall be made of samples collected within the first 30 minutes (or as soon thereafter as practical, but not to exceed one hour) of when the runoff or snowmelt begins discharging. The examinations shall document observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of storm water pollution. The examination must be conducted in a well-lit area. No analytical tests are required to be performed on the samples. All such samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch of rainfall) storm event. Where practicable, the same individual should carry out the collection and examination of discharges for the life of the permit.

Storm Event Information

Date of Storm Event:	
Duration of Storm Event (Hours):	
Rain Fall Measurement (Inches):	
Time elapsed Between Recorded & Previous Storm Event (Days):	
Estimated Total Volume of Discharge (include units):	

Visual Assessment Information

Date of Inspection:	
Time of Inspection:	
Inspector Name:	
Total Storm Water Discharge Points for this Facility:	
Name/Number Assigned to this Discharge Point:	
Probable Source of Observed Storm Water Contamination (if applicable):	

Color (Check One):

1. **Identification of Color:**

☐ Black	☐ Dark Brown	☐ Tan
☐ Dark Grey	☐ Chocolate Brown	☐ Yellow
☐ Medium Grey	☐ Medium Brown	☐ Green
☐ Light Grey	☐ Light Brown	☐ Other_____

2. **Intensity of Color:**
   - ☐ Very Intense Prominent
   - ☐ Moderately Perceptible
   - ☐ Hardly Perceptible

Comments:_____

_____

Clarity (Check One):

- ☐ Totally Opaque
- ☐ Slightly Translucent
- ☐ Translucent
- ☐ Nearly Transparent
- ☐ Transparent

Odor (Check all that Apply):

☐ Diesel	☐ Sewage	☐ Noxious
☐ Gasoline	☐ Chlorine	☐ Other
☐ Petroleum	☐ Rotten Egg	_____
☐ Solvent	☐ Sulfur	
☐ Musty	☐ No Odor	

Comments: _____

_____

Solids (Describe Below):

Floating Solids:_____

_____

Suspended and Settled Solids:_____

_____

Foam, Oil, Sheen, or other obvious indicators of pollution (Describe Below):

_____
_____
_____
_____
_____
_____
_____

Other Comments (Describe Below):

_____
_____
_____
_____
_____
_____
_____
_____

Annual MS4 Permit Compliance Review

General Information

Annual Review Completed By: _____

Signature: _____

Date: _____

Section numbers correspond to sections in the Utah small MS4 permit. Numbers in parentheses is the permit reference that is being checked in this checklist.

Section 1.0 - Coverage Under Small MS4 Permit

Yes	No	
☐	☐	Is there a ban on non-stormwater discharges (1.2.2.2)

Section 2.0 – Notice of Intent Requirements for New Applicants

Yes	No	
☐	☐	Is the SWMP on track to be implemented by May 2031? (2.1.6)
☐	☐	Is the SWMP Certified and Signed (2.1.7)

Section 3.0 – Special Conditions

Yes	No	
☐	☐	Have all Waterways maintained their existing Impairment Status? (3.1.1)
☐	☐	Have All Waterways maintained their existing TMDL status? (3.1.1.1)

Yes	No	
☐	☐	Does the Stormwater Program specifically address Nitrogen and Phosphorus water quality impacts? (3.3.1)

Section 4.0 – Stormwater Management Program

Yes	No	
☐	☐	Are Goals and milestones in the SWMP being met for MCM 1 (4.2.1)?
☐	☐	Are Goals and milestones in the SWMP being met for MCM 2 (4.2.2)?
☐	☐	Are Goals and milestones in the SWMP being met for MCM 3 (4.2.3)?
☐	☐	Are Goals and milestones in the SWMP being met for MCM 4 (4.2.4)?
☐	☐	Are Goals and milestones in the SWMP being met for MCM 5 (4.2.5)?
☐	☐	Are Goals and milestones in the SWMP being met for MCM 6 (4.2.6)?
☐	☐	Are all required agreements, contracts, and MOUs in place for any portions of the SWMP implemented by entities other than the City? (4.1.3.4) (4.3.1.3)
☐	☐	Are Selected BMPs in the SWMP effective? (4.1.2.3)
☐	☐	Is documentation being done for each MCM as it is listed in the SWMP? (4.1.2)
☐	☐	Are entities that share implementation of the SWMP effective in doing so? (4.3.1.1)
☐	☐	Have any changes to the SWMP gone through the correct process? (4.4.2)

Section 5.0 – Narrative Standard, Monitoring, Recordkeeping, and Reporting

Yes	No

☐ ☐ Is any analytical monitoring being done according to permit requirements (5.2)

☐ ☐ Are records being kept for a minimum of five years? (5.4.4)

☐ ☐ Is the Annual report being submitted through EPA's NeT system?

☐ ☐ Is illicit discharge prohibited by ordinance (5.6.1)

☐ ☐ Does the City require compliance with permits (CGP, CPP), Contracts, or orders through ordinance that allows escalating enforcement? (5.6.4)

☐ ☐ Does the City have adequate authority to enter and inspect stormwater facilities? (5.6.5)?

Section 6.0 – Standard Conditions

☐ ☐ Have there been no changes made to the MS4 permit that require modification of stormwater program? (6.25)

Issues and Follow-Up (If any items are answered as NO)

Responsible Party for Updates

_____

Actions Items needed to be compliant with Utah Small MS4 Permit

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

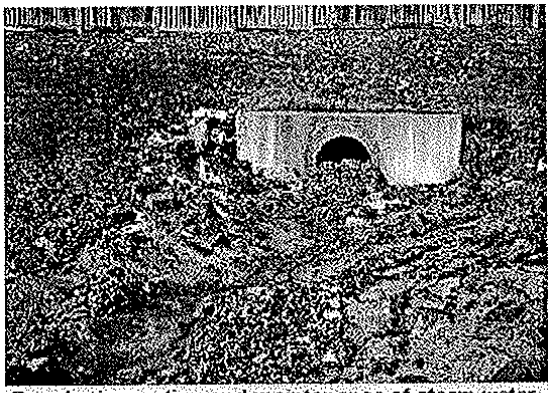
_____

APPENDIX E – COPY OF STORMWATER ORDINANCES

Required Ordinance	HCC Refrence
Prohibition on illicit Disharges	HCC 6-4-7(A)
Enforcement mechanism for illicit discharges	HCC 6-4-17 & HCC 6-4-20
Construction site UPDES permit requirement	HCC 6-4-23
Construction site escalating enfrocement	HCC 6-4-25(E)
Construction site right to inspect	HCC 6-4-25(A)
80th percentile storm retention requirement	HCC 10-4A-14(F)
Construction site operators required to prepare a SWPPP	HCC 6-4-23
New development and redevelopment sites required to improve water quality	HCC 6-4-11 & 10-4A-14
Inspeciton and enforcement of long term storm water control	HCC 6-4-14 & HCC 6-4-17 & HCC 6-4-20
Right to inspect stormwater controls	HCC 6-4-14

APPENDIX F – BMP FACT SHEETS

BMP: BMP Inspection and Maintenance BMPIM



Regular inspection and maintenance of storm water best management practices is important to ensure that the practices are functioning properly and to remove trash and organic debris

OBJECTIVES

- ☒ Manufacturing
- ☒ Material Handling
- ☐ Vehicle Maintenance
- ☒ Construction
- ☒ Commercial Activities
- ☐ Roadways
- ☒ Waste Containment
- ☐ Housekeeping Practices

DESCRIPTION:

To maintain the effectiveness of post-construction storm water control best management practices (BMPs), regulation inspection of control measures is essential. Inspection and maintenance can be categorized into two groups – expected routine maintenance and nonroutine (repair) maintenance.

APPROACH:

- ► Curging can be used at all industrial facilities. It is particularly useful in areas where liquid materials are transferred and as a stormwater runoff control.
- ► As with diking, common materials for curbing include earth, concrete, synthetic materials, metal, or other impenetrable materials. Asphalt is also a common material used to curbing. For maximum efficiency, spilled materials should be removed immediately, to allow spaced for future spills.
- ► Curbs should have pumping systems, instead of drainage systems, for collecting spilled materials.
- ► Curb systems should be maintained through curb repair (patching and replacement).
- ► To minimize the amount of spilled material tracked outside of the area by personnel, grade within the curbing to direct the spilled materials to a down-slope side of the curbing, thus keeping the spilled materials away from personnel and equipment. Grading will also facilitate clean-up.

LIMITATIONS:

- ► Curbing is not effective for holding large spills.
- ► May require more maintenance than diking.

MAINTENANCE:

- ► Inspection should be conducted before and after storm events.

TARGETED POLLUTANTS

- ☒ Sediment
- ☐ Nutrients
- ☒ Heavy Metals
- ■ Toxic Materials
- ☐ Oxygen Demanding Substance
- ☒ Oil & Grease
- ☒ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

- ■ High
- ☒ Medium
- ☐ Low

BMP: Contractor Certification & Inspector Training CCIT



Municipalities can establish training programs to educate contractors about erosion and sediment control practices



Construction reviewers periodically inspect construction sites to ensure that contractors have installed and maintained their erosion and sediment controls properly (Source: University of Connecticut Cooperative Extension System, 2000)

OBJECTIVES

- ☐ Manufacturing
- ☒ Material Handling
- ☐ Vehicle Maintenance
- ☒ Construction
- ☐ Commercial Activities
- ☐ Roadways
- ☒ Waste Containment
- ☐ Housekeeping Practices

DESCRIPTION:

One of the most important factors determining whether or not erosion and sediment controls will be properly installed and maintained on a construction site is the knowledge and experience of the contractor. Many communities require certification for key on-site employees who are responsible for implementing the ESC plan. Several states have contractor certification programs. The State of Delaware requires that at least one person on any construction project be formally certified. The Delaware program requires certification for any foreman or superintendent who is in charge of onsite clearing and land-disturbing activities for sediment and runoff control associated with a construction project.

APPLICATION:

- ► Training and certification will help to ensure that the plans are properly implemented and that best management practices are properly installed and maintained.
- ► Inspector training programs are appropriate for municipalities with limited funding and resources for ESC program implementation.
- ► Contractor certification can be accomplished through municipally sponsored training courses, or more informally, municipalities can hold mandatory pre-construction or pre-wintering meetings and conduct regular and final inspection visits to transfer information to contractors (Brown and Caraco, 1997).
- ► To implement an inspector training program, the governing agency would need to establish a certification course with periodic recertification, review reports submitted by private inspectors, conduct spot checks for accuracy, and institute fines or other penalties for noncompliance.
- ► Curb systems should be maintained through curb repair (patching and replacement).
- ► To minimize the amount of spilled material tracked outside of the area by personnel, grade within the curbing to direct the spilled materials to a down-slope side of the curbing, thus keeping the spilled materials away from personnel and equipment. Grading will also facilitate clean-up.

LIMITATIONS:

- ► Contractor certification and inspector training programs require a substantial amount of effort on the part of the municipality or regulatory agency.
- ► They need to develop curricula for training courses, dedicate staff to teach courses, and maintain a report review and site inspection staff to ensure that both contractors and inspectors are fulfilling their obligations and complying with the ESC program.

TARGETED POLLUTANTS

- ■ Sediment
- ■ Nutrients
- ☐ Heavy Metals
- ■ Toxic Materials
- ☐ Oxygen Demanding Substance
- ■ Oil & Grease
- ■ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ■ Capital Costs
- ■ O&M Costs
- ☒ Maintenance
- ☐ Training

- ■ High
- ☒ Medium
- ☐ Low

BMP: Classroom Education on Storm Water CESW



OBJECTIVES

- ☐ Manufacturing
- ☒ Material Handling
- ☐ Vehicle Maintenance
- ☐ Construction
- ☐ Commercial Activities
- ☐ Roadways
- ☒ Waste Containment
- ☒ Housekeeping Practices

DESCRIPTION:

Classroom education is an integral part of any storm water pollution outreach program. Providing storm water education through schools exposes the message not only to students but to their parents as well. Topics can include Water conservation, proper lawn and garden care, and proper disposal of hazardous household wastes.

APPLICATION:

- ► Building a strong relationship with the school district is the most important step in getting storm water education into the schools.
- ► When developing an outreach message for children, choose the age ranges to target.
- ► Many additional classroom materials are available for use free of cost. Educational materials available for downloading from the Internet at www.csu.org/water/watereducation/watereducation.html.
- ► Should make students aware of the potential impacts of hazardous household materials on water quality and inform residents of ways to properly store, handle, and dispose of the chemicals
- ► Water usage in the home can easily be reduced by 15 to 20 percent—without major discomfort—by implementing a program to conserve water in the home.
- ► Lawn and garden activities can result in contamination of storm water through pesticide, soil, and fertilizer runoff. Proper landscape management, however, can effectively reduce water use and contaminant runoff and enhance the aesthetics of a property.

LIMITATIONS:

- ► One of the limitations of classroom education is being able to incorporate storm water issues into the school curricula. With so many subjects to teach, environmental issues might be viewed as less important.

MAINTENANCE:

- ► Programs and educational materials can be re-used, but they must be presented on a continual basis.

TARGETED POLLUTANTS

- ■ Sediment
- ■ Nutrients
- ■ Heavy Metals
- ■ Toxic Materials
- ■ Oxygen Demanding Substance
- ■ Oil & Grease
- ■ Floatable Materials
- ■ Bacteria & Viruses

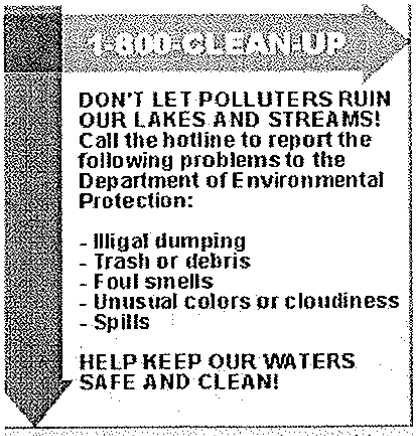
- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training

- ■ High
- ☒ Medium
- ☐ Low

BMP: Community Hotlines CH



Posters and magnets can be used to publicize hotlines

OBJECTIVES

- ■ Manufacturing
- ■ Material Handling
- ■ Vehicle Maintenance
- ■ Construction
- ■ Commercial Activities
- ☒ Roadways
- ☒ Waste Containment
- ■ Housekeeping Practices

DESCRIPTION:

Because regulators and authorities cannot monitor all water bodies at once, they sometimes rely on the public to keep them informed of water polluters. Community hotlines provide a means for concerned citizens and agencies to contact the appropriate authority when they see water quality problems.

