

Alaska Department of Environmental Conservation
610 University Avenue
Fairbanks, Alaska 99709

**Total Maximum Daily Load (TMDL)
for Petroleum Hydrocarbons, Oils and Grease
in the Waters of
Noyes Slough in Fairbanks, Alaska**

October 2011

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Total Maximum Daily Load for Petroleum Hydrocarbons, Oils and Grease in the Waters of Noyes Slough in Fairbanks, Alaska

TMDL AT A GLANCE:

<i>Water Quality-limited?</i>	Yes
<i>Hydrologic Unit Code:</i>	19040506
<i>Criteria of Concern:</i>	Petroleum Hydrocarbons, Oil and Grease
<i>Designated Uses Affected:</i>	Water supply; water recreation; growth and propagation of fish, shellfish, other aquatic life, and wildlife
<i>Major Source(s):</i>	Urban runoff
<i>Loading Capacity:</i>	The criterion for petroleum hydrocarbons, oil and grease prohibits inputs that cause visible sheen upon the surface of the water
<i>Wasteload and Load Allocation:</i>	No visible anthropogenic petroleum sheens on the surface of the water
<i>Margin of Safety:</i>	No visible anthropogenic petroleum sheens on the surface of the water

Executive Summary

The State of Alaska has included Noyes Slough on its section 303(d) list since 1994 as water quality-limited due to sediment, petroleum hydrocarbons, oils and grease, and residues (in the form of debris). The slough (Alaska ID Number 40506-003) is currently classified as a Category 5 waterbody (i.e., TMDL is needed). A Total Maximum Daily Load (TMDL) is established in this document to meet the requirements of section 303(d) of the Clean Water Act (CWA) and the U.S. Environmental Protection Agency's (EPA) Water Quality Planning and Management Regulations (at Title 40 of the *Code of Federal Regulations* [CFR] Part 130), which require the establishment of a TMDL for the achievement of water quality standards when a waterbody cannot meet water quality standards after the implementation of technology-based controls or other pollution control measures.

Noyes Slough is located in the City of Fairbanks and is a side branch of the Chena River. Noyes Slough is frequently stagnant and is used mostly during the winter months for dog mushing, skiing, snowmachining, and dog walking. Noyes Slough and its adjacent wetlands provide habitat for beavers, muskrat, and waterfowl and spawning grounds for grayling and other fish. Noyes Slough is also a popular canoeing area and serves as a "living laboratory" where local elementary students observe local wildlife and learn about the value of clean waterways and the effects of urban pollution.

This document addresses only the petroleum hydrocarbons, oils and grease impairments to Noyes Slough. Alaska Department of Environmental Conservation (DEC) developed, and EPA approved, a TMDL for residues in Noyes Slough in 2008. DEC is evaluating the sediment impairment, which will either be

delisted if the waterbody is shown to meet applicable water quality standards or addressed through a separate TMDL if the listed impairment is confirmed. The petroleum hydrocarbons, oils and grease potentially enter Noyes Slough from urban runoff and snowmelt. Noyes Slough does not fully support its designated uses of water supply, water recreation, and growth and propagation of fish, shellfish, other aquatic life, and wildlife due to the persistent occurrence of visible sheens on the waterbody. The sheens can indicate the presence of petroleum hydrocarbons, which can cause a wide range of impairments to aquatic life and habitat, including lethal or sublethal effects. They have the potential to coat and smother organisms. They also have the potential to change the physical properties of the sediment, contributing to indirect toxicity to aquatic life.

Since the narrative water quality criterion for petroleum hydrocarbons, oils and grease does not allow for any visible sheens on surface waters, the TMDL for sheens in Noyes Slough is set to no visible sheens. There is neither a load nor wasteload of petroleum hydrocarbons, oils and grease allocated for Noyes Slough and the explicit margin of safety (MOS) is set to no visible sheens. The goal of this TMDL will be to reduce inputs of petroleum hydrocarbons, oils, and grease to the slough so that visible sheen occurrence is no longer persistent and chronic.

Strategies for reducing the presence of sheens in Noyes Slough have been included in Section 6 (Implementation). Solving the sheen problem in Noyes Slough includes the prevention of debris entering the waterbody as well as possible clean-up activities associated with the Brownfields project in Noyes Slough. A number of actions, including increased public awareness of the importance of Noyes Slough as a resource and increased enforcement of local ordinances, could significantly reduce the amount of petroleum hydrocarbons, oils and grease entering the slough. Many of these activities are already ongoing through the work of the Tanana Valley Watershed Association (TVWA) and the municipal separate storm sewer system (MS4) permits for the co-permittees of the City of Fairbanks, the City of North Pole, the University of Alaska - Fairbanks, and the Alaska Department of Transportation and Public Facilities - Northern Regional Office (AKS-053406) and for the Fairbanks North Star Borough (FNSB) (AKS-053414).

The Cities of Fairbanks and North Pole as well as the FNSB also have stormwater management guides that provide an overview of the stormwater management design and construction requirements for new development and redevelopment projects regulated by the City of Fairbanks and City of North Pole and the FNSB (COF and CONP 2010; FNSB 2010b). These guides include information regarding effective best management practices (BMPs) for the Fairbanks Urbanized Area used to control the adverse water quality impacts associated with stormwater runoff, including oil and grease.

The City of Fairbanks developed the *Green Infrastructure Resource Guide* through a grant from the Alaska Department of Natural Resources. The guide was developed for homeowners in the Fairbanks area as part of an effort to prevent water pollution and improve water quality in their communities (Heinchon and Murray 2010). The guide contains information about green infrastructure BMPs that can be used to manage wet weather runoff. It is intended to be a resource for homeowners who wish to construct these types of BMPs on their properties for the purpose of mitigating the urban runoff and associated pollutants that flow into the Chena River and Noyes Slough.

Monitoring plans to assess the presence of sheens as well as the success of these implementation measures include creating a record of monthly visual observations at stormwater outfalls and when water quality samples are collected for sites on Noyes Slough.

