Fairbanks North Star Borough
Department of Public Works



Storm Water
BMP Design Guide



February 2020

Preface

This guide provides an overview of the storm water management design and construction requirements for new development and redevelopment projects regulated by the Fairbanks North Star Borough (FNSB). It is one part of a collaborative effort by the City of Fairbanks, City of North Pole, and FNSB to educate developers, engineers, contractors, and the general public on local storm water pollution control laws. Included in this guide is a brief overview of the FNSB storm water management program, project review requirements, general design considerations, and effective best management practices for the Fairbanks Urbanized Area. The City of Fairbanks and City of North Pole have a separate, but similar, design guide for their jurisdictions.

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Acronyms & Abbreviations

ADEC	Alaska Department of Environmental Conservation
ADOT&PF	Alaska Department of Transportation & Public Facilities
BMP	Best Management Practice
FNSB	Fairbanks North Star Borough
IDF	Intensity-Duration-Frequency
MS4	Municipal Separate Storm Sewer System
PSWCP	Permanent Storm Water Control Plan
RSA	Road Service Area
SWPPP	Storm Water Pollution Prevention Plan
TMDL	Total Maximum Daily Load
UAF	University of Alaska Fairbanks

1. Storm Water Management Program Overview

Storm water runoff is generated when water from rain and melting snow flows over land instead of infiltrating into the ground. As runoff travels over developed land such as lawns, driveways, streets, parking lots, building rooftops, and other constructed improvements, it accumulates pollutants. Such pollutants can include sediment, oil and grease, solvents, detergents, heavy metals, litter/debris, pesticides, fertilizers, nutrients, and pathogens. Local storm water conveyance systems, known as Municipal Separate Storm Sewer Systems (MS4s), concentrate runoff into storm drain pipes, ditches, and other conduits. When this concentrated flow leaves the MS4, it empties into local water bodies carrying the pollutant load with it. The results can significantly alter our natural environment by contaminating drinking water supplies, making recreational areas unsafe and unpleasant, harming fish and wildlife populations, and killing native vegetation.

Federal and State regulations based on the Clean Water Act require communities that reach certain population density levels to develop, implement, and enforce storm water management programs that will reduce the discharge of pollutants from the MS4 and protect water quality. These regulations are triggered when a community receives an urbanized area designation by the U.S. Census Bureau. By definition, an urbanized area is a land area comprised of an urban district and the adjacent densely settled surrounding area, known as the urban fringe, that together have a residential population of at least 50,000 people and an overall population density of at least 1,000 people per square mile. The U.S. Census Bureau determines urbanized areas based on census data and then maps the areas based on both visible physical boundaries such as roads or streams, and invisible administrative boundaries such as political corporate limits or subdivisions.