APPROACH:

- ► Once a city has determined that they need a hotline, they should chose between a telephone or an e-mail hotline.
- ► A party or agency responsible for maintaining the hotline and responding to incoming complaints must first be identified. The responsible party could be a division of local government, a water quality board, a public utility, or an environmental agency
- ► All distributed materials should include pollution hotline numbers and information.
- ► Curbs should have pumping systems, instead of drainage systems, for collecting spilled materials
- ► Generally, an investigation team promptly responds to a hotline call and, in most cases, visits the problem site.
- ► If a responsible party can be identified, the team informs the party of the problem, offers alternatives for future disposal, and instructs the party to resolve the problem.

LIMITATIONS:

- ► The community's ability to pay for it.
- ► The ability of the community to keep the hotline staffed

MAINTENANCE:

- ► The most important part is the responsiveness of the hotline. If a citizen reports an illegal dumping but no action is taken by the appropriate authority, that citizen could lose faith in the hotline and might not call back with future information.

TARGETED POLLUTANTS

- ☒ Sediment
- ☒ Nutrients
- ■ Heavy Metals
- ■ Toxic Materials
- ☒ Oxygen Demanding Substance
- ■ Oil & Grease
- ■ Floatable Materials
- ☒ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

- ➢ High
- ☒ Medium
- ☐ Low

BMP: Erosion Control Plan — ECP



Diversion dikes can be used to contain storm water onsite

OBJECTIVES

- ☐ Manufacturing
- ☐ Material Handling
- ☐ Vehicle Maintenance
- ■ Construction
- ☐ Commercial Activities
- ☒ Roadways
- ☐ Waste Containment
- ☐ Housekeeping Practices

DESCRIPTION:

Erosion and sediment control are generally two of the biggest problems on construction sites. Erosion control measures must be taken during a construction project. An Erosion Control Plan will be submitted and approved before work can begin on the project. An Erosion Control Plan describes what erosion control BMPs will be implemented, when and where, during the project. Erosion and sediment control measures should be installed before other construction activities begin.

APPLICATION:

- ► Create a list of possible erosion control BMPs that could be implemented in any given project.
- ► Require submittal of erosion & sediment control plans for projects that are on 1 acre and larger sites.
- ► Develop a review checklist for plan review personnel.
- ► Provide the review checklist to contractors/developers so they know what is expected.
- ► Provide inspectors with a copy of the approved plans.
  Check to make sure erosion control measures are properly installed before beginning other construction activities.

LIMITATIONS:

- ► Must be enforced to be affective.
- ► Sometimes site conditions are different than planned on and the plans have to be modified.
- ► The erosion control measures have to be maintained.
- ► The BMPs have to be installed early on in the project.
- ► The BMPs have to be removed after the threat of erosion is no longer present.

TARGETED POLLUTANTS

- ■ Sediment
- ☒ Nutrients
- ☐ Heavy Metals
- ☐ Toxic Materials
- ☐ Oxygen Demanding Substance
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☐ Maintenance
- ☒ Training

- ■ High
- ☒ Medium
- ☐ Low

BMP: Education Materials EM



OBJECTIVES

- ☒ Manufacturing
- ☒ Material Handling
- ☒ Vehicle Maintenance
- ☒ Construction
- ☒ Commercial Activities
- ☒ Roadways
- ☒ Waste Containment
- ☒ Housekeeping Practices

DESCRIPTION:

Educational Materials to present information to the public on storm water issues and water quality awareness is an integral part of any storm water education program. Providing storm water education by sending out information with bills, newsletters, or presented at city activities, in city offices, schools, and fair booths, exposes the message to a wide variety of people, if not city-wide. Topics can include Water conservation, proper lawn and garden care, and proper disposal of hazardous household wastes. Many educational materials can be used for city personnel, contractors as well as homeowners or businesses.

APPLICATION:

- ► Building a strong relationship with citizens is the most important step in getting storm water education city-wide.
- ► Educational materials can be tailored to all different age groups and technical background.
- ► Should make people aware of the potential impacts of hazardous household materials on water quality and inform residents of ways to properly store, handle, and dispose of the chemicals
- ► Water usage in the home can easily be reduced by 15 to 20 percent—without major discomfort—by implementing a program to conserve water in the home.
- ► Lawn and garden activities can result in contamination of storm water through pesticide, soil, and fertilizer runoff. Proper landscape management, however, can effectively reduce water use and contaminant runoff and enhance the aesthetics of a property.

LIMITATIONS:

- ► Not everyone will actually read or incorporate the information into their lives.
- ► Budgets need to have sufficient funds to obtain educational materials and their distribution.

MAINTENANCE:

- ► Programs and educational materials can be re-used, but they must be presented on a continual basis.

TARGETED POLLUTANTS

- ■ Sediment
- ■ Nutrients
- ■ Heavy Metals
- ■ Toxic Materials
- ■ Oxygen Demanding Substance
- ■ Oil & Grease
- ■ Floatable Materials
- ■ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training

- ■ High
- ☒ Medium
- ☐ Low

BMP: Employee Training ET



OBJECTIVES

- ☒ New Development
- ☒ Residential
- ☒ Commercial Activities
- ☒ Industrial Activities
- ☒ Municipal Facilities
- ☒ Illegal Discharges

DESCRIPTION:

Employee training, like equipment maintenance, is a method by which to implement BMPs. Employee training should be used in conjunction with all other BMPs as part of the facility's SWPPP.

The specific employee training aspects of each of the source controls are highlighted in the individual information sheets. The focus of this information sheet is more general, and includes the overall objectives and approach for assuring employee training in stormwater pollution prevention. Accordingly, the organization of this information sheet differs somewhat from the other information sheets in this chapter.

OBJECTIVES:

Employee training should be based on four objectives:

- ► Promote a clear identification and understanding of the problem, including activities with the potential to pollute stormwater;
- ► Identify solutions (BMPs);
- ► Promote employee ownership of the problems and the solutions; and
- ► Integrate employee feedback into training and BMP implementation.

APPROACH:

- ► Integrate training regarding stormwater quality management with existing training programs that may be required for other regulations.
- ► Employee training is a vital component of many of the individual source control BMPs included in this manual.

TARGETED POLLUTANTS

- ■ Sediment
- ■ Nutrients
- ■ Heavy Metals
- ■ Toxic Materials
- ■ Oxygen Demanding Substance
- ■ Oil & Grease
- ■ Floatable Materials
- ■ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☐ Regulatory
- ■ Training
- ☒ Staffing
- ☒ Administrative

- ■ High
- ☒ Medium
- ☐ Low

BMP: Housekeeping Practices HP



OBJECTIVES

- ☐ New Development
- ☒ Residential
- ☐ Commercial Activities
- ☐ Industrial Activities
- ☒ Municipal Facilities
- ☐ Illegal Discharges

DESCRIPTION:

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals.

APPROACH:

- ► Pattern a new program after the many established programs from municipalities around the country. Integrate this best management practice as much as possible with existing programs at your municipality.
- ► This BMP has two key audiences: municipal employees and the general public.
- ► For the general public, municipalities should establish a public education program that provides information on such items as storm water pollution and beneficial effects of proper disposal on water quality; reading product labels; safer alternative products; safe storage, handling, and disposal of hazardous products; list of local agencies; and emergency phone numbers. The programs listed below have provided this information through brochures or booklets that are available at a variety of locations including municipal offices, household hazardous waste collection events or facilities, and public information fairs.

Municipal facilities should develop controls on the application of pesticides, herbicides, and fertilizers in public right-of-ways and at municipal facilities. Controls may include:

- ► List of approved pesticides and selected uses.
- ► Product and application information for users.
- ► Equipment use and maintenance procedures.
- ► Record keeping and public notice procedures.

LIMITATIONS:

- ► There are no major limitations to this best management practice.

TARGETED POLLUTANTS

- ■ Sediment
- ■ Nutrients
- ☐ Heavy Metals
- ■ Toxic Materials
- ■ Oxygen Demanding Substance
- ■ Oil & Grease
- ☐ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☐ Capital Costs
- ☒ O&M Costs
- ☐ Regulatory
- ■ Training
- ☒ Staffing
- ☐ Administrative

- ■ High
- ☒ Medium
- ☐ Low

BMP: Hazardous Waste Management HWM



OBJECTIVES

- ☒ New Development
- ☒ Residential
- ☒ Commercial Activities
- ☒ Industrial Activities
- ☒ Municipal Facilities
- ☒ Illegal Discharges

DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from hazardous waste through proper material use, waste disposal, and training of employees and subcontractors.

APPLICATION:

Many of the chemicals used on-site can be hazardous materials which become hazardous waste upon disposal. These wastes may include:

- ► Paints and solvents; petroleum products such as oils; fuels and greases; herbicides and pesticides; acids for cleaning masonry; and concrete curing compounds.

In addition, sites with existing structures may contain wastes which must be disposed of in accordance with federal, state and local regulations, including:

- ► Sandblasting grit mixed with lead, cadmium or chromium based paints, asbestos, and PCBs.

INSTALLATION/APPLICATION CRITERIA:

The following steps will help reduce stormwater pollution from hazardous wastes:

- ► Use the entire product before disposing of the container.
- ► Do not remove the original product label; it contains important safety and disposal information.
- ► Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried off-site by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with federal and state regulations.

LIMITATIONS:

- ► Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste collector.

MAINTENANCE:

- ► Inspect hazardous waste receptacles and areas regularly.
- ► Arrange for regular hazardous waste collection.

TARGETED POLLUTANTS

- ☐ Sediment
- ☐ Nutrients
- ☐ Heavy Metals
- ■ Toxic Materials
- ☐ Oxygen Demanding Substance
- ☒ Oil & Grease
- ☐ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☐ Capital Costs
- ☒ O&M Costs
- ☒ Regulatory
- ☒ Training
- ☒ Staffing
- ☒ Administrative

- ■ High
- ☒ Medium
- ☐ Low

BMP: Illegal Dumping Controls IDC



OBJECTIVES

- ☐ New Development
- ☐ Residential
- ☐ Commercial Activities
- ☐ Industrial Activities
- ☐ Municipal Facilities
- ☒ Illegal Discharges

DESCRIPTION:

Implement measures to detect, correct, and enforce against illegal dumping of pollutants on streets, into the storm drain system, and into creeks. Substances illegally dumped on streets, into the storm drain system, and into creeks include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. All of these wastes can cause storm water and receiving water quality problems as well as clog the storm drain system.

APPROACH:

One of the keys to success is increasing the general public's awareness of the problem and to at least identify the incident, if not correct it. There are a number of ways of accomplishing this:

- ► Train municipal staff from all departments to recognize and report incidents.
- ► Deputize municipal staff that may come into contact with illegal dumping with the authority to write illegal dumping tickets for offenders caught in the act.
- ► Educate the public.
- ► Provide the public with a mechanism for reporting such as a hot line.

Establish system for tracking incidents which will identify:

- ► Illegal dumping "hot spots",
- ► Types and quantities (in some cases) of wastes,
- ► Patterns in time of occurrence (time of day/night, month, or year),
- ► Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accident/spills), and
- ► Responsible parties.

A tracking system also helps manage the program by indicating trends, and identifying who, what, when, and where efforts should be concentrated.

LIMITATIONS

- ► The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal.

TARGETED POLLUTANTS

- ☒ Sediment
- ☐ Nutrients
- ☒ Heavy Metals
- ■ Toxic Materials
- ■ Oxygen Demanding Substance
- ■ Oil & Grease
- ■ Floatable Materials
- ☒ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

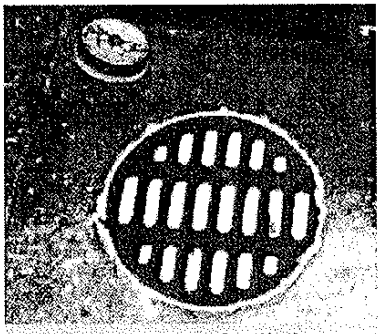
- ☐ Capital Costs
- ☒ O&M Costs
- ☐ Regulatory
- ■ Training
- ☒ Staffing
- ☐ Administrative

- ■ High
- ☒ Medium
- ☐ Low

BMP: Identifying Illicit Connections IIC



One of the ways to identify illicit connections is by inspecting storm drain system using video equipment (Source: Drain Patrol, no date)



A common source of pollution from businesses is a floor drain that is improperly connected to a storm drain (Source: Petro-Marine Company, Inc., no date)

OBJECTIVES

- ☒ Manufacturing
- ☒ Material Handling
- ☐ Vehicle Maintenance
- ☒ Construction
- ☒ Commercial Activities
- ☐ Roadways
- ☒ Waste Containment
- ☐ Housekeeping Practices

DESCRIPTION:

Involves the identification and elimination of illegal or inappropriate connections of industrial and business wastewater sources to the storm drain system. It attempts to prevent contamination of ground and surface water supplies by regulation, inspection, and removal of these connections. The large amount of storm and sanitary sewer pipes in a community creates a complex and often confusing system of utilities, so it is not unusual for improper connections to occur.

APPROACH:

- ► Discharges from industry and business may come from variety of sources including process wastewater, wash waters, and sanitary wastewater. The following methods are often used for identifying improper industrial discharges to the storm drain system.
- ► Visual Inspection. A physical examination of piping connections or analysis by closed circuit camera is used to identify possible illicit connection sites.
- ► Piping schematic Review. Architectural plans and plumbing details are examined for potential sites where improper connections have occurred.
- ► Smoke Testing. Smoke testing used to locate connections by injecting a non-toxic vapor (smoke) into the system and following its path of travel.
- ► Dye Testing. Colored dye is added to the drain water in suspect piping. Dyed water appearing in the storm drain system indicates an illegal connection, possibly between the sanitary sewer system and the storm drain.
- ► Instituting building and plumbing codes to prevent connections of potentially hazardous pollutants to storm drains.
- ► Flow Monitoring. Monitoring increases in storm sewer flows during dry periods can also be lead investigators to sources of infiltration due to improper connections.
- ► Inspection using video equipment
- ► Instituting building and plumbing codes to prevent connections of potentially hazardous pollutants to storm drains.

LIMITATIONS:

- ► A local ordinance is necessary to provide investigators with access to private property in order to perform field tests (Ferguson et al. 1997)
- ► Rain fall can hamper efforts to monitor flows and visual inspections

MAINTENANCE:

- ► Identifying illicit discharges requires teams of at least two people (volunteers can be use), plus administrative personnel, depending on the complexity of storm sewer system.