1. Overview

Section 303(d)(1)(C) of the Clean Water Act and the U.S. Environmental Protection Agency's (EPA) implementing regulations (40 CFR Part 130) require the establishment of a Total Maximum Daily Load (TMDL) for the achievement of state water quality standards when a waterbody is water quality-limited. A TMDL identifies the amount of a pollutant that a waterbody can assimilate and maintain compliance with water quality standards. TMDLs include an appropriate margin of safety and identify the level of pollutant control needed to reduce pollutant inputs to a level (or "load") that fully supports the designated uses of a given waterbody. The mechanisms used to address water quality problems after the TMDL is developed can include a combination of best management practices (BMPs) and/or effluent limits and monitoring required through Alaska Pollutant Discharge Elimination System (APDES) permits. This report presents the TMDL for petroleum hydrocarbons, oils and grease in Noyes Slough, Alaska.

1.1. Scope of the TMDL

Alaska Department of Environmental Conservation (DEC) has included Noyes Slough on the state's section 303(d) list since 1994 as water quality-limited due to sediment, petroleum hydrocarbons, oils and grease, and residues (in the form of debris).

The slough (Alaska ID Number 40506-003) is currently classified as a Category 5 waterbody in Alaska's Final 2010 Integrated Water Quality Monitoring and Assessment Report (ADEC 2010a). A Category 5 waterbody constitutes the Clean Water Act section 303(d) list of waters impaired by a pollutant(s) for which one or more TMDLs are needed. Alaska's 2010 Integrated Water Quality Monitoring and Assessment Report states:

"Noyes Slough has been on the Section 303(d) list for non-attainment of the sediment, petroleum hydrocarbons and oils and grease, and residues standards for sediment, petroleum products, and debris since 1994. Numerous water quality violations have been reported. These violations are a result of debris dumped into the slough. DEC completed a debris assessment in 2007. Data from the assessment were used to complete a TMDL for residues in 2008. Water quality data collected in 2005, 2007, and 2009 determined a TMDL is necessary for the oils and grease and hydrocarbon impairments. Data are being reviewed for the sediment standard impairment."

The pollutant source identified on the section 303(d) list is urban runoff. This document presents the TMDLs to address the petroleum hydrocarbons, oils and grease impairment in Noyes Slough. The residues TMDL was completed in 2008, and the sediment impairment is being reviewed by DEC to either be addressed in a separate TMDL document or be delisted.

The following sections provide general background information on the Noyes Slough watershed.

1.2. Location

Noyes Slough is a 5.5 mile long slough located in the City of Fairbanks and is a side branch to the Chena River (Figure 1-1). Noyes Slough branches off to the north from the Chena River and returns to the north bank of the Chena River upstream of the confluence of the Chena River with the larger Tanana River. The slough is used mostly during the winter months for dog mushing, snowmachining, skiing, and dog walking. Noyes Slough and its adjacent wetlands provide habitat for beavers, muskrat, and waterfowl and spawning grounds for grayling and other fish (Kennedy et al. 2004). Noyes Slough is also a popular canoeing area and serves as a "living laboratory" where local elementary students observe local wildlife and learn about the value of clean waterways and the effects of urban pollution (Kennedy et al. 2004).

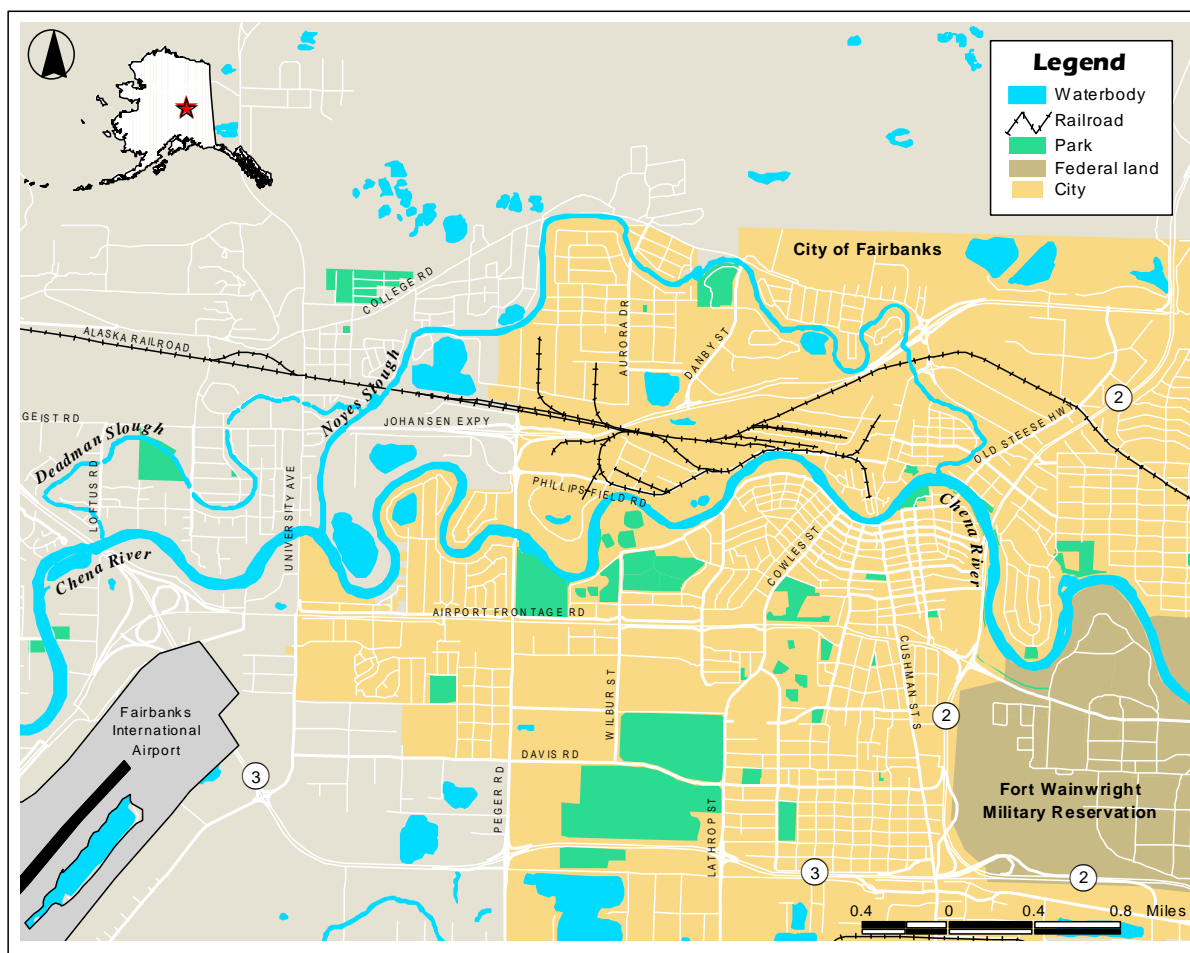


Figure 1-1. Noyes Slough and surrounding areas.