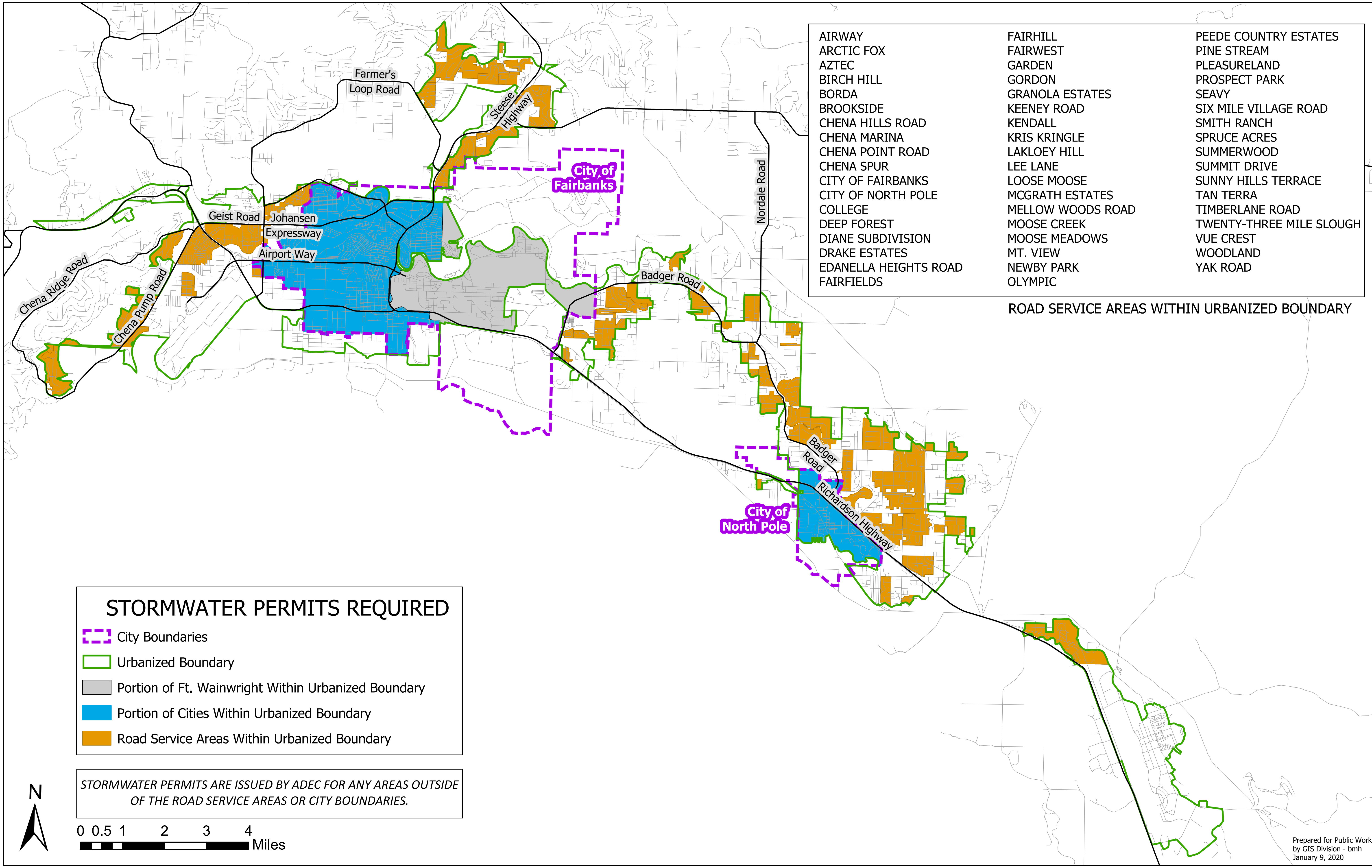
1.1 Fairbanks Urbanized Area

The U.S. Census Bureau designated the Fairbanks Urbanized Area in May 2002. After the 2010 Census, the Fairbanks Urbanized Area was expanded to include newly populated areas. It includes portions of the City of Fairbanks, City of North Pole, and 51 FNSB Road Service Areas (RSAs). An overview map of the urbanized area is included as Figure 1. To meet Federal and State storm water management mandates, FNSB adopted ordinances to regulate the design and construction of large new development and redevelopment projects within the urbanized area boundary when the projects impact the MS4. The MS4 is defined as the storm drain pipes, ditches, and other conveyances located within RSAs. Projects within the urbanized area boundary that do not impact the MS4 and projects that are outside of the urbanized area boundary are not regulated under FNSB's adopted ordinances. The adopted ordinances are contained in FNSB Code of Ordinances Title 13 and should be reviewed prior to the design or construction of a regulated project.

1.2 Comprehensive MS4 Map

In addition to the adoption of the aforementioned ordinances, the City of Fairbanks, City of North Pole, and FNSB, working collectively with the Alaska Department of Transportation & Public Facilities (ADOT&PF) and the University of Alaska Fairbanks (UAF), developed an area wide MS4 map. The map is GIS-based and includes the location of MS4 components for each entity including catch basins, manholes, storm drain pipe, ditches, culverts, and outfalls, as well as the locations of water bodies that will receive the storm water

discharges from the outfalls. The FNSB GIS has developed a link to the map on the Fairbanks Urbanized Area Storm Water Management webpage at:
https://gis.fnsb.us/portalarcgis/apps/webappviewer/index.html?id=9a73f3f15edd49cd86305ae23476aa36.
The map may be used by interested parties to identify the location of MS4 components near their project sites. All MS4 component information shown on the map must be field verified prior to design.