TARGETED POLLUTANTS

- ☐ Sediment
- ■ Nutrients
- ■ Heavy Metals
- ■ Toxic Materials
- ■ Oxygen Demanding Substance
- ■ Oil & Grease
- ■ Floatable Materials
- ■ Bacteria & Viruses

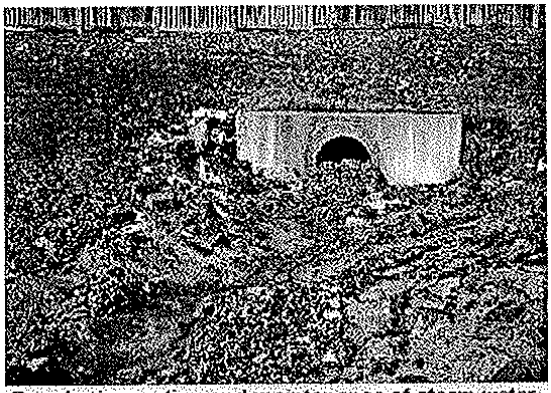
- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ■ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

- ■ High
- ☒ Medium
- ☐ Low

BMP: Infrastructure Planning IPL



Regular inspection and maintenance of storm water best management practices is important to ensure that the practices are functioning properly and to remove trash and organic debris

OBJECTIVES

- ☐ Manufacturing
- ☐ Material Handling
- ☐ Vehicle Maintenance
- ☒ Construction
- ☒ Commercial Activities
- ☒ Roadways
- ☐ Waste Containment
- ☐ Housekeeping Practices

DESCRIPTION:

This practice requires changes in the regional growth planning process to contain sprawl development. Sprawl development is the expansion of low-density development into previously undeveloped land. The American Farmland Trust has estimated that the United States is losing about 50 acres an hour to suburban and exurban development (Longman, 1998). This sprawl development requires local governments to extend public services to new residential communities whose tax payments often do not cover the cost of providing those services. For example, in Prince William County, Virginia, officials have estimated that the costs providing services to new residential homes exceeds what is brought in from taxes and other fees by $1,600 per home (Shear and Casey, 1996).

Infrastructure planning makes wise decisions to locate public services – water, sewer, roads, schools, and emergency services – in the suburban fringe and direct new growth into previously developed areas, discouraging.

Low-density development, Generally, this is done by drawing a boundary or envelope around a community, beyond which major public infrastructure investments are discouraged or not subsidized. Meanwhile, economic and other incentives are provided within the boundary to encourage growth in existing neighborhoods.

APPROACH:

- ► Sprawl development negatively impacts water quality in several ways. The most significant impact comes from the increase in impervious cover that is associated with sprawl growth. In addition to rooftop impervious area from new development, extension of road systems and additions of paved surface from driveways create an overall increase in imperviousness
- ► Urban Growth Boundaries. This planning tool establishes a dividing line that defines where a growth limit is to occur and where agricultural or rural land is to be preserved. Often, an urban services area is included in this boundary that creates a zone where public services will not be extended.
- ► Infill/Community Redevelopment. This practice encourages new development in unused or underutilized land in existing urban areas. Communities may offer tax breaks or other economic incentives to developers to promote the redevelopment of properties that are vacant or damaged.

LIMITATIONS:

- ► Intense development of existing ares can create a new set of challenges for storm water program managers. Storm water management solutions are often more difficult and comples in ultra-urban ares than in suburban areas
- ► Infrastructrue planning is often done on a regional scale and requires a cooperateive effort between all the communities within a given region in order to be successful.

TARGETED POLLUTANTS

- ☒ Sediment
- ☐ Nutrients
- ☐ Heavy Metals
- ☐ Toxic Materials
- ☐ Oxygen Demanding Substance
- ☐ Oil & Grease
- ☐
- ☐ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

- ■ High
- ☒ Medium
- ☐ Low

BMP: Illegal Solids Dumping Control ISDC



Signs can be used to discourage dumping in sensitive areas (Source: NCDENR, 2000)

OBJECTIVES

- ☒ Manufacturing
- ☒ Material Handling
- ☐ Vehicle Maintenance
- ☒ Construction
- ☒ Commercial Activities
- ☒ Roadways
- ☒ Waste Containment
- ☒ Housekeeping Practices

DESCRIPTION:

By locating and correcting illegal dumping practices through education and enforcement measures, the many risks to public safety and water quality associated with illegal disposal actions can be prevented. Illegal dumping control is important to preventing contaminated runoff from entering wells and surface water, as well as averting flooding due to blockages of drainage channels for runoff.

APPLICATION:

- ► Illegal dumping can occur in both urban and rural settings and can happen in all geographic regions.
- ► Illegal dumping control programs focus on community involvement and targeted enforcement to eliminate or reduce illegal dumping practices.
- ► Control programs use a combination of public education, citizen participation, site maintenance, and authorized enforcement measures to address illegal waste disposal.
- ► Issues that need to be examined when creating a program include the following:
- ► The locations of persistent illegal dumping activity
- ► Types of waste dumped and the profile of dumpers
- ► Possible driving forces behind illegal dumping such as excessive user fees, restrictive curbside trash pickup, or ineffective recycling programs, Previous education and cleanup efforts, Current control programs and local laws or ordinances addressing the problem, Sources of funding and additional resources that may be required.

LIMITATIONS:

- ► Illegal dumping is often spurred by cost and convenience considerations, and a number of factors encourage this practice
- ► A lack of understanding regarding applicable laws or the inadequacy of existing laws may also contribute to the problem.

MAINTENANCE:

- ► Efforts need to be continual

TARGETED POLLUTANTS

- ☐ Sediment
- ☒ Nutrients
- ■ Heavy Metals
- ■ Toxic Materials
- ☒ Oxygen Demanding Substance
- ■ Oil & Grease
- ■ Floatable Materials
- ■ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

- ■ High
- ☒ Medium
- ☐ Low

BMP: Landscape & Irrigation Plan — LIP



DESCRIPTION:

All developers are required to submit a landscape and irrigation plan for their developments. Lawn and garden activities can result in contamination of storm water through pesticide, soil, and fertilizer runoff. Proper landscape management, however, can effectively reduce water use and contaminant runoff as well as enhance the aesthetics of a property.

APPLICATION:

- Develop landscape and irrigation plan preparation guidelines.
- Require a landscape and irrigation plan for each new commercial development.
- Educate local developers on how to create effective landscape and irrigation plans for their new developments.
- Educate municipal staff to review property landscape and irrigation plans to minimize runoff.
- Check all new irrigation plans to ensure that there will be no overspray onto impervious surfaces and that the irrigation water will be contained on site.
- Uniform coverage for sprinkler systems should be checked to help minimize over watering.

LIMITATIONS:

- More time and effort will be required of the municipal staff to review new development plans.
- Some communities do note have the expertise to complete proper reviews in-house.

MAINTENANCE:

- Programs and educational materials can be repeatedly sent out or emphasized. Extension service continues to research and provide current data.

OBJECTIVES

- ☒ Manufacturing
- ☐ Material Handling
- ☐ Vehicle Maintenance
- ■ Construction
- ☒ Commercial Activities
- ☐ Roadways
- ☐ Waste Containment
- ☒ Housekeeping Practices

TARGETED POLLUTANTS

- ☐ Sediment
- ■ Nutrients
- ☐ Heavy Metals
- ☐ Toxic Materials
- ☐ Oxygen Demanding Substance
- ☒ Oil & Grease
- ☐ Floatable Materials
- ☐ Bacteria & Viruses

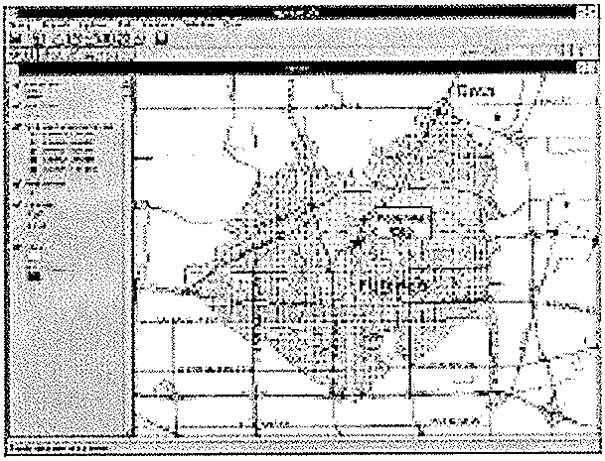
- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☐ Maintenance
- ☒ Staffing

- ■ High
- ☒ Medium
- ☐ Low

BMP: Map Storm Water Drains MSWD



OBJECTIVES

- ☒ Manufacturing
- ☐ Material Handling
- ☐ Vehicle Maintenance
- ☒ Construction
- ☒ Commercial Activities
- ☐ Roadways
- ☒ Waste Containment
- ☐ Housekeeping Practices

DESCRIPTION:

Develop an integrated storm water sewer system map that identifies existing piping, open channels, storm drain outfalls, receiving water bodies and retention/detention basins.

APPROACH:

- ► Determine if effort will be out-sourced or completed in-house
- ► Compile existing drawings
- ► Gather drawings of new developments
- ► Convert drawing to a GIS program
- ► Identify any possible illegal discharges
- ► Use in determining possible causes of a pollution
- ► Require new developments to supple city with updated drainage maps to be integrated into the system.

LIMITATIONS:

- ► Some additional surveying may need to be done on existing structures
- ► Training may be required to familiarize with software

MAINTENANCE:

- ► Map will need to be updated constantly as new developments arise
- ► Checks and changes may be necessary as as-builds and differences are discovered
- ► Inspection

TARGETED POLLUTANTS

- ☒ Sediment
- ☒ Nutrients
- ☒ Heavy Metals
- ☒ Toxic Materials
- ☒ Oxygen Demanding Substance
- ☒ Oil & Grease
- ☒ Floatable Materials
- ☒ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ■ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☒ Training

- ■ High
- ☒ Medium
- ☐ Low

BMP: Non-Stormwater Discharges to Drains NSWD



OBJECTIVES

- ☒ Manufacturing
- ☐ Material Handling
- ☒ Vehicle Maintenance
- ☐ Construction
- ☒ Commercial Activities
- ☐ Roadways
- ☒ Waste Containment
- ☒ Housekeeping Practices

DESCRIPTION:

Eliminate non-stormwater discharges to the stormwater collection system. Nonstormwater discharges may include: process wastewaters, cooling waters, wash waters, and sanitary wastewater.

APPROACH:

The following approaches may be used to identify non-stormwater discharges:

- ► Visual inspection: the easiest method is to inspect each discharge point during dry weather. Keep in mind that drainage from a storm event can continue for three days or more and groundwater may infiltrate the underground stormwater collection system.
- ► Piping Schematic Review: The piping schematic is a map of pipes and drainage systems used to carry wastewater, cooling water, sanitary wastes, etc... A review of the “as-built” piping schematic is a way to determine if there are any connections to the stormwater collection system. Inspect the path of floor drains in older buildings.
- ► Smoke Testing: Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two systems. During dry weather the stormwater collection system is filled with smoke and then traced to sources. The appearance of smoke at the base of a toilet indicates that there may be a connection between the sanitary and the stormwater system.
- ► Dye Testing: A dye test can be performed by simply releasing a dye into either the sanitary or process wastewater system and examining the discharge points from the stormwater collection system for discoloration.

LIMITATIONS:

- ► Many facilities do not have accurate, up-to-date schematic drawings.
- ► Video and visual inspections can identify illicit connections to the storm sewer, but further testing is sometimes required (e.g. dye, smoke) to identify sources.

TARGETED POLLUTANTS

- ☐ Sediment
- ■ Nutrients
- ■ Heavy Metals
- ■ Toxic Materials
- ■ Oxygen Demanding Substance
- ■ Oil & Grease
- ☒ Floatable Materials
- ■ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☒ Training

- ■ High
- ☒ Medium
- ☐ Low

BMP: Ordinance Development OD



OBJECTIVES

- ☒ Manufacturing
- ☒ Material Handling
- ☒ Vehicle Maintenance
- ☒ Construction
- ☒ Commercial Activities
- ☒ Roadways
- ☒ Waste Containment
- ☒ Housekeeping Practices

DESCRIPTION:

By locating and correcting illegal dumping practices through education and enforcement measures, the many risks to public safety and water quality associated with illegal disposal actions can be prevented. Illegal dumping control is important to preventing contaminated runoff from entering wells and surface water, as well as averting flooding due to blockages of drainage channels for runoff.

APPLICATION:

- ► Review existing storm drain ordinances for consistency and compliance with state and federal regulations and make improvements, if necessary. Ensure that no conflicts will occur with new ordinances that will be written and adopted.
- ► Write and adopt an ordinance that prohibits (to the extent allowable under State, Tribal, or local law) the discharge of non-storm water discharges into the MS4 with appropriate enforcement procedures and actions.
- ► Write and adopt an ordinance, with sanctions to ensure compliance, requiring the implementation of proper erosion and sediment controls, and controls for other wastes, on applicable construction sites.
- ► Write and adopt an ordinance requiring the implementation of post-construction runoff controls to the extent allowable under State, Tribal, or local law.
- ► Educate the public about the new ordinances.
- ► Enforce the new ordinances.

LIMITATIONS:

- ► Wording of ordinances is often difficult. It should be specific to serve the intended purpose, but not too specific to cause potential conflicts with other ordinances or situations.
- ► Once an ordinance is adopted, it can be difficult to modify ordinances to meet changing needs.
- ► Ordinances have to be enforced to be beneficial.
- ► Ordinances take time to change.

TARGETED POLLUTANTS

- ☒ Sediment
- ☒ Nutrients
- ☒ Heavy Metals
- ☒ Toxic Materials
- ☒ Oxygen Demanding Substance
- ☒ Oil & Grease
- ☒ Floatable Materials
- ☒ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ■ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training

- ■ High
- ☒ Medium
- ☐ Low

BMP: Public Education/Participation PEP



OBJECTIVES

- ☐ New Development
- ☒ Residential
- ☒ Commercial Activities
- ☐ Industrial Activities
- ☒ Municipal Facilities
- ☒ Illegal Discharges

DESCRIPTION:

Public education/participation, like an ordinance or a piece of equipment, is not so much a best management practice as it is a method by which to implement BMPs. This information sheet highlights the importance of integrating elements of public education and participation into a municipality's overall plan for stormwater quality management.

A public education and participation plan provides the municipality with a strategy for educating its employees, the public, and businesses about the importance of protecting stormwater from improperly used, stored, and disposed of pollutants. Municipal employees must be trained, especially those that work in departments not directly related to stormwater but whose actions affect stormwater. Residents must become aware that a variety of hazardous products are used in the home and that their improper use and disposal can pollute stormwater. Increased public awareness also facilitates public scrutiny of industrial and municipal activities and will likely increase public reporting of incidents.