1.3. Population

The estimated 2009 population for Fairbanks North Star Borough is 98,660 (U.S. Census 2009), with more than 35,000 people in the city of Fairbanks and approximately 6,500 people residing in the area immediately surrounding Noyes Slough.

1.4. Topography

The topography of the Noyes Slough immediate drainage area has very little variation. The area of the slough is located at 430 feet above sea level while Chena River at the inlet and outlet of the slough is located at 420 feet.

1.5. Land Use

Land use coverage of the area surrounding Noyes Slough was obtained from the FNSB Zoning Designations (2007). Land between Noyes Slough and the Chena River is a mix of residential, commercial and industrial uses (Figure 1-2). The upper reaches pass through industrial and commercial areas, and lower reaches pass through residential and recreational areas. Land north of the slough is dominated by rural and agricultural uses.

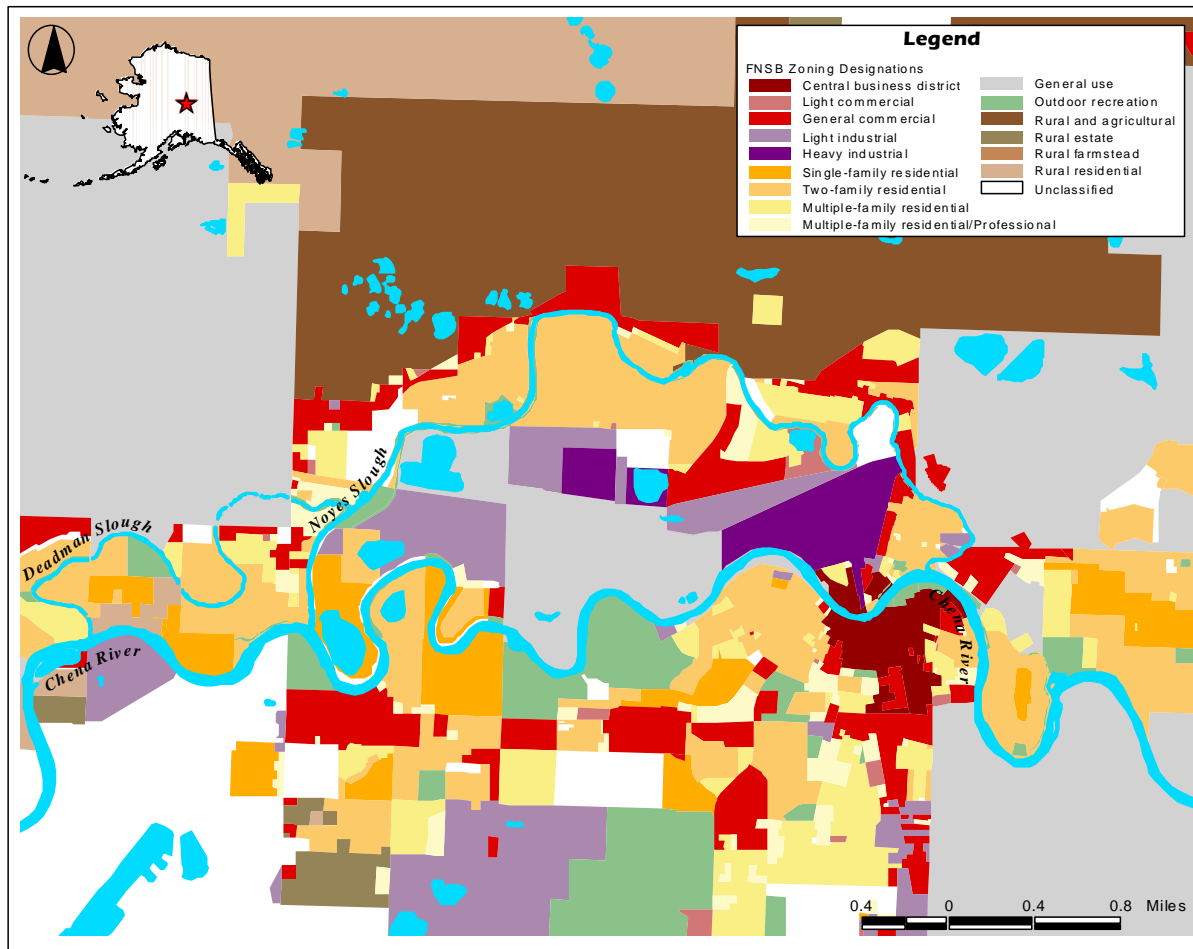


Figure 1-2. Land use surrounding Noyes Slough.

1.6. Climate

Fairbanks has a continental climate typified by warm, moist summers and cold, dry winters. Mean minimum January temperature is -19°F, and mean maximum July temperature is 72°F (Burrows et al. 2000). On average, Fairbanks receives about 70 inches of snowfall annually. Mean annual precipitation at Fairbanks International Airport is 11 inches (Burrows et al. 2000).

1.7. Hydrology¹

Prior to 1945, both the Chena River and the Tanana River contributed water to Chena Slough, which is now the lower Chena River through Fairbanks. Noyes Slough acts as an overflow channel during high flows on the lower Chena River. Flow in Noyes Slough has declined over the past 50 years because of flood-control structures on the Chena and Tanana Rivers. Moose Creek Dike was built across Chena Slough in 1945, blocking flow from the Tanana River. The 1967 flood on the Chena River resulted in the construction of a diversion dam (Moose Creek Dam), a floodway leading to the Tanana River, and a levee along the north bank of the Tanana River to avoid potentially severe flooding in Fairbanks. Peak flows in the Chena River were reduced further in 1980 after the completion of the Chena River Lakes Flood Control Project, which was designed to limit Chena River flow through Fairbanks to 12,000 cubic feet per

¹ Information in this section is taken from Burrows et al. (2000) and Kennedy et al. (2004).

second (cfs). The reduction in peak flows in the Chena River likely resulted in reduced flows in Noyes Slough. These flow-reduction measures have also caused down-cutting (lowering) of the Chena River channel bed at the entrance to Noyes Slough, reducing the magnitude and duration of surface water flow from Chena River to the slough. Beavers are also highly active in the slough. There are beaver dams approximately every half mile in the slough which further inhibits flow. Consequently, Noyes Slough is slowly drying up, and flows will likely continue to decline without intervention to reverse the process.