Farmer's
Loop Road
Steese
Highway
City of
Fairbanks
Nordale Road
Geist Road
Johansen
Expressway
Airport Way
Chena Ridge Road
Chena Pump Road
Badger Road
Badger
Road
Richardson Highway
City of
North Pole
AIRWAY
ARCTIC FOX
AZTEC
BIRCH HILL
BORDA
BROOKSIDE
CHENA HILLS ROAD
CHENA MARINA
CHENA POINT ROAD
CHENA SPUR
CITY OF FAIRBANKS
CITY OF NORTH POLE
COLLEGE
DEEP FOREST
DIANE SUBDIVISION
DRAKE ESTATES
EDANELLA HEIGHTS ROAD
FAIRFIELDS
FAIRHILL
FAIRWEST
GARDEN
GORDON
GRANOLA ESTATES
KEENEY ROAD
KENDALL
KRIS KRINGLE
LAKLOEY HILL
LEE LANE
LOOSE MOOSE
MCGRATH ESTATES
MELLOW WOODS ROAD
MOOSE CREEK
MOOSE MEADOWS
MT. VIEW
NEWBY PARK
OLYMPIC
PEEDE COUNTRY ESTATES
PINE STREAM
PLEASURELAND
PROSPECT PARK
SEAVY
SIX MILE VILLAGE ROAD
SMITH RANCH
SPRUCE ACRES
SUMMERWOOD
SUMMIT DRIVE
SUNNY HILLS TERRACE
TAN TERRA
TIMBERLANE ROAD
TWENTY-THREE MILE SLOUGH
VUE CREST
WOODLAND
YAK ROAD
ROAD SERVICE AREAS WITHIN URBANIZED BOUNDARY
STORMWATER PERMITS REQUIRED
City Boundaries
Urbanized Boundary
Portion of Ft. Wainwright Within Urbanized Boundary
Portion of Cities Within Urbanized Boundary
Road Service Areas Within Urbanized Boundary
STORMWATER PERMITS ARE ISSUED BY ADEC FOR ANY AREAS OUTSIDE OF THE ROAD SERVICE AREAS OR CITY BOUNDARIES.
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0 0.5 1 2 3 4
Miles
Prepared for Public Works
by GIS Division - bmh
January 9, 2020

2. Review Requirements

New development and redevelopment projects that, when constructed, will result in a ground disturbance of greater than or equal to one acre, or result in a ground disturbance less than one acre but will be part of a larger common plan of development or sale that will collectively disturb more than one acre; and, impact the MS4 must have permanent and temporary storm water best management practices (BMPs) approved prior to construction.

The use of both permanent and temporary best management practices (BMPs) are required for new development and redevelopment projects to eliminate or reduce pollutant discharges to storm water, storm water conveyance systems, and/or receiving waters to the maximum extent practicable. The two types of BMPs are incorporated into different phases of the project, and require separate project submittals. Permanent BMPs are incorporated into the project design and expected to be maintained for the life of the new or redeveloped facility, while temporary BMPs are utilized only during the construction phase of the project. An example of a permanent BMP would be a grass swale designed and constructed along the down-slope edge of a parking lot to filter accumulated pollutants in runoff from the parking lot. An example of a temporary BMP would be silt fence installed along the perimeter of the construction site when soils are exposed, which would later be removed when the soils have been stabilized.

The approval process is administered through the FNSB Department of Public Works (Department) and consists of the acceptance of a Permanent Storm Water Control Plan (PSWCP) and approval of a Site Development Permit. Upon completion of construction, each Site Development Permit must be closed and certified as-built plans of the permanent storm water BMPs must be submitted along with a maintenance agreement, which will be recorded with the State of Alaska. Within ten business days after receiving all pertinent data, the Department will accept, accept with conditions, or deny a PSWCP and approve, approve with conditions, or deny a Site Development Permit based on conformance with the provisions of Title 13. The Department may inspect project sites as necessary to complete review of a PSWCP or maintenance agreement. All permitted construction sites will be inspected at least once per year. No person or entity shall occupy, utilize, or operate a constructed facility or site until the Site Development Permit is closed, certified as-built plans are submitted, and a maintenance agreement is recorded. A copy of the latest review and inspection fee schedule is available through the FNSB permits webpage.