APPROACH:

- ► Pattern a new program after the many established programs around the country.
- ► Implement public education/participation as a coordinated campaign in which each message is related to the last.
- ► Present a clear and consistent message and image to the public regarding how they contribute to stormwater pollution and what they can do to reduce it.
- ► Utilize multi-media to reach the full range of audiences.
- ► Translate messages into the foreign languages of the community to reach the full spectrum of your populace and to avoid misinterpretation of messages.
- ► Create an awareness and identification with the local watershed.
- ► Use everyday language in all public pieces. Use outside reviewers to highlight and reduce the use of technical terminology, acronyms, and jargon.
- ► Make sure all statements have a sound, up-to-date technical basis. Do not contribute to the spread of misinformation.
- ► Break complicated subjects into smaller more simple concepts. Present these concepts to the public in a metered and organized way to avoid "overloading" and confusing the audience.

LIMITATIONS:

- ► None.

TARGETED POLLUTANTS

- ■ Sediment
- ■ Nutrients
- ■ Heavy Metals
- ■ Toxic Materials
- ■ Oxygen Demanding Substance
- ■ Oil & Grease
- ■ Floatable Materials
- ■ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ■ Capital Costs
- ☒ O&M Costs
- ☐ Regulatory
- ☒ Training
- ☒ Staffing
- ☒ Administrative

- ■ High
- ☒ Medium
- ☐ Low

BMP: Using the Media

UM



Television can be an effective means of informing the public about storm water problems and outreach events

OBJECTIVES

- ☒ Manufacturing
- ☒ Material Handling
- ☒ Vehicle Maintenance
- ☒ Construction
- ☒ Commercial Activities
- ☒ Roadways
- ☒ Waste Containment
- ☒ Housekeeping Practices

DESCRIPTION:

The media can be strong allies to a storm water pollution prevention campaign in educating the public about storm water issues. Through the media, a program can educate targeted or mass audiences about problems and solutions, build support for remediation and retrofit projects, or generate awareness and interest in storm water management, Best of all, packaging a storm water message as a news story is virtually free.

APPROACH:

- ► Newspapers and Magazines. Newspapers are powerful vehicles for delivering educational information, policy analyses, public notices, and other messages. Many displays at watershed seminars proudly post newspaper articles on the projects being presented in recognition of the importance and impacted of newspaper coverage.
- ► Newspapers can be accessed in several ways. Depending on the message or event, the appropriate format might be a news release, news advisory, query letter, letter to the editor or (for urgent, timely information) a news conference.
- ► Magazines. Magazines, like newspapers, allow for greater length and analysis that television and provide the additional benefit of targeting specific audiences (e.g., landscapers, automobile mechanics, farmers, or recreationists).
- ► Radio. In spite of the popularity of video, radio remains a strong media contender due to its affordable production costs and creative possibilities. Further, commuters who drive to work spend much time in their vehicles.
- ► Television. Television is the primary source of news for the majority of the population, and local reporters are generally interested in covering environmental stories that pertain to their area.
- ► Issues will attract television coverage if they involve local people or issues. Focus on unique or unusual attributes. Affect many people throughout a region, involve controversy or strong emotions.
- ► Internet Message. Increasingly, the Internet is becoming a powerful means of communication. It provides worldwide access to hundreds of thousands of sites containing millions of documents, chat rooms for special interest groups, and incredible database/mapping features.

LIMITATIONS:

- ► Working with the media is essentially free, but not always.

TARGETED POLLUTANTS

- ■ Sediment
- ■ Nutrients
- ■ Heavy Metals
- ■ Toxic Materials
- ■ Oxygen Demanding Substance
- ■ Oil & Grease
- ■ Floatable Materials
- ■ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☐ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training

- ■ High
- ☒ Medium
- ☐ Low

BMP: Used Oil Recycling

UOR



Used oil can be disposed of at a waste collection facility, where it will be collected and later sent to a recycling facility

OBJECTIVES

- ☒ Manufacturing
- ☒ Material Handling
- ☒ Vehicle Maintenance
- ☒ Construction
- ☒ Commercial Activities
- ☐ Roadways
- ☒ Waste Containment
- ☒ Housekeeping Practices

DESCRIPTION:

Used motor oil is a hazardous waste because it contains heavy metals picked up from the engine during use. Since it is toxic to humans, wildlife, and plants, it should be disposed of at a local recycling or disposal facility.

APPROACH:

- ► When establishing oil recycling programs, municipalities should provide the public with the proper informational resources.
- ► The public can also call 1-800-RECYCLE or contact Earth's 911 at *www.1800cleanup.org/* for more information.
- ► Municipalities also need to address oil filter recycling in their recycling programs.
- ► To make recycling motor oil more convenient for the do-it-yourselfers, oil recycling programs should be located throughout all communities.
- ► Two types of programs currently in use are drop-off locations and curbside collection. Drop-off locations include service stations, recycling centers, auto parts retail stores, quick lubes, and landfills.

LIMITATIONS:

- ► If oil is mixed with other substances or if storage containers have residues of other substances, this can contaminate oil and make it a hazardous waste.
- ► It is often difficult to effectively educate the public and convince them of the importance of recycling oil. This limitation can be addressed if municipalities include recycling information in utility bill inserts, newspaper ads, and mailings.

MAINTENANCE:

- ► Costs for used motor oil recycling programs vary depending on whether a community has already established similar types of recycling programs.
- ► Major costs associated with oil recycling programs include advertisement costs and oil collection costs.

TARGETED POLLUTANTS

- ☐ Sediment
- ☐ Nutrients
- ■ Heavy Metals
- ■ Toxic Materials
- ☐ Oxygen Demanding Substance
- ■ Oil & Grease
- ☐ Floatable Materials
- ☐ Bacteria & Viruses

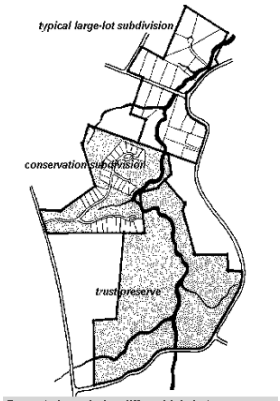
- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

- ■ High
- ☒ Medium
- ☐ Low

BMP: Zoning ZO



Property boundaries differ widely between traditional large-lot zoning, which maximizes the acreage of individual properties, and conservation zoning, which maximizes the amount of shared open space (Source: Arendt, 1996)

OBJECTIVES

- ☐ Manufacturing
- ☐ Material Handling
- ☐ Vehicle Maintenance
- ☒ Construction
- ☒ Commercial Activities
- ☐ Roadways
- ☐ Waste Containment
- ☐ Housekeeping Practices

DESCRIPTION:

Zoning is a classification scheme for land use planning. Zoning can serve numerous functions and can help mitigate storm water runoff problems by facilitating better site designs. By correctly applying the right zoning technique, development can be targeted into specific areas, limiting development in other areas and providing protection for the most important land conservation areas.

APPLICATION:

- Impervious Overlay Zoning: This type of overlay zoning limits future impervious areas.
- Incentive Zoning: This planning technique relies on bonuses or incentives for developers to encourage the creation of certain amenities or land use designs. A developer is granted the right to build more intensively on a property or given some other bonus in exchange for an amenity or a design that the community considers beneficial.
- Performance Zoning: Performance zoning is a flexible approach that has been employed in a variety of fashions in several different communities across the country. Some performance factors include traffic or noise generation limits, lighting requirements, storm water runoff quality and quantity criteria, protection of wildlife and vegetation, and even architectural style criteria
- Urban Growth Boundaries: Urban growth boundaries are sometimes called development service districts and include areas where public services are already provided (e.g., sewer, water, roads, police, fire, and schools).

LIMITATIONS:

Some zoning techniques may be limited by economic and political acceptance and should be evaluated on these criteria as well as storm water management goals.

TARGETED POLLUTANTS

- ☒ Sediment
- ☐ Nutrients
- ☐ Heavy Metals
- ☐ Toxic Materials
- ☐ Oxygen Demanding Substance
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Staffing

- ■ High
- ☒ Medium
- ☐ Low

APPENDIX G – PROGRAM AGREEMENT

J-U-B ENGINEERS, Inc.
AGREEMENT FOR PROFESSIONAL SERVICES

J-U-B Project No.: 55-24-044
J-U-B Project Manager: Taylor Stauffer

This Agreement entered into and effective this 28 day of 02 2025, between Hooper City , hereinafter referred to as the "CLIENT" and J-U-B ENGINEERS, Inc., an Idaho corporation, hereinafter referred to as "J-U-B".

WITNESSETH:

WHEREAS the CLIENT intends to: Perform professsional engineering services, on an on call basis through multiple assignments documented through various Scopes of Work over time hereinafter referred to as the "Project". The Services to be performed by J-U-B are hereinafter referred to as the "Services."

NOW, THEREFORE, the CLIENT and J-U-B, in consideration of their mutual covenants herein, agree as set forth below:

CLIENT INFORMATION AND RESPONSIBILITIES

The CLIENT will provide to J-U-B all criteria and full information as to CLIENT's requirements for the Project, including design objectives and constraints, space, capacity and performance requirements, flexibility and expandability, and any budgetary limitations; and furnish copies of all design and construction standards, rules and laws which CLIENT or others will require to be included in the drawings and specifications, and upon which J-U-B can rely for completeness and accuracy.

The CLIENT will furnish to J-U-B all data, documents, and other items in CLIENT's possession, or reasonably obtainable by CLIENT, including, without limitation: 1) borings, probings and subsurface explorations, hydrographic surveys, laboratory tests and inspections of samples, materials and equipment; 2) appropriate professional interpretations of all of the foregoing; 3) environmental assessment and impact statements; 4) surveys of record, property descriptions, zoning, deeds and other land use restrictions, rules and laws; and 5) other special data or consultations, all of which J-U-B may use and rely upon in performing Services under this Agreement.

The CLIENT will obtain, arrange and pay for all advertisements for bids, permits and licenses, and similar fees and charges required by authorities, and provide all land, easements, rights-of-ways and access necessary for J-U-B's Services and the Project.

In addition, the CLIENT will furnish to J-U-B those items described in **Attachment 1**.

PROJECT REPRESENTATIVES

The CLIENT and J-U-B hereby designate their authorized representatives to act on their behalf with respect to the Services and responsibilities under this Agreement. The following designated representatives are authorized to receive notices, transmit information, and make decisions regarding the Project and Services on behalf of their respective parties, except as expressly limited herein. These representatives are not authorized to alter or modify the TERMS AND CONDITIONS of this Agreement.

For the CLIENT:

1.	Name	**Sherri Bingham**	Work telephone	**801-732-1064**
	Address	**5580 West 4600 South**	Home/cell phone	801 628-1670
		Hooper, UT 84315	FAX telephone	
		Sheri Bingham	E-mail address	**sbingham@hoopercity.com**

For J-U-B:

1.	Name	**Taylor Stauffer**	Work telephone	**801-547-0393**
	Address	**466 North 900 West**	Cell phone	**385-207-9147**
		Kaysville, Utah 84037	FAX telephone	
			E-mail address	**tstauffer@jub.com**

In the event any changes are made to the authorized representatives or other information listed above, the CLIENT and J-U-B agree to furnish each other timely, written notice of such changes.

J-U-B ENGINEERS, Inc.
TERMS AND CONDITIONS

GENERAL

All J-U-B Services shall be covered by this Agreement. The Services will be performed in accordance with the care and skill ordinarily used by members of the subject profession practicing under like circumstances at the same time and in the same locality. **J-U-B MAKES NO WARRANTY EITHER EXPRESS OR IMPLIED ON BEHALF OF IT OR OTHERS.** Nothing herein shall create a fiduciary duty between the parties.

The CLIENT acknowledges and agrees that requirements governing the Project may be ambiguous and otherwise subject to various and possibly contradictory interpretations and J-U-B is, therefore, only responsible to use its reasonable professional efforts and judgment to interpret such requirements. Accordingly, CLIENT should prepare and plan for clarifications or modifications which may impact both the cost and schedule of the Project.

J-U-B shall not be responsible for acts or omissions of any other party involved in the Project, including but not limited to the following: the failure of CLIENT or a third party to follow J-U-B's recommendations; the means, methods, techniques, sequences or procedures of construction; safety programs and precautions selected by third parties; compliance by CLIENT or third parties with laws, rules, regulations, ordinances, codes, orders or authority; and delays caused by CLIENT or third parties;. CLIENT, therefore, releases and shall indemnify, defend and hold J-U-B harmless from the acts, errors, or omissions of CLIENT or third parties involved in the Project.

J-U-B shall not be required to execute any documents, no matter by whom requested, that would result in J-U-B's having to certify, guarantee or warrant the existence of conditions. CLIENT acknowledges that subsurface conditions can vary widely between adjacent samples and test points, and therefore J-U-B makes no warranty or other representation regarding soil investigations and characterization of subsurface conditions for the Project.

Any sales tax or other tax on the Services rendered under this Agreement, additional costs due to changes in regulation, and fees for credit card payment transactions shall be paid by the CLIENT.

CLIENT grants J-U-B and its subsidiaries the unrestricted right to take, use, and publish images, or edited images, of the project site and workers for J-U-B's purposes including, but not limited to, website, intranet, and marketing. This right shall survive the termination of this Agreement.

REUSE OF DOCUMENTS

Documents that may be relied upon by CLIENT as instruments of service under this Agreement are limited to the printed copies (also known as hard copies) that are signed or sealed by J-U-B (including non-vector PDF facsimiles thereof). All printed materials or other communication or information ("Documents") that may be prepared or furnished by J-U-B pursuant to this Agreement are instruments of service with respect to the Project. J-U-B grants CLIENT a limited license to use the Documents on the Project subject to receipt by J-U-B of full payment for all Services related to preparation of the Documents.

Although CLIENT may make and retain copies of Documents for reference, J-U-B shall retain all common law, statutory and other reserved rights, including the copyright thereto, and the same shall not be reused on this Project or any other Project without J-U-B's prior written consent. Submission or distribution of Documents to meet regulatory or permitting requirements, or for similar purposes, in connection with the Project, including but not limited to distribution to contractors or subcontractors for the performance of their work, is not to be construed as publication adversely affecting the reserved rights of J-U-B.

Any reuse without written consent by J-U-B, or without verification or adoption by J-U-B for the specific purpose intended by the reuse, will be at CLIENT's sole risk and without liability or legal exposure to J-U-B. The CLIENT shall release, defend, indemnify, and hold J-U-B harmless from any claims, damages, actions or causes of action, losses, and expenses, including reasonable attorneys' and expert fees, arising out of or resulting from such reuse.