Typically, Noyes Slough is navigable except during low flows. Low flows typically correspond with the driest parts of the year, mid-summer and early fall. During very dry periods there is still standing water in the slough, but there is little to no flow. Many reaches of the slough are stagnant and unsightly due to the presence of debris. At times of no surface water flow from the Chena River into Noyes Slough, pools of water in the deeper parts of the slough correspond to local groundwater levels, indicating input from groundwater. In winter, no water flows in the slough, and the channel is filled with ice and snow.

Beaver dams, log jams, and other factors contributing to low flow volumes are major contributors to the condition of Noyes Slough. When Noyes Slough does not receive much flow, debris (trash and brush) may accumulate, changing the entrance conditions to the slough. When the slough receives significant flow, the debris is washed out and flow conditions improve. The alternating debris pattern at the slough entrance and the groundwater inflow and outflow likely account for the variation in discharge measurements at lower flows.

1.8. Fish Populations

Kennedy et al. (2004) documents data collected by the U.S. Geological Survey in 2001 to assess fish habitat in Noyes Slough. The data collection included the number and type of fish found in the slough. Alaska blackfish (*Dallia pectoralis*) were found in much greater numbers than any other species of fish captured or observed in Noyes Slough. Northern pike (*Esox lucius*) was the second most widely distributed fish and were found mostly in the downstream half of the slough. Other fish captured included Arctic grayling (*Thymallus arcticus*), Arctic lamprey (*Lampetra japonica*), burbot (*Lota lota*), humpback whitefish (*Coregonus pidschian*), lake chub (*Couesius plumbeus*), longnose sucker (*Catostomus catostomus*), and slimy sculpin (*Cottus cognatus*). Most of these species were found within a mile of the Chena River.

The large number of Alaska blackfish throughout most of the slough was indicative of the environmental conditions in the slough. The numerous beaver dams reduce the already limited flow in the slough and create stagnant pools with low dissolved oxygen concentrations. Alaska blackfish are capable of breathing atmospheric oxygen and can live in water that is uninhabitable to other species.

Noyes Slough has the potential to provide high quality habitat for fish and wildlife resources. The Alaska Department of Fish and Game has indicated that Noyes Slough could provide important rearing habitat for chinook salmon and arctic grayling (USACE 1997) if the slough was readily accessible to fish from the Chena River.

2. Water Quality Standards and TMDL Target

Water quality standards designate the “uses” to be protected (e.g., water supply, recreation, aquatic life) and the “criteria” for their protection (e.g., how much of a pollutant can be present in a waterbody without impairing its designated uses). TMDLs are developed to meet applicable water quality standards, which may be expressed as numeric water quality criteria or narrative criteria for the support of designated uses. The TMDL target identifies the numeric goals or endpoints for the TMDL that equate to attainment of the water quality standards. The TMDL target may be equivalent to a numeric water quality standard where one exists, or it may represent a quantitative interpretation of a narrative standard. This section reviews the applicable water quality standards and identifies an appropriate TMDL target for calculation of the petroleum hydrocarbons, oils and grease TMDL for Noyes Slough.

2.1. Applicable Water Quality Standards

Title 18, Chapter 70 of the Alaska Administrative Code (AAC) establishes water quality standards for the waters of Alaska, including the designated uses to be protected and the water quality criteria necessary to protect the uses. Designated uses established in the State of Alaska Water Quality Standards (18 AAC 70.020) for fresh waters of the state include (1) water supply, (2) water recreation, and (3) growth and propagation of fish, shellfish, other aquatic life, and wildlife, and are applicable to all fresh waters, unless specifically exempted. Petroleum hydrocarbons, oils and grease water quality criteria for all uses are applicable to Noyes Slough. Table 2-1 lists water quality criteria for petroleum hydrocarbons, oils and grease.

Table 2-1. Alaska Water Quality Criteria for Petroleum Hydrocarbons, Oils and Grease in Fresh Waters

Designated Use	Description of Criteria
Petroleum hydrocarbons, oils and grease	
(A) Water Supply	
(i) drinking, culinary, and food processing	May not cause a visible sheen upon the surface of the water. May not exceed concentrations that individually or in combination impart odor or taste as determined by organoleptic tests.
(ii) agriculture, including irrigation and stock watering	May not cause visible sheen upon the surface of the water.
(iii) aquaculture	Total aqueous hydrocarbons (TAqH) in the water column may not exceed 15 µg/L (see note a). Total aromatic hydrocarbons (TAH) in the water column may not exceed 10 µg/L (see note a). There may be no concentrations of petroleum hydrocarbons, animal fats, or vegetable oils in shoreline or bottom sediments that cause deleterious effects to aquatic life. Surface waters and adjoining shorelines must be virtually free from floating oil, film, sheen, or discoloration.
(iv) industrial	May not make the water unfit or unsafe for the use.
(B) Water Recreation	
(i) contact recreation	May not cause a film, sheen, or discoloration on the surface or floor of the waterbody or adjoining shorelines. Surface waters must be virtually free from floating oils.

Designated Use	Description of Criteria
(ii) secondary recreation	Same as contact recreation above
(C) Growth and propagation of fish, shellfish, other aquatic life, and wildlife	Total aqueous hydrocarbons (TAqH) in the water column may not exceed 15 µg/L (see note a). Total aromatic hydrocarbons (TAH) in the water column may not exceed 10 µg/L (see note a). There may be no concentrations of petroleum hydrocarbons, animal fats, or vegetable oils in shoreline or bottom sediments that cause deleterious effects to aquatic life. Surface waters and adjoining shorelines must be virtually free from floating oil, film, sheen, or discoloration.

Source: 18 AAC 70.020

2.2. Sediment Quality Targets

The water quality criteria for growth and propagation of fish, shellfish, other aquatic life, and wildlife states that “there may be no concentrations of petroleum hydrocarbons, animal fats, or vegetable oils in shoreline or bottom sediments that cause deleterious effects to aquatic life.” To date, DEC has not adopted numeric sediment quality standards for the evaluation of impacts to aquatic life. However, the DEC Contaminated Sites Remediation Program has issued the technical memorandum *Sediment Quality Guidelines* (ADEC 2004), which recommends using the Threshold Effects Levels (TELs) and Probable Effects Levels (PELs) for evaluating sediment quality. TELs define chemical sediment concentrations below which toxic effects are rarely observed in sensitive species, while PELs define concentrations above which effects are frequently or always observed. Table 2-2 presents TELs and PELs applicable to petroleum hydrocarbon contamination in freshwater sediments, as summarized in the National Oceanic and Atmospheric Administration (NOAA) *Screening Quick Reference Tables* (SQiRTs; Buchman 2008). The TELs and PELs specifically refer to polycyclic aromatic hydrocarbons (PAHs) in bottom sediments.