2.1 Permanent Storm Water Control Plan Submittals

PSWCP submittals may be forwarded to the Department by cover letter from the project site owner. Each submittal shall contain the following information:

A. Cover Letter

B. PSWCP developed by a Certified Professional in Erosion and Sediment Control or a Professional Engineer registered in the State of Alaska containing the following items:

   i. BMP Selection Narrative

a. Site Description: Provide a description of the property boundary, construction site boundary (area of disturbance), existing soil types, and approximate depth to groundwater.
b. Site Conditions: Include a summary of pre- and post-developed site conditions including existing and proposed land use, amount of impervious area, drainage patterns to and from the site, existing and expected storm water runoff quantities, and any known historical drainage problems such as flooding and/or erosion.
c. Receiving Waters: Identify the point of discharge to the MS4 and the receiving water to which the MS4 outfalls. Also include the name and approximate distance (to the nearest 100 feet) of all other receiving waters, including wetlands as defined by the U.S. Army Corps of Engineers, where storm water will discharge.
d. Pollutant Sources: Include a description of all potential pollutant sources from the proposed land use, which may add pollutants to storm water discharges.
e. BMP Selection: Identify all permanent structural and non-structural BMPs selected and incorporated into the project design to eliminate or reduce pollutant discharges to storm water, storm water conveyance systems, and/or receiving waters to the maximum extent practicable.
f. Operation & Maintenance Procedures: Include a description of all operation and maintenance procedures for each BMP to be installed on site including snow storage provisions.

ii. Site Plan

a. Site Characteristics: Include the property boundary, construction site boundary, names of all adjacent streets or roadways, north arrow, and scale bar.
b. Development Plan: Include the location of all planned excavation and fill activities, existing and proposed buildings, surfaced areas, and utility installations.
c. Drainage Patterns: Include approximate slopes (to the nearest percent) and direction of slopes (i.e. flow direction arrows) for both pre- and post-development for all surfaces, ditches, and culverts.
d. Receiving Waters: Identify the point of discharge to the MS4. Also identify all other surface waters and wetlands within one mile of the construction site, including the location where storm water will discharge to the receiving waters.
e. Permanent Storm Water Controls: Identify the location of all permanent structural BMPs to be installed on site, as well as all areas where non-structural BMPs will be implemented.

iii. Sizing & Design Information

a. Include calculations, manufacturers' guidance, or other process decisions showing how all permanent structural BMPs were sized and designed, and their performance goals. See Table 5 on page 13.

C. A signed statement that the owner of the site will operate, maintain, and/or schedule all permanent BMP(s) in accordance with the PSWCP.
D. Payment of the PSWCP Plan Review Fee.

2.2 Site Development Permit Application

A Site Development Permit application may be forwarded to the Department from the project site owner or construction contractor. Application forms are available through the FNSB permits webpage and must be accompanied by the following items:

A. Copy of the Storm Water Pollution Prevention Plan (SWPPP) developed by a Certified Professional in Erosion and Sediment Control or a Professional Engineer registered in the State of Alaska and conforming to the most recently issued Alaska Department of Environmental Conservation (ADEC) Construction General Permit, the most recently issued Alaska Storm Water Guide and ADOT&PF Alaska SWPPP Guide, and any additional construction site storm water runoff standards adopted by FNSB, as appropriate.

B. Copy of the Notice of Intent submitted to the ADEC.

C. Payment of the SWPPP Plan Review Fee.

D. Payment of the Construction Site Inspection Fee.

For more information contact:

Storm Water Engineer
FNSB, Department of Public Works
P.O. Box 71267, Fairbanks, Alaska 99707
Phone: (907) 459-1345

3. General Design Considerations

Storm water BMPs must be designed and implemented based on the unique characteristics of the urbanized area. Geology, climate, precipitation intensities, and existing pollutant loads and distributions all factor into how much storm water can be expected and how the storm water can be managed.