CONSTRUCTION PHASE SERVICES

It is understood and agreed that J-U-B does not have control over, and neither the professional activities of J-U-B nor the presence of J-U-B at the Project Site shall give, J-U-B control over contractor(s) work nor shall J-U-B have authority over or responsibility for the means, methods, techniques, sequences or procedures of construction selected by contractor(s), for safety precautions and programs incident to the work of the contractor(s) or for any failure of contractor(s) to comply with laws, rules, regulations, ordinances, codes or orders applicable to contractor(s) furnishing and performing their work or providing any health and safety precautions required by any regulatory agencies. Accordingly, J-U-B does not guarantee or warrant the performance of the construction contracts by contractor(s), nor assume responsibility of contractor(s)' failure to furnish and perform their work in accordance with the Contract Documents.

The CLIENT agrees that the general contractor shall be solely responsible for jobsite safety, and CLIENT agrees that this intent shall be set forth in the CLIENT's contract with the general contractor. The CLIENT also agrees that the CLIENT, J-U-B, and J-U-B's subconsultants shall be indemnified by the general contractor in the event of general contractor's failure to assure jobsite safety and shall be made additional insureds under the general contractor's policies of general liability insurance.

If **Standard Exhibit A** – Construction Phase Services is attached, the additional terms contained therein apply to this Agreement.

OPINIONS OF COST AND PROJECT FINANCIAL INFORMATION

CLIENT understands that J-U-B has no control over the cost of labor, materials, equipment or services furnished by others, the contractor(s)' methods of determining prices, nor bidding or market conditions. J-U-B's opinions of probable Project costs and construction, if any, are to be made on the basis of J-U-B's experience, and represent J-U-B's best judgment as a professional engineer, familiar with the construction industry.

CLIENT understands and acknowledges that J-U-B cannot and does not guarantee that proposals, bids or actual Project or construction costs will not vary from opinions of probable cost prepared by J-U-B. J-U-B's Services to modify the Project to bring the construction costs within any limitation established by the CLIENT will be considered Additional Services and paid for as such by the CLIENT in accordance with the terms herein.

CLIENT agrees that J-U-B is not acting as a financial advisor to the CLIENT and does not owe CLIENT or any third party a fiduciary duty pursuant to Section 15B of the Exchange Act with respect to J-U-B's professional Services. J-U-B will not give advice or make specific recommendations regarding municipal securities or investments and is therefore exempt from registration with the SEC under the municipal advisors rule. CLIENT agrees to retain a registered financial municipal advisor as appropriate for Project financing and implementation.

TIMES OF PAYMENTS

J-U-B shall submit monthly statements for Services rendered and for expenses incurred, which statements are due on presentation. CLIENT shall make prompt monthly payments. If CLIENT fails to make any payment in full within thirty (30) days after receipt of J-U-B's statement, the amounts due J-U-B will accrue interest at the rate of 1% per month from said thirtieth day or at the maximum interest rate allowed by law, whichever is less.

If the CLIENT fails to make payments when due or otherwise is in breach of this Agreement, J-U-B may suspend performance of Services upon five (5) days' notice to the CLIENT. J-U-B shall have no liability whatsoever to the CLIENT for any costs or damages as a result of such suspension caused by any breach of the Agreement by the CLIENT. Upon cure of breach or payment in full by the CLIENT within thirty (30) days of the date breach occurred or payment is due, J-U-B shall resume Services under the Agreement, and the time schedule and compensation shall be equitably adjusted to compensate for the period of suspension, plus any other reasonable time and expense necessary for J-U-B to resume performance. If the CLIENT fails to make payment as provided herein and cure any other breach of this Agreement within thirty (30) days after suspension of Services, such failure shall constitute a material breach of this Agreement and shall be cause for termination of this Agreement by J-U-B.

CLIENT shall promptly review J-U-B's invoices and shall notify J-U-B in writing of any dispute with said invoice, or portion thereof, within thirty (30) days of receipt. Failure to provide notice to J-U-B of any dispute as required herein shall constitute a waiver of any such dispute. CLIENT shall pay all undisputed portions of such invoice as required by this Agreement. Client shall not withhold any payment or portion thereof as an offset to any current or prospective claim.

TERMINATION

The obligation to provide further Services under the Agreement may be terminated by either party upon thirty (30) days' written notice. If this Agreement is terminated by either party, J-U-B will be paid for Services and Additional Services rendered and for expenses incurred. In addition to any other remedies at law or equity, if the Agreement is terminated by

J-U-B ENGINEERS, INC.

J-U-B ENGINEERS, Inc.
AGREEMENT FOR PROFESSIONAL SERVICES

Attachment 1 – Scope of Services, Basis of Fee, and Schedule

PROJECT NAME: Hooper City General Engineering Services
CLIENT: Hooper City
J-U-B PROJECT NUMBER: 55-24-044
CLIENT PROJECT NUMBER:
ATTACHMENT TO:

☒ **AGREEMENT DATED:** **; or**

☐ **AUTHORIZATION FOR CONTRACT AMENDMENT # ; DATED:**

The referenced Agreement for Professional Services executed between J-U-B ENGINEERS, Inc. (J-U-B) and the CLIENT is amended and supplemented to include the following provisions regarding the Scope of Services, Basis of Fee, and/or Schedule:

PART 1 - PROJECT UNDERSTANDING

J-U-B's understanding of this project's history and CLIENT's general intent and scope of the project are described as follows:

Hooper City requires engineering assistance for various projects throughout the City. This contract is a master services agreement that will cover all work performed by J-U-B that is not included in a specific contract.

PART 2 - SCOPE OF SERVICES BY J-U-B

J-U-B's Services under this Agreement are limited to the following tasks. Any other items necessary to plan and implement the project, including but not limited to those specifically listed in PART 3, are the responsibility of CLIENT.

All City engineering and other services as requested by the city.

PART 3 - CLIENT-PROVIDED WORK AND ADDITIONAL SERVICES

A. **CLIENT-Provided Work -** CLIENT is responsible for completing, or authorizing others to complete, all tasks not specifically included above in PART 2 that may be required for the project including, but not limited to:
   1. Information as requested

PART 4 - BASIS OF FEE AND SCHEDULE OF SERVICES

A. CLIENT shall pay J-U-B for the identified Services in PART 2 as follows:
   1. For Lump Sum fees:
      a. The portion of the Lump Sum amount billed for J-U-B's services will be based upon J-U-B's estimate of the percentage of the total services actually completed during the billing period.
   2. For Time and Materials fees:
      a. For all services performed on the project, Client shall pay J-U-B an amount equal to the cumulative hours charged to the Project by each class of J-U-B's personnel times J-U-B's standard billing rates.

J-U-B ENGINEERS, INC.

J-U-B ENGINEERS, Inc.
AGREEMENT FOR PROFESSIONAL SERVICES

Standard Exhibit A – Construction Phase Services

The Agreement for Professional Services is amended and supplemented to include the following agreement of the parties with respect to Services during the construction phase of the Project.

For the purposes of this exhibit, 'Agreement for Professional Services' and 'the Agreement' shall refer to the document entitled 'Agreement for Professional Services,' executed between J-U-B and CLIENT to which this exhibit and any other exhibits have been attached.

For the purposes of this exhibit, the term 'Contract Documents,' shall be defined as documents that establish the rights and obligations of the parties engaged in construction and include the Construction Agreement between CLIENT and contractor, Addenda (which pertain to the Contract Documents), contractor's bid (including documentation accompanying the bid and any post-bid documentation submitted prior to the notice of award) when attached as an exhibit to the Construction Agreement, the notice to proceed, the bonds, appropriate certifications, the General Conditions, the Supplementary Conditions, the Specifications and the Drawings, together with all Written Amendments, Change Orders, Work Change Directives, Field Orders, and J-U-B's written interpretations and clarifications issued on or after the Effective Date of the Construction Agreement. Shop Drawings and the reports and drawings of subsurface and physical conditions are not Contract Documents.

For the purposes of this exhibit, the term 'Work,' shall be defined as the entire construction or the various separately identifiable parts thereof required to be provided by the construction contractor under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction; all as required by the Contract Documents.

For the purposes of this exhibit, the term 'Site,' shall be defined as lands or areas indicated in the Contract Documents as being furnished by CLIENT upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by CLIENT which are designated for the use of contractor.

CONSTRUCTION PHASE SERVICES

J-U-B shall provide Construction Phase Services as agreed below. There is a "Yes" and "No" box to the left of each Service. If a box is marked "Yes", J-U-B agrees to perform the Service listed. If a box is marked "No", J-U-B undertakes no duty to perform the Service listed. If a duty or a condition of performance is listed below that is a responsibility of CLIENT, CLIENT's agreement to perform the same is assumed.

It is understood and agreed that J-U-B shall not, during the performance of Services, or as a result of observations of the Work in progress, supervise, direct, or have control over contractor(s) Work; nor shall J-U-B have authority over or responsibility for the means, methods, techniques, sequences or procedures of construction selected by contractor(s), for safety precautions and programs incident to the Work of the contractor(s) or for any failure of contractor(s) to comply with laws, rules, regulations, ordinances, codes or orders applicable to contractor(s) furnishing and performing their Work or providing any health and safety precautions required by any regulatory agencies. Accordingly, J-U-B does not guarantee or warrant the performance of the construction contracts by contractor(s) nor assume responsibility of contractor(s) failure to furnish and perform their Work in accordance with the Contract Documents.

The CLIENT agrees that the general contractor shall be solely responsible for jobsite safety, and warrants that this intent shall be carried out in the CLIENT's contract with the general contractor. The CLIENT also agrees that the CLIENT, J-U-B and J-U-B's subconsultants shall be indemnified by the general contractor in the event of general contractor's failure to assure jobsite safety and shall be named as additional insureds under the general contractor's policies of general liability insurance.

Construction Phase

After receiving written authorization from CLIENT to proceed with the construction phase, J-U-B may provide the following Services with respect to this part of the Project:

☒ Yes
☐ No

1. *General Administration of the Contract Documents.* Consult with, advise, and assist CLIENT in J-U-B's role as CLIENT's representative. Relevant J-U-B communications with contractor shall be imputed to the CLIENT. Nothing contained in this Standard Exhibit B creates a duty in contract, tort, or otherwise to any third party; but, instead, the duties defined herein are performed solely for the benefit of the CLIENT. CLIENT shall agree to include this language in any such agreements it executes with contractor, subcontractors or suppliers.

☒ Yes
☐ No

2. *Pre-Construction Conference.* Participate in a pre-construction conference.

☒ Yes
☐ No

10. *Disagreements between CLIENT and Contractor.* Assist CLIENT in rendering formal written decisions on claims of CLIENT and contractor relating to the acceptability of the Work or the interpretation of the requirements of the Contract Documents pertaining to the execution and progress of the Work. In assisting in such decisions, J-U-B shall not be liable in connection with any decision rendered in good faith.

☒ Yes
☐ No

11. *Applications for Payment.* Based on J-U-B's on-site observations as an experienced and qualified design professional, and upon written request of CLIENT, review Applications for Payment and the accompanying supporting documentation. Assist CLIENT in determining the amounts owed to contractor and, if requested by CLIENT, recommend in writing to CLIENT that payments be made to contractor in such amounts. Such recommendations of payment will constitute a representation to CLIENT that, to the best of J-U-B's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of such Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, and subject to any subsequent tests called for in the Contract Documents or to any other qualification stated in the recommendation), and the conditions precedent to contractor's being entitled to such payments appear to have been fulfilled insofar as it is J-U-B's responsibility to observe the Work. In the case of unit price Work, J-U-B's recommendation of payment will include final determinations of quantities and classifications of the Work (subject to any subsequent adjustments allowed by the Contract Documents). By recommending any payment and after reasonable inquiry, J-U-B shall not thereby be deemed to have represented that exhaustive, continuous, or detailed reviews or examinations have been made by J-U-B to check the quality or quantity of the Work as it is furnished and provided beyond the responsibilities specifically assigned to J-U-B in this Agreement and the Contract Documents. J-U-B's review of the Work for the purposes of recommending payments will not impose on J-U-B the responsibility to supervise, direct, or control such Work, or for the means, methods, techniques, sequences, or procedures of construction or safety precautions or programs incident thereto, or contractor's compliance with laws and regulations applicable to its furnishing and performing the Work. J-U-B's review will also not impose responsibility on J-U-B to make any examination to ascertain how or for what purposes contractor has used monies paid to contractor by CLIENT; to determine that title to any of the Work, including materials or equipment, has passed to CLIENT free and clear of any lien, claims, security interests, or encumbrances; or that there may not be other matters at issue between CLIENT and contractor that might affect the amount that should be paid.

☒ Yes
☐ No

12. *Contractor's Completion Documents.* Receive and review maintenance and operating instructions, schedules, guarantees, bonds and certificates of inspection, tests and approvals, Shop Drawings, Samples, other data approved, and the annotated record documents which are to be assembled by contractor in accordance with the Contract Documents (such review will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspection, tests, or approvals indicates compliance with, such Contract Documents); transmit them to CLIENT with written comments.

☒ Yes
☐ No

13. *Substantial Completion.* Promptly after notice from CLIENT that contractor considers the Work for this part of the Project is ready for its intended use, in company with CLIENT and contractor, conduct a site visit to determine if the Work is substantially complete. Provide recommendation to CLIENT relative to issuance of Certificate of Substantial Completion.

☒ Yes
☐ No

14. *Final Notice of Acceptability of the Work.* Assist CLIENT in conducting a final inspection to determine if the completed Work is acceptable so that J-U-B may recommend, in writing, that final payment be made to contractor.

☒ Yes
☐ No

15. *Additional Tasks.* Perform or provide the following additional construction phase tasks or deliverables as delineated in Attachment 1 – Scope of Services and/or Schedule and/or Basis of Fee, which is included with the Agreement.

General Limitation of Responsibilities. J-U-B shall not be responsible for the acts or omissions of any contractor or of any of their subcontractors, suppliers, or any other individual or entity performing or furnishing any of the Work. J-U-B shall not be responsible for failure of any contractor to perform or furnish the Work in accordance with the Contract Documents. CLIENT shall agree to include this language in any such agreements it executes with contractor, subcontractors or suppliers.

J-U-B's Construction Phase Services will be considered complete on the date of Final Notice of Acceptability of the Work.