Table 2-2. Freshwater Sediment Quality Screening Levels for PAHs

Compound	TEL (µg/kg)	PEL (µg/kg)
Acenaphthene	6.71	88.9
Acenaphthylene	5.87	128
Anthracene	46.9	245
Benzo(a)pyrene	31.9	782
Benzo(a)anthracene	31.7	385
Chrysene	57.1	862
Dibenzo(a,h)anthracene	6.22	135
Fluoranthene	111	2,355
Fluorene	21.2	144
Naphthalene	34.6	391
Phenanthrene	41.9	515
Pyrene	53	875
Total PAHs	N/A	N/A

Source: Buchman (2008)

N/A = not available

2.3. Antidegradation

Alaska's Water Quality Standards (18 AAC 70.015) also include an antidegradation policy, which states that existing water uses and the level of water quality necessary to protect the existing uses must be maintained and protected.

Water quality must be maintained and protected unless the state finds that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the water is located. In allowing such degradation or lower water quality, the state must ensure water quality adequate to fully protect existing uses of the water.

The methods of pollution prevention, control, and treatment found to be the most effective and reasonable will be applied to all discharges. All discharges will be treated and controlled to achieve the highest statutory and regulatory requirements for point sources and all cost-effective and reasonable BMPs for nonpoint sources.

State water exhibiting high quality water constitutes an outstanding national resource and must be maintained and protected.

2.4. Designated Use Impacts

Designated uses for Alaska's waters are established by regulation and are specified in the State of Alaska Water Quality Standards (18 AAC 70). For fresh waters of the state, these designated uses include (1) water supply, (2) water recreation, and (3) growth and propagation of fish, shellfish, other aquatic life, and wildlife. Noyes Slough does not fully support its designated uses because of visible sheens on the surface of the slough. The sheens can indicate the presence of petroleum hydrocarbons. Petroleum hydrocarbons can cause a wide range of impairments to aquatic life and habitat, including lethal or sublethal effects. Although Noyes Slough is not currently used for drinking water, the designated use of water supply must also be protected per Alaska water quality standards.

Noyes Slough is listed on Alaska's 2010 section 303(d) list for not meeting state water quality criteria for petroleum hydrocarbons, oil and grease, and sediment. Note that this document addresses only the petroleum hydrocarbons, oils and grease impairments to Noyes Slough. DEC is evaluating the sediment impairment, which will either be delisted if the waterbody is shown to meet applicable water quality standards or addressed through a separate TMDL if the listed impairment is confirmed. Petroleum products can cause a wide range of impairments to aquatic life and habitat, including lethal or sublethal effects. They have the potential to coat and smother organisms. Due to the lipophilic nature of petroleum products, they tend to reside in the fats and oils of organisms and are often found in the sediment rather than the water column. They also have the potential to change the physical properties of the sediment, contributing to indirect toxicity to aquatic life.

The slough was initially included on the section 303(d) list for petroleum hydrocarbon impairments based on a qualitative assessment (observed sheens). There is the potential for petroleum problems because of the large industrial area along the slough. DEC's 1989 Nonpoint Source Water Quality Assessment indicates a suspected petroleum hydrocarbon problem because of a large industrial area along Noyes Slough that stores petroleum on site. Sheens could also originate from groundwater plumes associated with the industrial development around the slough or from buried automotive bodies and sunken drums. DEC's section 303(d) listing documents also indicate urban runoff from melting snow and deliberate snow dumps into the slough containing petroleum products as reasons for including the petroleum hydrocarbons impairment on the section 303(d) list. Deliberate snow dumps on the slough are no longer allowed, although they may have caused problems in the past.

Recent surface water monitoring has found that numeric water quality criteria for TAH and TAqH are currently being met in the water column (see Section 3). Review of petroleum hydrocarbon data in sediment has also found that TELs and PELs for PAHs in sediment are being met (see Section 3). The study area remains listed as impaired, however, due to the sheens consistently observed on the waterbody.

The current impaired status of Noyes Slough is based on exceedances of the Water Supply, Water Recreation, and Growth and Propagation water quality criteria provisions, which state that “[petroleum hydrocarbons and oil & grease] may not cause a visible sheen upon the surface of the water” and “surface waters and adjoining shorelines must be virtually free from floating oil, film, sheen, or discoloration”.

2.5. TMDL Target

The TMDL target is the numeric endpoint used to evaluate the loading capacity and necessary load reductions and represents attainment of applicable water quality standards. In the case of petroleum hydrocarbons, oils and grease in Noyes Slough, the TMDL target is set to be consistent with applicable water quality standards allowing no visible sheen on the surface of the water.

3. Data Summary

This section summarizes the data available for Noyes Slough relevant to the petroleum hydrocarbons, oils and grease impairment, including studies on sediment and surface water contamination.

3.1. Petroleum Hydrocarbons in Surface Water

Although Noyes Slough is listed for petroleum hydrocarbons, a comparison of the water quality data to the TAH and TAqH water quality criteria do not indicate impairment in the water column (Tables 3-1 and 3-2). None of the TAH data in Table 3-1 or TAqH data in Table 3-2 are exceeding the TAH and TAqH water quality criteria of 10 and 15 µg/L, respectively. TAH is the sum of benzene, ethylbenzene, toluene, and xylene isomers (BTEX), while TAqH is the sum of BTEX and the PAHs listed in EPA's method 610 (acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorine, ideno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene). Many of the observations were non-detects, which were treated as 0 (zero) for data analysis purposes and, therefore, do not exceed the water quality criteria. Figure 3-1 presents the locations of the water quality monitoring stations.