3.1 Geology

The urbanized area lies on the northern edge of the Tanana River Valley in the interior of the state. The valley is bounded by the White Mountains to the north and the Alaska Range to the south with gently sloping alluvial fans between the hills and floodplains. The uplands in the immediate vicinity of the urbanized area are comprised of rounded ridges and hills consisting of weathered bedrock covered by varying depths of windblown silt. The lowlands are generally level floodplains and low benches consisting of sand and gravel deposits covered by varying depths of silts and peat. Meandering streams with sloughs and oxbow lakes are abundant. In general, vegetation is dominated by black spruce and sphagnum moss in the poorly drained lowlands and higher north facing slopes, and white spruce with paper birch and aspen in the better drained uplands and south facing slopes.

Discontinuous permafrost is present in the lowlands and on the higher north facing slopes. This permafrost is often found to be at or near 32 ºF and thus susceptible to melting when ground cover is disturbed by fire or human activity. The active layer varies from two feet or less in areas with undisturbed vegetated cover to in excess of 10 feet under roads or parking areas that are kept free of snow during winter. Groundwater levels are also prone to fluctuations with groundwater in the lowlands generally observed at depths between five and 20 feet below the ground surface. These levels are highly influenced by the Tanana and Chena Rivers and can vary from two to five feet throughout the year. Levels are highest in the late spring and early summer and drop throughout the late fall and winter with the lowest levels reached just before the spring melt.

3.2 Climate

The region has a continental subarctic climate with the warmest summers in the state, as well as the lowest record winter temperatures with extremes ranging from above 90 ºF to below -60 ºF. Mean annual temperatures average slightly below freezing, with a mean summer (June through August) temperature of approximately 59 ºF and a mean winter (November through March) temperature of approximately -1 ºF. Wintertime temperatures are strongly controlled by ground-based inversions, and as such may vary widely over short distances and in response to human modification of the local environment. The average annual precipitation is slightly above 10 inches with July and August on average the wettest months and April the driest. Snow covers the ground continuously from mid-October to late April with an average annual snowfall of approximately 68 inches and a mean monthly snow depth of approximately 14 inches.

3.3 Precipitation Data

Rainfall intensity-duration-frequency (IDF) curves for the Fairbanks area were developed as part of a storm water management study conducted by UAF in 2002. The IDF curves are presented in tabular form below for use in designing storm water BMPs in the Fairbanks Urbanized Area. Note that a second study conducted by UAF in 2003 contained possible calculation errors producing intensities for small duration storms much larger than field observations support. Use of the 2003 study is discouraged without further clarification from the study's authors.

Table 1. Selected Rainfall Intensity Data (inches per hour) for Fairbanks

Duration (hours)	Return Period (years) 1.5	2	5	10	25	50
0.083 (5 min)	0.91	1.00	1.38	1.90	2.74	2.98
0.167 (10 min)	0.70	0.77	1.06	1.46	2.11	2.29
0.25 (15 min)	0.59	0.65	0.89	1.23	1.78	1.93
0.50 (30 min)	0.41	0.45	0.62	0.86	1.23	1.34
1	0.26	0.28	0.40	0.52	0.72	0.81
2	0.17	0.19	0.26	0.32	0.43	0.52
3	0.13	0.15	0.20	0.24	0.32	0.41
6	0.09	0.10	0.13	0.15	0.19	0.26
12	0.06	0.06	0.08	0.09	0.11	0.17
18	0.04	0.05	0.06	0.07	0.09	0.13
24	0.04	0.04	0.05	0.06	0.07	0.11

3.4 Receiving Waters & Pollutants of Concern

The primary receiving waters within the urbanized area are the Chena River, Chena Slough, and Noyes Slough. Although any water body impacted by storm water from a new development or redevelopment project must be considered in the design and implementation of BMPs, these primary receiving waters are identified as impaired on ADEC's 303(d) list and, therefore, require added attention. The State of Alaska's Final 2008 Integrated Water Quality Monitoring and Assessment Report identifies the pollutants of concern for the Chena River and Chena Slough as sediment from urban runoff, and for Noyes Slough as petroleum products, sediment, and debris from urban runoff. The State of Alaska's Final 2010 Integrated Water Quality Monitoring and Assessment Report can be found at http://dec.alaska.gov/water/water-quality/integrated-report/.