CONSTRUCTION PHASE ADDITIONAL SERVICES

If authorized by CLIENT and expressly agreed by J-U-B; or, if performed by J-U-B with the knowledge of the CLIENT after the signing of the Agreement for Professional Services, J-U-B shall furnish or obtain from others Additional Services of the types listed in this paragraph:

1. Services in connection with Work Change Directives and Change Orders to reflect changes requested by CLIENT if the resulting change in compensation for Construction Phase Services is not commensurate with the Services rendered; Services in making revisions to Drawings and Specifications occasioned by the acceptance of substitutions proposed by contractor and Services after the award of the contract; Services in evaluating and determining the acceptability of an unreasonable or excessive number of substitutions proposed by contractor; and Services resulting from significant delays, changes, or price increases occurring as a direct or indirect result of material equipment, or energy shortages.

2. Services involving out-of-town travel required of J-U-B other than visits to the Site or CLIENT's office.

3. Assistance in connection with bid protests, rebidding, or renegotiating the Construction Agreement.

4. Services in connection with any partial utilization of the Work by CLIENT prior to Substantial Completion.

5. Additional or extended Services during construction of the Work made necessary by (a) emergencies or acts of God endangering or delaying the Work, (b) the discovery of constituents of concern, (c) Work damaged by fire or other cause during construction, (d) a significant amount of defective Work, (e) acceleration of the progress schedule involving Services beyond normal working hours, and (f) default by contractor, including extensions of the construction period.

6. Evaluating an unreasonable number of claims submitted by contractor or others in connection with the Work.

7. Protracted or extensive assistance in refining and adjusting any equipment or system (such as initial startup, testing, adjusting, and balancing).

8. Services or consultations after completion of the construction phase, such as excessive inspections during any correction period and reporting observed discrepancies under guarantees called for in the Construction Agreement for the Work (except as agreed to under Construction Phase Services).

9. Preparing to serve or serving as a consultant or witness for CLIENT in any litigation, arbitration, or other legal or administrative proceeding involving the Project to which J-U-B has not been made a party.

10. Additional Services in connection with the Work, including Services which are to be furnished by CLIENT and Services not otherwise provided for in this Agreement.

RESIDENT PROJECT REPRESENTATIVE

If provided as part of Construction Phase Services, J-U-B shall furnish a Resident Project Representative ("RPR"), assistants, and other field staff to assist J-U-B in observing progress and quality of the Work. The RPR, assistants, and other field staff will provide full-time representation or, if specifically directed by the CLIENT, may provide representation to a lesser degree. RPR is J-U-B's Project Engineer (J-U-B PE) or J-U-B Project Manager (J-U-B PM) representative at the Site, will act as directed by and under the supervision of J-U-B PE or J-U-B PM, and will confer with J-U-B PE or J-U-B PM regarding RPR's actions. The J-U-B PE or J-U-B PM will serve as the official liaison with the CLIENT and the contractor. .

Through such additional observations of the Work and field checks of materials and equipment by the RPR and assistants, J-U-B shall endeavor to identify defects and deficiencies in the Work. It is understood and agreed that J-U-B shall not, during the performance of Services, or as a result of observations of the Work in progress, supervise, direct, or have control over contractor(s)' Work; nor shall J-U-B have authority over or responsibility for the means, methods, techniques, sequences or procedures of construction selected by contractor(s), for safety precautions and programs incident to the Work of the contractor(s) or for any failure of contractor(s) to comply with laws, rules, regulations, ordinances, codes or orders applicable to contractor(s) furnishing and performing their Work or providing any health and safety precautions required by any regulatory agencies. Accordingly, J-U-B does not guarantee or warrant the performance of the construction contracts by contractor(s) nor assume responsibility of contractor(s)' failure to furnish and perform their Work in accordance with the Contract Documents.

The RPR's duties under this Agreement shall be strictly limited to the following:

1. *General.* RPR is J-U-B's agent at the Site, will act as directed by and under the supervision of J-U-B, and will confer with J-U-B regarding RPR's actions.

2. *Schedules.* Review the progress schedule, schedule of Shop Drawing and Sample submittals, and schedule of values prepared by contractor and consult with the J-U-B PE or PM, who will communicate with the CLIENT concerning acceptability of such schedules.

c) Obtain from the contractor an accurate, up-to-date lists of the names, addresses, e-mail addresses, and telephone numbers of all contractors, subcontractors, and major suppliers of materials and equipment.

d) Maintain records for use in preparing documentation of the Work.

e) Upon completion of the Work with respect to the Project, furnish a complete set of all RPR Project documentation to designated recipients.

12. *Reports.*

a) Furnish to J-U-B PE or J-U-B PM periodic reports as required of progress of the Work and of contractor's compliance with the progress schedule and schedule of Shop Drawing and Sample submittals.

b) Present to J-U-B PE or J-U-B PM proposed Change Orders, Work Change Directives, and Field Orders.

c) Furnish to J-U-B PE or J-U-B PM copies of all inspection, test, and system startup reports.

d) Report immediately to J-U-B PE, J-U-B PM, and CLIENT the occurrence of any Site accidents, emergencies, natural catastrophes endangering the Work, possible force majeure or delay events, property damaged by fire or other causes, and the discovery or presence of any constituents of concern.

13. *Payment Request:* Review Applications for Payment with contractor for compliance with the established procedure for their submission and forward with recommendations to J-U-B PE OR J-U-B PM, noting particularly the relationship of the payment requested to the schedule of values, Work completed, and materials and equipment delivered at the Site, but not incorporated in the Work.

14. *Certificates, Operation and Maintenance Manuals.* During the course of the Work, obtain and collate materials and equipment certificates, operation and maintenance manuals, and other data required by the Contract Documents to be assembled and furnished by contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to J-U-B PE or J-U-B PM for review.

15. *Completion.*

a) Participate in J-U-B PE or PM's visits to the Site regarding Substantial Completion, assist in the determination of Substantial Completion, and prior to the issuance of a Certificate of Substantial Completion submit a punch list of observed items requiring completion or correction.

b) Participate in J-U-B PE or PM's visit to the Site in the company of CLIENT and Contractor, to determine completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.

Observe whether all items on the final punch list have been completed or corrected, and make recommendations to J-U-B PE or PM concerning acceptance and issuance of the Notice of Acceptability of the Work

The RPR shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of J-U-B's authority as set forth in the Agreement for Professional Services.

3. Undertake any of the responsibilities of contractor, subcontractors, suppliers, or contractor's superintendent.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences, or procedures of construction or of the Work, unless such advice or directions are specifically required by the Contract Documents.

5. Advise on, issue directions regarding, or assume control over safety practices, precautions, and programs in connection with the activities or operations of CLIENT or contractor.

6. Participate in specialized field or laboratory tests or inspections conducted by others, except as specifically authorized by J-U-B PE or J-U-B PM.

7. Accept Shop Drawing or Sample submittals from anyone other than J-U-B.

8.. Authorize CLIENT to occupy the Work in whole or in part.

Outlook

RE: [EXTERNAL] Agreement with Hooper City

From Day, Summer <sday@webercountyutah.gov>
Date Mon 2026-01-26 3:53 PM
To amackliet@jub.com <amackliet@jub.com>

External Email - This Message originated from outside J-U-B ENGINEERS, Inc.

This message needs your attention

- This is their first email to you.

Mark as Safe Report this Email

Powered by Mimecast

Aaron

We do not maintain written agreements with the MS4. Our office completes and fulfills the requirements established in the UAC R317 and R305-10(minimum Performance standards). However, we believe that as defined in the MS4 General Permit all MS4 should have the ability in enact the requirements outline in the General Permit. This includes but is not limited to the sections below. We will respond and help on water quality emergency responses but are not willing to take over enforcements action intended to be fulfilled by the MS4.

MS4 General Permit Requirements.

- 4.2.3.2. Effectively prohibit, through ordinance or other regulatory mechanism, non-storm water discharges to the MS4, including spills, illicit connections, illegal dumping and sanitary sewer overflows ("SSOs") into the storm sewer system. The IDDE program shall require removal of such discharges consistent with Part 4.2.3.6. of this Permit and implement appropriate enforcement procedures and actions. The Permittee must have a variety of enforcement options in order to apply and escalate enforcement procedures as necessary based on the severity of violation and/or the failure of the violator to address the violation(s). Discharges pursuant to a separate UPDES Permit (other than the UPDES Permit for discharges from the MS4) and non-storm water discharges listed in Part 1.2.2.2. are exempt.
- 4.2.3.5.1 When the source of an illicit non-storm water discharge is identified and confirmed, the Permittee must record the following information in an inspection report: the date the Permittee became aware of the non-storm water discharge, the date the Permittee initiated an investigation of the discharge, the date the discharge was observed, the location of the discharge, a description of the discharge, the method of discovery, date of removal, repair, or enforcement action; date and method of removal verification. Analytical monitoring may be necessary to aid in the identification of potential sources of an illicit discharge and to characterize the nature of the illicit discharge. The decision process for utilizing analytical monitoring must be fully documented in the inspection report.
- 4.2.3.6. Implement SOPs or similar types of documents for ceasing the illicit discharge, including notification of appropriate authorities; notification of the property owner; technical assistance for removing the source of the discharge or otherwise eliminating the discharge; follow-up inspections; and escalating enforcement and legal actions if the discharge is not eliminated. Illicit discharges to the MS4 are prohibited and any such discharges violate this Permit and remain in violation until they are eliminated.
- 4.2.4.2. Develop a written enforcement strategy and implement the enforcement provisions of the ordinance or other regulatory mechanism. The enforcement strategy shall include:
- 4.2.4.2.1 Standard operating procedures (SOPs) or similar types of documents that include specific processes and sanctions to minimize the occurrence of violations and obtain compliance from violators. The SOP or similar type of document shall include appropriate, escalating enforcement procedures and actions, including an appeals process that is published in a publicly accessible location.
- 4.2.5.2. Regulatory Mechanism. Develop and adopt an ordinance or other regulatory mechanism that requires long-term post-construction storm water controls at new development and redevelopment sites. The ordinance or other regulatory mechanism shall apply, at a minimum, to new development and redevelopment sites that discharge to the MS4 that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale which collectively disturbs land greater than or equal to one acre. The ordinance or other regulatory mechanism shall require BMP selection, design, installation, operation, and maintenance standards necessary to protect water quality and reduce the discharge of
- pollutants to the MS4. The Permittee shall implement an enforcement strategy and implement the enforcement provisions of the ordinance or other regulatory mechanism. The Permittee's ordinance or other regulatory mechanism must include an appeals process.
- 4.2.5.2.1 The Permittee must include enforcement provisions in the ordinance or other regulatory mechanism that must contain procedures for specific processes and sanctions to minimize the occurrences of violations and obtain compliance from chronic and recalcitrant violators. These processes and sanctions shall include appropriate, escalating enforcement procedures and actions.

Thank You
Summer Day
Program Manager
801-399-7175

From: Aaron Mackliet <amackliet@jub.com>
Sent: Monday, January 26, 2026 10:26 AM
To: Env Health Science <envhealth@webercountyutah.gov>
Subject: [EXTERNAL] Agreement with Hooper City

EXTERNAL EMAIL - This email was sent by a person from outside your organization. Exercise caution when clicking links, opening attachments or taking further action, before validating its authenticity.

You don't often get email from amackliet@jub.com. Learn why this is important

I am currently assisting Hooper City with matters related to its MS4 permit obligations. As part of this process, the City is seeking to formalize an agreement with the Health Department regarding procedures for responding to illicit discharges. I wanted to check whether there is an existing agreement, either from prior coordination or modeled after arrangements used by other municipalities, that we could reference for our records. Any assistance or available documentation you can provide would be greatly appreciated.

Thanks

Aaron Mackliet

Project Designer

J-U-B ENGINEERS, Inc.

466 North 900 West, Kaysville, UT 84037

e amackliet@jub.com

p 801-547-0393

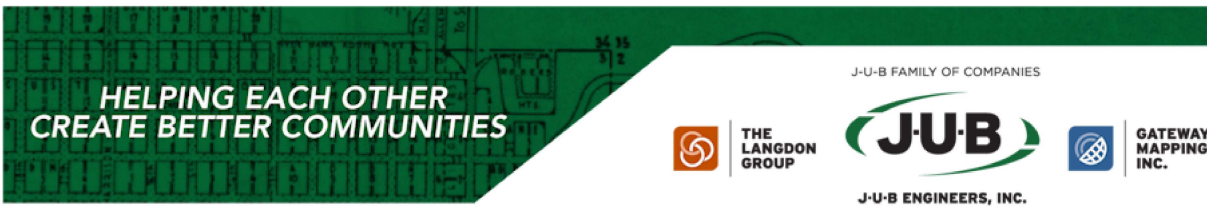
c 385-319-9074

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Interlocal Agreement Relating to Obligations
Required for a Small MS4 General UPDES Permit No. UTR090000
For
Storm Water Management

This Agreement made effective this 3rd day of January, 2019 is entered into by and among the City of Hooper (hereafter "City"), and Weber County (hereafter "County").

Recitals

WHEREAS, the Utah Interlocal Cooperation Act, Title 11, Chapter 13, Utah Code Annotated 1953, as amended, permits public agencies to enter into agreements with one another for the purpose of exercising, on a joint and cooperative basis, powers and privileges that will benefit their citizens and make the most efficient use of their resources; and,

WHEREAS, all of the parties hereto are public agencies as defined by the Interlocal Cooperation Act;

WHEREAS, the County is a body politic duly organized under the laws of Utah;

WHEREAS, the City is a municipal corporation duly organized under Title 10 of the Utah Code Annotated, as amended;

WHEREAS, in accordance with the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1987, and the Utah Water Quality Act, together with federal and state regulations adopted pursuant to such Acts, the County and the City, as operators of storm water systems, must reduce pollutants in storm water to the Maximum Extent Practicable (hereafter "MEP") to protect water quality;

WHEREAS, the Phase 2 NPDES and UPDES Storm Water Regulations (hereafter "Regulations") specify that compliance with the Regulations can be attained by developing, implementing and enforcing a storm water management plan which incorporates Best Management Practices addressing State of Utah Department of Environmental Quality Division of Water Quality Small MS4 General UPDES Permit, No. UTR090000 (MS4 Permit)

WHEREAS, pursuant to said MS4 Permit Section 4.3. Sharing Responsibility, the County and the City as Permittees may share with each other the implementation of the MS4 Permit Section 4.2. Minimum Control Measures; listed in Permit Articles:

4.2.1 Public Education and Outreach on Storm Water Impacts
4.2.2 Public Involvement /Participation
4.2.3. Illicit Discharge Detection and Elimination (IDDE)
4.2.4. Construction Storm Water Runoff Control
4.2.5. Long-Term Storm Water Management in New Development and Redevelopment (Post-Construction Storm Water management)

4.2.6. Pollution Prevention and Good Housekeeping for Municipal Operations;

through a written agreement with the obligations of said Permit to be maintained as part of each Permittee's Storm Water Management Plan or SWMP.