Table 3-1. TAH Data for Surface Waters of Noyes Slough

Date	Station Name ^a	TAH ^{b,c} (µg/L)
6/18/2000	N2 (Minnie Street Bridge)	1.38
8/2/2005	11-2005	1.1
5/22/2007	11	0
5/22/2007	12	1.2
5/22/2007	16	0
5/22/2007	17	0
5/22/2007	20	0
8/2/2005	31 (NS Mouth)	0
6/18/2000	N3 (College Cleaners)	0
6/18/2000	N3 (College Cleaners-Duplicate)	0
6/18/2000	N13 (Lions Park)	0
5/22/2007	10	0
5/22/2007	13/14	0
5/15/2009	NS5	0
5/12/09 and 5/14/09	NS1	0
5/12/09 and 5/14/09	NS2	0
5/12/09 and 5/14/09	NS3	0
5/12/09 and 5/14/09	NS4	0

^aNote that some of the monitoring stations in Noyes Slough have multiple names. Although there may be multiple station names presented on each row of the table above, they are the same station.

^bTAH = BTEX = benzene, toluene, ethylbenzene, and xylene isomers.

^cAll observations cited as zero (0) in the above table were non-

detects and were treated as 0 for data analysis purposes.

Table 3-2. TAqH Data for Surface Waters of Noyes Slough

Date	Station Name ^a	TAqH ^{b,c} (µg/L)
8/2/2005	11	1.1
5/22/2007	11	0
5/22/2007	12	1.2
5/22/2007	16	0
5/22/2007	17	0
5/22/2007	20	0
8/2/2005	31 (NS Mouth)	0
5/22/2007	10	0
5/22/2007	13/14	0
5/15/2009	NS5	0
5/12/09 and 5/14/09	NS1	0
5/12/09 and 5/14/09	NS2	0
5/12/09 and 5/14/09	NS3	0
5/12/09 and 5/14/09	NS4	0

^aNote that some of the monitoring stations in Noyes Slough have multiple names. Although there may be multiple station names presented on each row of the table above, they are the same station.

^bTAqH = BTEX (benzene, toluene, ethylbenzene, and xylene isomers) + PAH (PAHs in EPA method 610).

^cAll observations cited as zero (0) in the above table were non-detects and were treated as 0 for data analysis purposes.

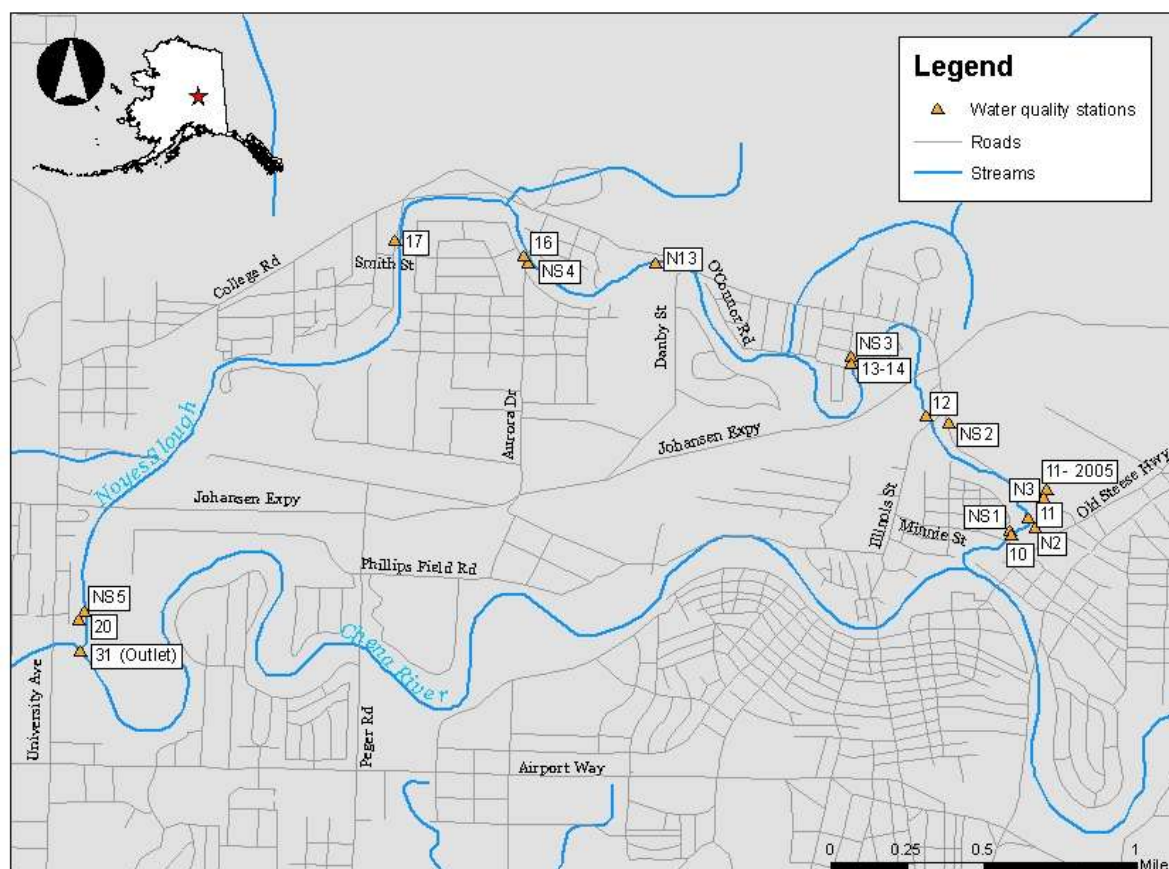


Figure 3-1. Surface water quality sampling locations in Noyes Slough.

3.2. Petroleum Hydrocarbons in Sediment

Noyes Slough has been designated as a Brownfield, which is an area that typically has hazardous substances and is redeveloped and reused under the Brownfields program (USEPA 2006). Under the Brownfields program, Noyes Slough may qualify for funding for an environmental assessment and cleanup. The Tanana Valley Watershed Association (TVWA) received assistance from EPA for a Targeted Brownfield Assessment (TBA) of Noyes Slough.

DEC funded a report, called *Summary of Environmental Research: Noyes Slough Reclamation Evaluation, Fairbanks, Alaska* (Oasis 2008), which included research and compilation of information on the environmental impacts to Noyes Slough.

EPA provided assistance to TVWA for the TBA. URS Corporation performed the TBA at Noyes Slough in 2009 (URS 2010). The purpose of the TBA was to evaluate sediment quality in Noyes Slough in support of potential stream rehabilitation and redevelopment efforts. Based on the Oasis (2008) *Summary of Environmental Research* report, the TBA focused on several pollutants in their sediment characterization, including petroleum hydrocarbons.