To date, the only Total Maximum Daily Load (TMDL) established for any of these identified pollutants is a TMDL of zero for debris on Noyes Slough. This TMDL document can be viewed from ADEC's TMDL webpage at http://dec.alaska.gov/water/water-quality/impaired-waters/.

Developers must ensure the project design and construction site controls adhere to all approved TMDLs, as well as identify other potential pollutants of concern for the design so appropriate BMPs are selected to address those pollutants. The type and amount of pollutants generated in storm water is often determined by the type of land use. Some examples of pollutants of concern for various land uses in the Fairbanks area are provided in Table 2 below.

Table 2. Pollutants of Concern for Various Land Uses

Category	Sediment	Oil & Grease	Solvents & Detergents	Heavy Metals	Litter & Debris	Pesticides & Fertilizers	Nutrients	Pathogens
Residential Development	X	X	X		X	X	X	X
Commercial Development	X	X	X		X	X	X	X
Car Wash Facilities	X	X	X	X	X			
Gas Stations/ Automotive Repair Shops	X	X	X	X	X			
Restaurants			X		X		X	X
Hotels/ Motels			X		X	X		
Shopping Centers	X	X			X			
Streets and Highways	X	X		X	X			

3.5 Snow Disposal Sites

Snow removed from roads and parking lots contains various pollutants including sand, litter, animal waste, and automotive fluids. Finding a place to dispose of this collected snow can be difficult as the pollutants are easily transported with melt water runoff. ADEC has developed a guide for the selection, preparation, and maintenance of snow disposal facilities. The guide is available on the ADEC storm water webpage at http://dec.alaska.gov/water/wnpspc/stormwater/Resources.htm and should be used for all new development or redevelopment projects regulated by FNSB that include a constructed snow disposal facility. Note that normal snow storage areas located on the same property where the snow fell are not considered to be constructed snow disposal facilities.

3.6 Septic Systems

Conventional on-site wastewater disposal systems, or septic systems, are widely used in the urbanized area. Proper installation and care of these systems by home-owners and contractors is an essential part of keeping associated pollutants out of storm water. ADEC has developed various training programs and manuals on installation and maintenance. These publications are available on the ADEC on-site disposal systems webpage at http://dec.alaska.gov/water/wastewater/engineering/ and should be used for all new development or redevelopment projects regulated by FNSB that include installation of a septic system.

3.7 Parking Lots

Parking lots can collect sediment, oil, grease, litter, debris, pesticides, and/or fertilizers, which are often released in large concentrations during spring breakup and summer rain events. In order to protect water quality, permanent storm water treatment BMPs must be included in the PSWCP for parking areas that serve commercial developments or multi-family residential lots. In addition to the treatment BMPs, parking lot maintenance practices, such as sweeping, must be addressed.

4 Effective Best Management Practices for Fairbanks

BMPs are the methods or system of methods that developers, operators, or consumers use to control the adverse water quality impacts associated with storm water runoff. BMPs can include the prohibition of certain practices, the use of scheduling and phasing techniques, the development of permanent physical controls, or the establishment of operation and maintenance procedures. BMP selection is based on project type and local environment. As noted in Section 3, the urbanized area has unique cold climate characteristics. Specific challenges that must be considered in cold climates include, but are not limited to, the susceptibility of pipes to freezing due to deep winter frost penetration, ice formation on ponded water surfaces, reduction in biological activity due to cooler year-round temperatures, shorter growing seasons, permafrost, frost heaves, and high pollutant loads contained in the spring melt runoff volumes. This chapter lists recommended non-structural and structural BMPs for use in the urbanized area, outlines general BMP performance goals for the urbanized area, and identifies pertinent resources that should be used in the BMP selection process.

4.1 Non-structural Best Management Practices

Non-structural BMPs are management practices that can be implemented without constructing physical improvements. They are designed to prevent or limit the entry of pollutants into storm water runoff and are typically less costly than structural BMPs.