WHEREAS, the County and the City desire to work cooperatively in compliance with the MS4 Permit and subsequent renewals of the MS4 Permit with other relevant federal and state storm water Regulations as enacted within the time period of this agreement or through subsequent extensions to this agreement;

NOW, THEREFORE, for the reasons cited above, and in consideration of the mutual covenants and agreements contained herein, the City and County do mutually agree and undertake as follows:

Section One

Scope of Agreement

Intent. The parties intend by this Agreement to co-permit with one another in compliance to and for the implementation of the State of Utah Department of Environmental Quality Division of Water Quality MS4 Permit.

Specifically, this Agreement addresses the obligations of the County and the City in relation to compliance with the Regulations which require developing, implementing and enforcing a storm water management plan (SWMP) incorporating Best Management Practices. Each party remains responsible for its own implementation of its Storm Water Management Plan.

1. County Storm Water Management. The County shall provide for Storm Water Management Administration in accordance with the relevant rules and regulations and laws imposed upon the County.

2. Golden Spike Stormwater Coalition Management. The County, after following its procurement process, shall select and provide a contracted entity or firm to serve as a Golden Spike Stormwater Coalition Manager to assist in the direction and management of the Golden Spike Stormwater Coalition. If allowed by the County's procurement law, the City and each other member of the Coalition shall have the right to provide input regarding the selection of the Coalition Manager. After the contract with the Manager is in place, the Coalition shall supervise the Manager. The agreement of a majority of all Coalition members shall be required for any decision of the Coalition to take effect. Each Coalition member shall have an equal vote in all decisions to be made by the Coalition.

3. Co-permitting. The County and the City mutually agree to jointly implement the current and subsequent MS4 Permit, which may be renewed on a 5 year basis, and shall provide one another with the relevant management plan, storm water information, and other necessary documentation relevant to said MS4 Permit, with applicable forms provided by the Department of Environmental Quality.

4. Services Provided. Each party shall be responsible for each of the following control measures within its own jurisdictional boundaries (i.e., in unincorporated areas for the County, and within the municipal boundaries for the City) but shall not be responsible for the control measures in other jurisdictions, except as noted below. However, upon request, a party may agree to work cooperatively with the other party on a control measure within the other party's jurisdictional boundaries.

    a. Public Education and Outreach. The parties shall work with the Manager of the Golden Spike Stormwater Coalition to provide materials and coordinate educational activities within their jurisdictions, including but not limited to media and public relations, publications and advertisements, and school outreach programs. The Manager shall receive and respond to concerns from all Coalition members and relevant public committee recommendations. Coalition members may do additional public education and outreach at their discretion.

    b. Public Involvement and Participation. The County shall participate actively with the City through the Golden Spike Stormwater Coalition for public involvement and participation for addressing storm water issues.

    c. Illicit Discharge Detection and Elimination. In coordination with the Weber-Morgan Health Department, the County shall provide for this control measure as it relates to mapping and coordinating of discharges occurring in multiple jurisdictions, or otherwise crossing jurisdictional boundaries between the Coalition participants.

    d. Construction Site Runoff Control.

    e. Post Construction Storm Water Management.

    f. Pollution Prevention and Good House Keeping.

5. Annual Fee. The County, through its participation in the Golden Spike Stormwater Coalition, may assess an annual fee to the City and other Coalition participants to reimburse the County for the costs of administering the contract, including the costs of compensation to the entity or firm serving as the Coalition Manager, copy costs, brochure and publication costs, community outreach program costs, etc. This fee will equal the City's share of the total of such costs, with each Coalition member paying an equal share. The City agrees to pay the fee assessed by the County, in a timely manner, upon receiving a written billing notice for the same from the Coalition or County. Each party will establish and maintain its own budget for income and expenses related to this agreement. Each party will be responsible for acquiring, holding, and disposing of all property to be used under this agreement, except as otherwise stated or implied in this agreement.

6. Limitations. Except as outlined by this Agreement or by agreement separate from this, neither party assumes any responsibility to inspect, install, operate or otherwise maintain the other party's storm water system, storm water program, or storm water utility. Further, this

Agreement does not impose on either party any duty regarding storm water management, fees, inspections, or any other types of activity outside the scope of this Agreement.

7. Designated Contacts. The City shall designate its contact with the County for any and all issues which may arise under this Agreement. The County designates the Weber County Engineer as its contact with the City for any and all issues which may arise under this Agreement. The County and the City contacts may also consult with each other from time to time on the status of mutual relations and the terms of this Agreement. To the extent that any administration of this Agreement becomes necessary, then the parties' contacts, or their successors, shall constitute a joint board for such purpose, and each party shall have an equal vote in any decision that needs to be made.

Section Two

General Provisions

1. Term and Renewal. This Agreement shall automatically terminate upon the expiration of the term of the current MS4 permit. If the MS4 permit is renewed or extended, then the parties may renew this Agreement to match the term of the renewed MS4 permit.

2. Termination. This Agreement may be terminated by either party upon ninety (90) days written notice from the Mayor or County Commission provided either to the County Clerk or the City Recorder, as the case may dictate. Upon termination of the Agreement, each party shall retain all property that it has contributed to this joint effort and that remains in the possession of either party, unless the parties negotiate for the transfer of the property to the other party for adequate consideration.

3. Effective Date. This Agreement shall become effective upon compliance with state law governing interlocal cooperation agreements and upon ratification by the parties as provided in U.C.A. Title 11, Chapter 13, Part 2, as amended.

4. Amendment. This Interlocal Agreement may be changed, modified, or amended by written agreement of the participants, upon adoption of appropriate resolutions from the County and the City, along with being approved as to form by the County Attorney and City Attorney, and upon meeting all other applicable requirements of the Interlocal Cooperation Act.

5. Entire Agreement. This Agreement, together with any written amendments, shall constitute the entire agreement between the parties and any prior understanding or representation of any kind preceding the date of this Agreement shall not be binding upon either party except for the resolutions of each party herein attached and incorporated by reference.

6. Indemnification. Each party agrees to indemnify, defend, and save and hold the other party and its respective officers, trustees, agents, employees, and permitted assigns harmless against and in respect of the following:

a. all claims, losses, liabilities, damages, costs, deficiencies, and expenses affecting any persons or property as a result of the indemnifying party's actions;

b. any misrepresentation, material omission, breach of warranty, or non-fulfillment of any covenant or agreement by the indemnifying party, relating to this Agreement; and

c. any and all actions, suits, proceedings, demands, assessments, judgments, costs, legal and accounting fees, and other expenses incident to any of the foregoing.

7. Employee Status. It is understood and agreed by the parties that any and all personnel furnished by the parties shall remain employees of the respective parties and shall abide by the personnel policies of the respective parties.

8. Hired Consultant Status. It is understood and agreed by the parties that any consultant including and not limited to the firm or entity serving as Coalition Manager as engaged by the County to provide management for the Coalition shall not be, and shall not represent themselves as, employees of the respective parties.

9. Warranties. Each party represents and warrants that it is a public agency within the meaning of the Interlocal Cooperation Act, is authorized to execute and deliver this Agreement and there is no litigation, legal action or investigation between the parties that would adversely affect this Agreement.

10. Documents on File. Executed copies of this Agreement shall be placed on file in the office of the County Clerk and the City Recorder and shall remain on file for public inspection for the duration of this Agreement.

11. Governing Law. It is understood and agreed by the parties that this Agreement shall be governed by the laws of the State of Utah as to interpretation and performance.

12. Non-transferable. This rights, duties, powers and obligations of this Agreement may not be transferred, assigned or delegated without the consent of the parties.

13. Rules of Construction and Severability. Standard rules of construction, as well as the context of this agreement, shall be used to determine the meaning of the provisions herein, except as follows: If any of the provisions herein are different from what is normally allowed or required by law, every effort shall be made to construe the clauses to be legally binding and to infer voluntary arrangements which are in addition to what is normally allowed or required by law. If any provision, article, sentence, clause, phrase, or portion of this agreement, including but not limited to any written amendments, is for any reason held to be invalid or unconstitutional by the decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions of this agreement, unless the invalidation of the provision materially alters the agreement by interfering with the purpose of the agreement or by resulting in non-compliance with applicable law. If the invalidation of the provision materially alters the agreement, then the parties shall negotiate in good faith to modify the agreement to match, as

closely as possible, the original intent of the parties. It is thus the intention of the parties that each provision of this agreement shall be deemed independent of all other provisions herein, as long as the overall purpose of the agreement is preserved.

14. Additional Interlocal Cooperation Act provisions. In satisfaction of the requirements of the Interlocal Cooperation Act, the parties agree as follows:

    a. This Agreement shall be authorized and adopted by resolution of the legislative body of each party, pursuant to Section 11-13-202.5.

    b. This Agreement shall be reviewed as to proper form and compliance with applicable law by a duly authorized attorney on behalf of each party, pursuant to Section 11-13-202.5.

    c. A duly executed original counterpart of this Agreement shall be filed immediately with the keeper of records of each party pursuant to Section 11-13-209.

    d. This Agreement shall become effective upon (a) its approval and execution by each party and (b) the filing of an executed copy of this Agreement with the keeper of records of each of the parties.

    e. Immediately after execution of this Agreement by both parties, each party shall cause to be published notice regarding this Agreement pursuant to Section 11-13-219.

    f. The parties agree that they do not, by this Agreement, create an interlocal entity or any separate entity.

Interlocal Agreement Relating To Obligations
Required For a Small MS4 General UPDES Permit No. UTR090000
For
Storm Water Management

DATED this _____ Day of _____, _____

FOR WEBER COUNTY:

_____
(Chair, Weber County Commission)

ATTEST:

_____
County Clerk

APPROVED AS TO FORM AND COMPLIANCE WITH APPLICABLE LAW:

_____
County Attorney

DATED this 3rd Day of January, 2019

FOR the CITY OF HOOPER_____:

_____
Mayor

HOOPER CITY SEAL STATE OF UTAH

ATTEST:

_____
City Clerk

APPROVED AS TO FORM AND COMPLIANCE WITH APPLICABLE LAW:

_____
City Attorney

HOOPER
RESOLUTION NO. R-2019-01

A RESOLUTION APPROVING AN INTERLOCAL AGREEMENT BETWEEN HOOPER CITY AND WEBER COUNTY RELATING TO OBLIGATIONS REQUIRED FOR UPDES GENERAL PERMIT FOR DISCHARGES FROM SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4'S) PERMIT NO. UTR090000

WHEREAS, the Utah Interlocal Cooperation Act, Title 11, Chapter 13, Utah Code Annotated 1953 as amended, permits governmental units to enter into agreements with one another for the purpose of exercising on a joint cooperative basis powers and privileges that will benefit their citizens and make the most efficient use of their resources; and

WHEREAS, Title 11, Chapter 13 of the Utah Code Annotated, 1953 as amended, requires that governing bodies of governmental units adopt resolutions approving an interlocal agreement before such agreements become effective; and

WHEREAS, Weber County and have negotiated an Agreement for the purposes of providing storm water services in accordance with the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1987, and the Utah Water Quality Act, together with federal and state regulation adopted pursuant to such Acts for the City of Hooper;

WHEREAS, Weber County and Hooper City find that mutual benefit and cost effective government can be achieved through this interlocal agreement for services entailed herein;

NOW, THEREFORE, BE IT RESLVED by the Mayor and City Council of Hooper City the attached interlocal agreement is entered with Weber County for the purposes of storm water management as authorized in the Interlocal Agreement, and the Interlocal Agreement is hereby approved and incorporated by this reference. The Hooper City Council hereby authorizes and directs the Mayor to execute the Interlocal Agreement for and on behalf of Hooper.

PASSED AND APPROVED by the Hooper City Council this 3rd day of January, 2019.

Mayor, Hooper

ATTEST:
City Recorder

HOOPER CITY SEAL STATE OF UTAH

2023 W. 1300 N.
Farr West, UT 84404
(801) 782-3580

Board of Trustees
Kevin Ward
Mike Hancock
Boyd Ferrin
Gordon Cutler
Val Heiner
Ryan Hill
Jim Truett
Scott Van Leeuwen
Rob Vanderwood
David Yonan

October 9, 2025

To Whom It May Concern:

Hooper City is a member of the Weber Fire District and, as such, receives all emergency services—including Fire, EMS, and related support—from the District.

Weber Fire District provides hazardous materials (HAZMAT) emergency response at the HAZMAT Technician level. In addition, all district personnel are certified to a minimum of the HAZMAT Operations level, and all Weber Fire District apparatus are equipped to respond to HAZMAT incidents.

In the event of a HAZMAT incident within Hooper City, Weber Fire District personnel will respond and manage the situation. Once the incident is stabilized, the District will coordinate with appropriate governmental agencies and private vendors to ensure the incident is fully resolved and properly mitigated.

If you have any questions or concerns, please feel free to contact me directly.

Sincerely,

Britt Clark
Fire Chief
Weber Fire District
801-850-7873
bclark@weberfiredistrict.gov

2023 W. 1300 N.
Farr West, UT 84404
(801) 782-3580

Board of Trustees
Kevin Ward
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If you have any questions or concerns, please feel free to contact me directly.

Sincerely,

Britt Clark
Fire Chief
Weber Fire District
801-850-7873
bclark@weberfiredistrict.gov

AGREEMENT BETWEEN HOOPER CITY AND
WEBER COUNTY FOR LAW ENFORCEMENT SERVICES

This Agreement is made and entered into pursuant to § 11-13-101, Utah Code Annotated, 1953, as amended, commonly referred to as the Interlocal Cooperation Act, by and between Weber County, a body corporate and politic of the State of Utah, hereinafter referred to as "County", and Hooper City, a municipal corporation of the State of Utah, hereinafter referred to as "City".

WITNESSETH

WHEREAS, City wants a safe and secure environment for its citizens, businesses and all others within the City boundaries; and

WHEREAS, City desires to make the most cost effective use of tax dollars to provide law enforcement services; and

WHEREAS, City feels that the Weber County Sheriff will provide excellent, cost effective law enforcement services within the City boundaries; and

WHEREAS, the Weber County Sheriff's Office is able and willing to provide the law enforcement services needed by City; and

WHEREAS, City and County have determined that it is mutually advantageous to enter into this Agreement for the Weber County Sheriff's Office to provide law enforcement services in the City; and

WHEREAS, it is agreed that the services provided will be paid for by City as hereinafter set forth and the respective entities have determined and agree that the amount set forth herein is reasonable, fair and adequate compensation for providing the described law enforcement services;

NOW THEREFORE, pursuant to the Utah Interlocal Cooperation Act the parties hereby agree as follows:

SECTION ONE
AGREEMENT

1.01 The County, through the Weber County Sheriff's Office agrees to furnish law enforcement services and to enforce State laws and City ordinances within the corporate limits of City, to the extent and in the manner hereinafter set forth.