Sediment samples were collected from 16 locations along the Noyes Slough channel and one location upstream of the slough on the Chena River (URS 2010) (Figure 3-2). A column of fine sediment was

collected at each sample location. The results of the sampling effort were compared to freshwater sediment screening values from NOAA's SQuIRTS, including TEL and PEL. Exceedances of the screening values do not necessarily indicate contamination, but only the need for additional evaluation to assess risk (URS 2010). TELs represent the concentrations below which adverse effects on benthic organisms are expected to rarely occur, while PELs represent concentrations above which effects on benthic organisms are frequently expected.

None of the sediment concentrations in Noyes Slough exceeded these screening levels for petroleum hydrocarbons (PAHs), indicating that PAHs are not impairing the sediments of Noyes Slough. **Error! Reference source not found.** presents the PAH data collected in the sediments of Noyes Slough. Note that only those parameters with NOAA TEL or PEL screening levels are included.

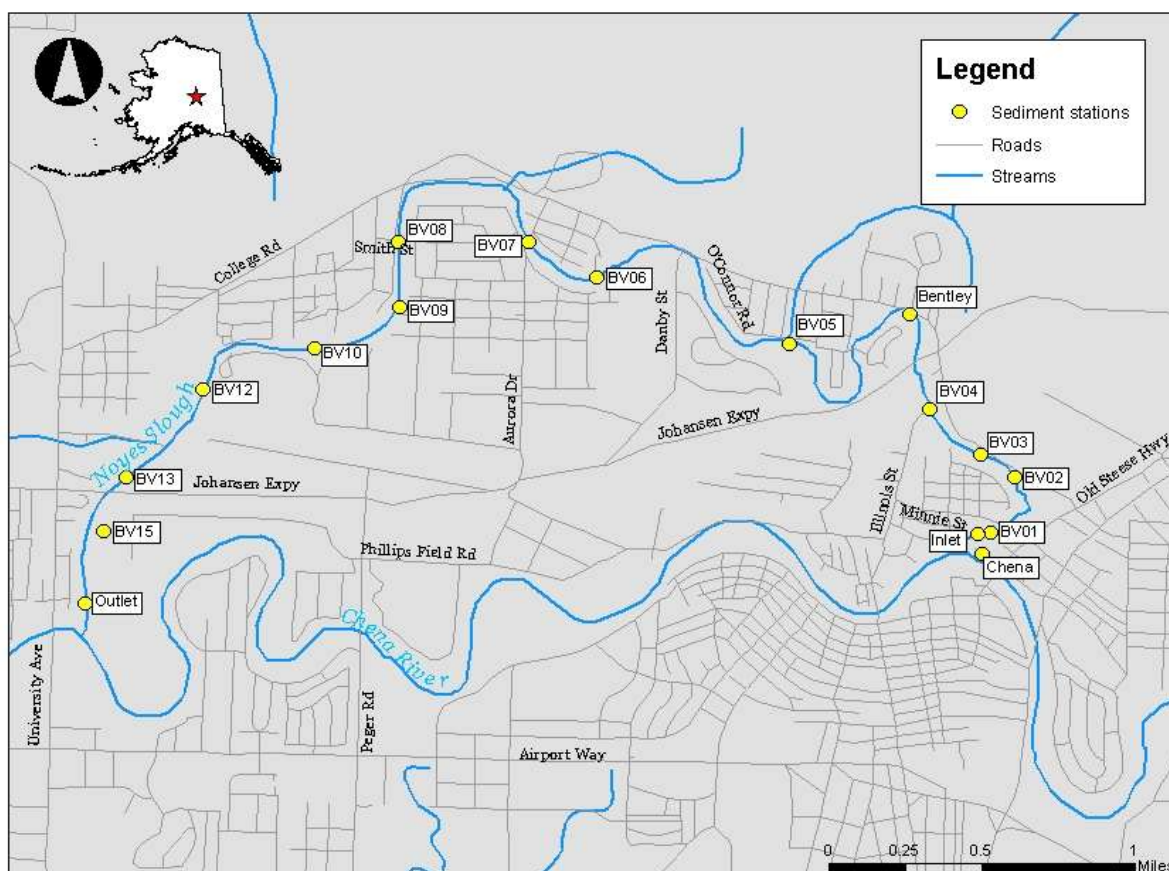


Figure 3-2. Sediment sampling stations in Noyes Slough.

Table 3-3. Petroleum Hydrocarbons in the Sediments of Noyes Slough

Date	Station	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)pyrene	Benzo(a)anthracene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Napthalene	Phenanthrene	Pyrene
		(µg/Kg)											
7/22/2009	Bentley	0	0	0	0	0	2.2	0	2.9	0	0	0	0
7/23/2009	BV01	0	0	0	0	0	0	0	3.2	0	0	2.7	2.6
7/23/2009	BV02	0	0	0	0	0	1.8	0	4.1	0	0	4.5	2.5
7/23/2009	BV02	0	0	0	0	0	0	0	0	0	0	0	0
7/23/2009	BV02	0	0	0	0	0	0	0	0	0	1.2	0	2.2
7/22/2009	BV03	0	0	0	0	0	0	0	0	0	0	0	0
7/22/2009	BV04	0	0	0	0	0	1.7	0	3.9	0	0	3.6	2.5
7/22/2009	BV05	0	0	0	0	0	0	0	0	0	0	0	0
7/22/2009	BV06	0	0	0	0	0	0	0	2	0	0	2.4	0
7/22/2009	BV06	4.7	0	0	0	2.3	3.4	0	8.3	3.5	2.1	0	7
7/22/2009	BV06	0	0	0	0	0	0	0	2.7	0	0	0	0
7/22/2009	BV07	0	0	0	0	0	0	0	0	0	0	0	0
7/21/2009	BV08	0	0	0	0	0	2.8	0	8.5	0	0	6	5.5
7/21/2009	BV09	0	0	0	0	0	0	0	0	0	0	0	0
7/21/2009	BV10	0	0	0	0	0	0	0	0	0	1.8	0	0
7/21/2009	BV12	0	0	0	0	0	0	0	4.4	0	0	4.1	2.4
7/21/2009	BV13	0	0	0	0	0	0	0	0	0	0	0	0
7/21/2009	BV15	0	0	0	0	0	0	0	0	0	0	0	0
7/23/2009	Chena	0	0	0	0	0	0	0	0	0	0	0	0
7/23/2009	Inlet	0	0	0	0	0	0	0	0	0	0	0	0
7/21/2009	Outlet	0	0	0	0	0	0	0	0	0	0	0	0

*All observations cited as zero (0) were non-detects and were treated as 0 for data analysis purposes.