Table 3. Examples of Non-structural BMPs

Type	Examples
Project Design	Preserve natural vegetation
	Utilize buffer zones
	Design improvements with existing topography in mind
	Limit encroachments in natural drainage paths
	Cluster Development
Good Housekeeping	Routinely clean catch basins
	Routinely sweep streets and parking lots
	Place snow storage facilities away from lowlands and water bodies
	Select a proper location and use proper materials for vehicle/equipment washing
	Prepare spill prevention and control plans for liquid storage and handling
	Dispose of trash and debris appropriately
Construction Scheduling or Phasing	Schedule activities to minimize soil exposure during high precipitation periods
	Phase clearing and grading activities to minimize extent of soil exposure

4.2 Structural Best Management Practices

Structural BMPs are physical improvements. They are designed to either reduce the amount of pollutants that accumulate in storm water runoff by reducing the amount of runoff itself or by providing mechanisms to remove and/or treat the pollutants.

Table 4. Examples of Structural BMPs

Type	Examples
Erosion Control or Stabilization	Mark clearing limits
	Surface roughening and terracing
	Mulching
	Temporary seeding or sodding
	Use of manufactured rolled products (nets, blankets, etc.)
Sediment Control	Temporary sediment trap
	Silt fence
	Inlet protection (sandbag filters, catch basin inserts, etc.)
	Brush barriers
	Wattles
	Vehicle tracking entrance/exit
Velocity Control	Slope drains
	Rock flumes
	Outlet protection
	Diffusers
	Storm water conveyance channels
	Rock check dams
Treatment Practices	Bioretention
	Infiltration
	Filtering practices
	Dry ponds
	Grass channels
	Filter strips

4.3 Performance Goals

Temporary BMPs are those utilized during the construction phase of a project. They focus on erosion and sediment control with the goal being to limit erosion and stop sediment from leaving a construction site to the maximum extent practicable. Permanent BMPs are those expected to stay in place for the life of the new or redeveloped facility. They focus on runoff volume and quality control with the goal being to limit and treat post-development runoff to the maximum extent practicable. Table 5 identifies the parameters that should be used to attain these goals.

Table 5. Temporary and Permanent BMP Design Criteria

Category	Design Requirement	Purpose	Criteria
Temporary BMPs	Erosion Control	Limit erosion from the construction site to the maximum extent practicable.	All erosion control BMPs shall be designed to handle the 2-year, 6-hour duration storm event without failure of the BMPs.
	Sediment Control	Remove sediment from runoff from the construction site to ensure the water quality of receiving water(s) will not degrade.	Provide sediment control for all down slope boundaries (i.e. silt fence, vegetative buffer strips, etc.) and, as necessary, provide for storage of runoff.
Permanent BMPs	Runoff Volume	Limit post-development peak runoff to 5% over pre-development peak runoff.	Runoff calculations shall be based on the 10-year, 1-hour duration storm event.
	Runoff Quality	Treat first flush pollutant loading.	Treat the initial 0.5 inch of runoff from each storm event.
		Treat runoff after first flush.	Provide treatment at a minimum rate of 0.005 inches per minute.

4.4 Resources

The following resources contain information on non-structural and structural BMPs suitable for the Fairbanks area, and should be used in the BMP selection process.

- Alaska Storm Water Guide (ADEC, 2011)
  - http://dec.alaska.gov/water/wastewater/stormwater/guidance
- BMP Effectiveness Report for Fairbanks (Shannon & Wilson, 2006)
  - http://www.co.fairbanks.ak.us/pw/StormWaterDocuments/AKDEC_BMP_Effectiveness_Report.pdf

- ADOT&PF Alaska SWPPP Guide (2011)
    - www.dot.state.ak.us/stwddes/desenviron/assets/pdf/swppp/english/2016/swppp_guide_with_apdx.pdf
- Stormwater BMP Design Supplement for Cold Climates (Center for Watershed Protection, 1997)
    - https://www.in.gov/indot/files/BMP_Design_Cold_Climates.pdf

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