1.02 This Agreement terminates and supersedes any existing law enforcement service agreement, whether oral or written, between the parties.

1.03 The concepts set forth in the above recitals are recognized and incorporated as an integral part of this Agreement.

SECTION TWO
AGREEMENT

2.01 The Weber County Sheriff's Office will furnish all necessary equipment and personnel for the investigation and enforcement of State laws and City ordinances, and will conduct traffic enforcement, felony and misdemeanor investigations, follow-up investigations, as well as any other services in the field of public safety that are within the legal power and ability of the Sheriff to provide.

2.02 The personnel and equipment furnished by the Sheriff will provide an active field force on duty on behalf of the City, providing direct services 24 hours per day, 365 days per year.

2.03 The County will designate a deputy and/or an appropriate supervisor as the liaison to the City for the purpose of coordinating the activities of the Sheriff's Office, attending staff and City Council meetings as reasonably requested, and to oversee the delivery of police services under this Agreement.

2.04 The City may request additional services or personnel not otherwise provided for in this Scope of Services Section. Sheriff will review the need /request with City to determine whether such additional service is feasible and will determine the cost of providing the service to City. If both City and Sheriff agree on the service and the cost, the parties shall execute a written amendment to this Agreement containing the additional services and costs agreed upon.

2.05 The Sheriff's Office will provide and participate in crime prevention programs, including programs to prevent crime in both residential and business areas.

SECTION THREE
SPECIAL EVENTS

3.01 The Sheriff will respond, to reasonable requests, to special law enforcement situations that may arise from time-to-time within the City for traffic enforcement of special events, celebrations or parades, protection from vandalism and such other special law enforcement assistance or community policing.

SECTION FOUR
EQUIPMENT AND OTHER FACILITIES

4.01 The County will furnish all necessary labor, supervision, equipment, communications facilities, uniforms, badges, firearms and other items of equipment reasonably necessary to provide the services described herein.

SECTION FIVE
AUTHORITY AND EMPLOYMENT STATUS

5.01 For purposes of liability, County officers or employees shall not be deemed to be City officers or employees except as more fully specified in this Agreement. All law enforcement officers employed by the County to perform duties under the terms of this Agreement shall be County employees, and shall have no right to any City pension, civil service, or any other City benefit for services provided hereunder. The County will have full supervision authority over all persons employed to carry out the requirements of this Agreement.

SECTION SIX
INDEMNIFICATION BY THE CITY

6.01 The City shall be responsible for all damages to persons or property that occur as a result of the negligence or fault of the City in connection with the performance of this Agreement. The City shall also defend and indemnify the County for all claims and expenses that arise out of the enforcement of a City Ordinance that is deemed to be unlawful or unconstitutional.

SECTION SEVEN
INDEMNIFICATION BY COUNTY

7.01 The County shall be responsible for all damages to persons or property that occur as a result of the negligence or fault of the County in connection with the performance of this Agreement. The County shall indemnify and hold the City free and harmless from all claims that arise as a result of the negligence or fault of the County, its officers, agents and employees. In the event that the City or any of its officers or employees are named as co-defendants with the County or any of its offices or employees in any civil action based upon the delivery of services under the terms of this Agreement, the County agrees to undertake the defense of the City or any of its officers or employees so named under a reservation of rights agreement until such time as they have been successfully dismissed from the action or it has been determined by the County that a conflict of interest exists, at which time City will be notified of its duty to independently undertake and pay for the defense of the City or its officer or employee named as a co-defendants in such civil actions.

SECTION EIGHT
RESPONSIBILITY FOR SALARY AND BENEFITS

8.01 The City shall not assume any liability for the payment of any salaries, wages, employment benefits or other compensation to any County personnel performing services hereunder for the City and will not assume any other employment related liability accept as provided for in this Agreement.

8.02 The City shall not be liable for compensation or indemnity to any County employee for injury or sickness arising out of his employment, unless otherwise provided herein, and the County hereby agrees to hold the City harmless against any such claim.

SECTION NINE
PERIOD OF AGREEMENT

9.01 Unless sooner terminated as provided for herein, this Agreement shall be effective 12:01 a.m., July 1, 2022 and shall run for a sixty (60) month period until 12 midnight June 30, 2027. The Sheriff shall be the administrator of this Agreement.

9.02 In the event the City desires to extend this Agreement for a succeeding five (5) year period, the City Council, by March 31st of the year of the expiration date of this Agreement, shall notify the Board of County Commissioners that it wishes to renew the agreement, whereupon the Board of County Commissioners, not later than April 15th, shall notify the City Council in writing of its determination concerning the renewal for an additional five (5) year period together with any readjusted rates for the new extended agreement and a new agreement shall be executed. If these notifications are not made, this agreement shall terminate at the end of the five (5) year period.

9.03 Notwithstanding the provisions of this Section, either party may terminate this Agreement at any time by giving 180 days prior written notice to the other party.

SECTION TEN
COST OR PAYMENT

10.01 The City agrees to pay to the County the amount set forth in Attachment A, which is attached hereto and incorporated herein by reference, for the services provided pursuant to this agreement. The amount listed on Attachment A includes, but is not limited to: salary, benefits, uniform costs, training, overtime, supervision, supplies, communications equipment, fleet/motor pool expenses, system services, insurance, crime scene investigations, equipment, and associated administrative/support staff costs. The contract cities pay the costs of the enforcement positions that are not covered by the general fund. The amount that each city pays is determined using a population and calls for service formula (See Attachment A). Costs are determined annually. The costs for the next fiscal year (July – June) will be calculated and sent to the contract Cities no later than January 15th prior to the new fiscal year. An annual adjustment will be deducted from the amount billed to the City for any State Beer Tax Funds collected by the County on behalf of the City.

10.02 The City shall remit one quarter (1/4) of the contract amount to the Weber County Sheriff's Office, 721 West 12th Street, Ogden, UT 84404, within 20 days after the close of each calendar quarter. If such payment is not remitted to the County Sheriff when due, County is entitled to recover interest thereon as well as the contract amount. Interest shall be at the rate of twelve percent (12%) per annum.

10.03 The rates set forth in Attachment A may be renegotiated, at the request of either party prior to July 1st of each year of this Agreement, to reflect the current cost of the provided services in accordance with the policies and procedures for the determination of such rate as adopted by the Board of County Commissioners and agreed to by City.

10.04 The compensation paid by the City to the County pursuant to this Agreement shall be used only for the services provided pursuant to this Agreement, and County shall not have the authority or right to use such funds for other purposes. Further, the County agrees not to offset the Sheriff's present or future budget because of the compensation paid pursuant to this Agreement.

SECTION ELEVEN
REPORTS AND RECORDS

11.01 Records will be maintained of all law enforcement activity and services in the city and the records will be accessible to the City at all reasonable times. The Sheriff's Office will prepare an annual report of law enforcement efforts in the City and will review the report with the City Council each year at one of the Council's regular meetings.

11.02 The Sheriff's Office will coordinate with the City to provide an activity report that details the activities of the Sheriff's Office in the City. The report shall contain, at a minimum, the number of calls answered and the number of traffic stops made. Additional details may be provided, as requested by the City, as long as that information is reasonably obtainable and does not violate law or Sheriff's Office policy. The report will be generated and provided monthly. However, that frequency may be modified if agreed to by the City and the Sheriff's Office.

SECTION TWELVE
PROBLEM RESOLUTION

12.01 The City's Mayor, City Council or other designated representatives, shall have the right upon request to meet and confer with the Sheriff, and/or his designated contract representatives, to discuss any problems arising from the Sheriff's Office performance or the individual deputies performing services under this Agreement, the costs for future periods under this contract, or any other issues related to this contract.

IN WITNESS WHEREOF HOOPER CITY, BY RESOLUTION DULY ADOPTED BY ITS City Council, causes this Agreement to be signed by its Mayor and attested by its Clerk, and the County of Weber, by resolution of its Board of County Commissioners, has caused this Agreement to be signed by the Chairman of said Board and attested by its Clerk, all on the day and year appearing below their respective signatures.

HOOPER CITY

By _____
Mayor

Date: 6-10-2022

ATTEST:

HOOPER CITY SEAL STATE OF UTAH

_____
City Recorder

Approved as to form and for compliance with State law:

_____
City Attorney

BOARD OF COUNTY COMMISSIONERS OF WEBER COUNTY

By _____
Scott Jenkins, Chair

Date 7/19/2022

ATTEST:

_____
Weber County Clerk/Auditor

Approved as to form and for compliance with State law:

_____
Weber County Attorney's Office

2022-2023 Contract Cities Allocation Calculation

Attachment A

Total Cost	$ 11,726,385	
General Fund	39%	31 from general fund/80 total
Contract City Cost Burc	$ 7,182,411	
# Deputies	80	
Avg. Adjusted FTE Cost	$ 146,580	

	Population %	Calls/Svc %	Tax Val %	US Census 2020 Population	019-202 Calls/Svc	Year End 2020 Taxable Value
Farr West	11.03%	9.08%	9.29%	7,691	3,018	$ 693,944,446
Hooper	13.03%	7.38%	8.23%	9,087	2,452	$ 614,724,215
Huntsville	0.93%	1.31%	1.13%	648	434	$ 84,297,118
MSL	3.06%	7.16%	4.41%	2,135	2,382	$ 329,135,821
Plain City	11.23%	6.23%	7.42%	7,833	2,070	$ 554,025,872
Uintah	1.96%	2.53%	1.55%	1,367	842	$ 115,740,914
Washington Terrace	13.29%	17.77%	7.39%	9,267	5,908	$ 552,321,017
West Haven	24.01%	25.18%	18.27%	16,739	8,373	$ 1,365,062,423
Unincorporated	21.46%	23.36%	42.31%	14,963	7,767	$ 3,160,568,896
	100.00%	100.00%	100.00%	69,730	33,246	$ 7,469,820,722

2022/23 Formula		
Population	Calls/Svc	Other
40%	60%	0%
$ 316,879	$ 391,202	$ -
$ 374,396	$ 317,836	$ -
$ 26,698	$ 56,256	$ -
$ 87,965	$ 308,762	$ -
$ 322,730	$ 268,320	$ -
$ 56,322	$ 109,143	$ -
$ 381,812	$ 765,813	$ -
$ 689,668	$1,085,333	$ -
$ 616,495	$1,006,782	$ -
$2,872,964	$4,309,446	$ -

	2022/23 Cost	2021/22 Cost	% Change	$ Change	2022/23 Cost/Resident	2022/23 Cost per Call
Farr West	$ 708,081	$ 651,132	8.75%	$ 56,949	$ 92.07	$ 234.62
Hooper	$ 692,232	$ 651,825	6.20%	$ 40,406	$ 76.18	$ 282.31
Huntsville	$ 82,955	$ 77,272	7.35%	$ 5,683	$ 128.02	$ 191.14
MSL	$ 396,727	$ 360,767	9.97%	$ 35,960	$ 185.82	$ 166.55
Plain City	$ 591,049	$ 548,048	7.85%	$ 43,001	$ 75.46	$ 285.53
Uintah	$ 165,465	$ 154,101	7.37%	$ 11,364	$ 121.04	$ 196.51
Washington Terrace	$ 1,147,625	$1,071,704	7.08%	$ 75,921	$ 123.84	$ 194.25
West Haven	$ 1,775,001	$1,635,833	8.51%	$ 139,169	$ 106.04	$ 211.99
Unincorporated	$ 1,623,276	$1,521,253	6.71%	$ 102,024	$ 108.49	$ 209.00
	$ 7,182,411	$6,671,934	7.65%	$ 510,476.64		

7.22% of the 7.65% increase is payroll increase

Quarterly	2022/23 Cost
Farr West	$177,020
Hooper	$173,058
Huntsville	$20,739
MSL	$99,182
Plain City	$147,762
Uintah	$41,366
Washington Terrace	$286,906
West Haven	$443,750
Unincorporated	$405,819
	$1,795,603

Hooper City Inc.
5580 West 4600 South
Hooper, UT 84315
Phone: (801) 732-1064 Fax: (801) 732-0598
Email: hoopercity@hotmail.com Website: hoopercity.com

Street Sweeping Services AGREEMENT
Between Hooper City and the Sweep N Utah

This Agreement is made between **Hooper City ("City")** and the **Sweep N Utah("Contractor")** for the purpose of establishing procedures to provide street sweeping for Hooper City. Not include is any agreement regarding the cost, fees, or compensation for services.

1. **Scope of Services**
   Contractor shall provide street sweeping using a modern mechanical or vacuum street sweeper to thoroughly sweep the gutter on city streets as requested from the City. Each street shall be swept clean to the adjacent property line. Swept clean shall mean minimal debris residual or trailings left on the swept surface following the completion of a pass of the street sweeping machine.
2. **Notification**
   Hooper City may request services from the Contractor on an as-needed basis, as determined by the Public Works Director. The Contractor shall perform such services as its schedule reasonably permits.
3. **Responsibilities** Contractor shall dispose of all debris in a legal manner, as required in the current MS4 Permit, which shall include, but is not limited to the following:
   - All deposits within the intersection shall be removed as part of the sweeping operations.
   - All dust suppression systems shall be as mandated by the State of Utah.
   - No sweeper shall blow debris onto private property.
   - Materials removed shall be dewatered in a contained area and discharged to the local sanitary sewer, where feasible. The solid material will need to be stored and disposed of properly to avoid discharge during a storm event.
   - Solid materials shall be stored and disposed of in accordance with federal, state, and local laws.
   - Contractor shall comply with all Utah Pollutant Discharge Elimination System (UPDES) requirements, applicable State, Federal, County, and/or City Ordinances dealing with sweeping of streets, water quality, air quality, and hazardous waste and rubbish disposal.
4. **Term and Termination**
   This Agreement shall remain in effect until modified or terminated in writing by mutual consent of both parties.

Authorized Representatives:

Hooper City
By: Aaron Mackliet
Name: Aaron Mackliet
Title: Stormwater Coordinator
Date: July 21, 2026

Sweep N Utah
By:
Name: Lance King
Title: President
Date: 1-27-26