3.3. Sheens

Parsons (2006) noted some “visible sheen” on the slough in 2005 as did DEC in its 2007 and 2009 sampling efforts, according to the DEC field notes. The locations and dates of sheen observations are presented in Table 3-4. Figure 3-1 shows the locations of all sampling locations in Noyes Slough. Alaska’s narrative water quality criteria for petroleum hydrocarbons, oils and grease states that pollutants may not cause a visible sheen upon the surface of the water.

Sheens may occur naturally as well as from petroleum products. Sheens that occur naturally from bacteria or decomposing material will break apart when poked with a stick as opposed to sheens from petroleum products which will swirl back together. Many of the observed sheens had characteristic(s) of petroleum and in some cases accompanied a petroleum smell. Some sheens were observed on the stream bank sediments adjacent to the slough. In one case the petroleum appeared to be dripping from the bridge. Sheens were noted most frequently at station NS-3, Illinois Street.

Data indicate that Noyes Slough meets the portions of the water quality criteria related to concentrations of petroleum hydrocarbons in surface water or sediments. However, petroleum and oil related sheens have been observed on slough water and sediments. Therefore, the petroleum hydrocarbons, oils and grease TMDL is written to address the sheens observed in Noyes Slough.

Table 3-4. Locations of sheens observed in Noyes Slough

Date	Station Name	Station Location	Notes	Source
August 2005	unknown	unknown	Visible sheen was observed on the water surface at one Noyes Slough site during the 2005 sampling. The source of this information does not provide information on where this sheen was seen.	Parsons (2006)
5/22/07	17	Smith Street	There was a sheen visible on water possibly kicked up by boots.	ADEC (2007)
06/15/09	NS-2	Illinois Street	Visible sheen	ADEC (2009)
	NS-5	Goldizen Road	Visible sheen	ADEC (2009)
07/22/09	NS-2	Illinois Street	Sheen downstream. No petroleum smell.	ADEC (2009)
	NS-3	O'Connor Road	Visible sheen	ADEC (2009)
	NS-4	Aurora Drive	Sheen downstream	ADEC (2009)
07/29/09	NS-2	Illinois Street	Diesel sheen and smell	ADEC (2009)
	NS-3	O'Connor Road	Oil spots seeping up on banks	ADEC (2009)
08/06/09	NS-3	O'Connor Road	Oil on ground. Appears to have dripped from bridge.	ADEC (2009)
08/24/09	NS-1	Minnie Street	Samplers kicking up sheen	ADEC (2009)
	NS-2	Illinois Street	Sheen present	ADEC (2009)
	NS-5	Goldizen Road	Sheen on bank and in slough. Petroleum smell.	ADEC (2009) ADEC (2009))
09/16/09	NS-1	Minnie Street	Significant sheen	ADEC (2009)
	NS-2	Illinois Street	Visible sheen	ADEC (2009)

4. Pollutant Sources

The identification of pollutant sources is important to control pollutant loading to a stream. Characterizing watershed sources can provide information on the relative magnitude and influence of each source and its impact on in-stream water quality conditions. This section discusses the potential sources of petroleum hydrocarbons, oils and grease to Noyes Slough, including point and nonpoint sources.

4.1. Permitted Stormwater

The Stormwater Phase I Rule (55 *Federal Register* 47990, November 16, 1990) requires all operators of medium and large municipal separate storm sewer systems (MS4s) to obtain a National Pollutant Discharge Elimination System (NPDES) permit and develop a stormwater management program. Medium and large MS4s are defined by the size of the population within the MS4 area, not including the population served by combined sewer systems. A medium MS4 has a population of between 100,000 and 249,999. A large MS4 has a population of 250,000 or more.

Phase II requires a select subset of small MS4s to obtain an NPDES stormwater permit. A small MS4 is any MS4 not already covered by the Phase I program as a medium or large MS4. The Phase II Rule automatically covers all small MS4s in urban areas, as defined by the Bureau of the Census. It also includes small MS4s outside an urban area that are so designated by APDES permitting authorities, case by case.

Although not permitted to discharge petroleum hydrocarbons, oils and grease, or the resulting sheens into Noyes Slough, municipal stormwater systems are possible point source contributors to the slough because urban runoff can contain high concentrations of pollutants. Stormwater discharges are generated by runoff from urban land and impervious areas such as paved streets, parking lots, and rooftops during precipitation events.

The State of Alaska took authority over MS4 permits from EPA in October 2009. Under the Alaska Pollutant Discharge Elimination System (APDES) stormwater program, operators of large, medium, and regulated small MS4s must obtain authorization to discharge pollutants. Many stormwater discharges are considered point sources and require coverage by an APDES permit.

There are no Phase I MS4 permits in the Noyes Slough watershed; however, there are two Phase II MS4 permits (AKS-053406 and AKS-053414). MS4 permit AKS-053406 includes the City of Fairbanks, the City of North Pole, the University of Alaska - Fairbanks, and the Alaska Department of Transportation and Public Facilities. MS4 permit AKS-053414 includes the Fairbanks North Star Borough. The urban area included in the MS4 permits is shown in Figure 4-1. The entire length of Noyes Slough flows through the urban area; however, there are portions of the watershed north of the slough that are not included in the urban area boundary.

The sheens in Noyes Slough likely result from a source within the MS4, which could be natural organics, groundwater, garbage and debris, or urban runoff delivery of petroleum hydrocarbons, oils and grease. Input may be directly to the slough from adjacent areas or carried through the MS4 conveyance system from other areas of the watershed. The Phase II MS4 permits only regulate the indirect inputs brought into the slough through the stormwater conveyance system. It is impossible to determine whether the sheens are delivered from the MS4 or non-MS4 area.

The locations of the stormwater outfalls that discharge to Noyes Slough are presented in Figure 4-2 along with the locations of the water quality sampling sites. The majority of outfalls, industrial development,

and beaver dams are in the upper half of Noyes Slough. Note that there are stormwater outfalls at or near all but one of the locations where sheens were observed in Noyes Slough (NS3, 13-14, 17, NS2, 12, NS4, 16, NS1, and 10). There is no outfall located near the outlet of Noyes Slough (stations NS5, 20, and 31).

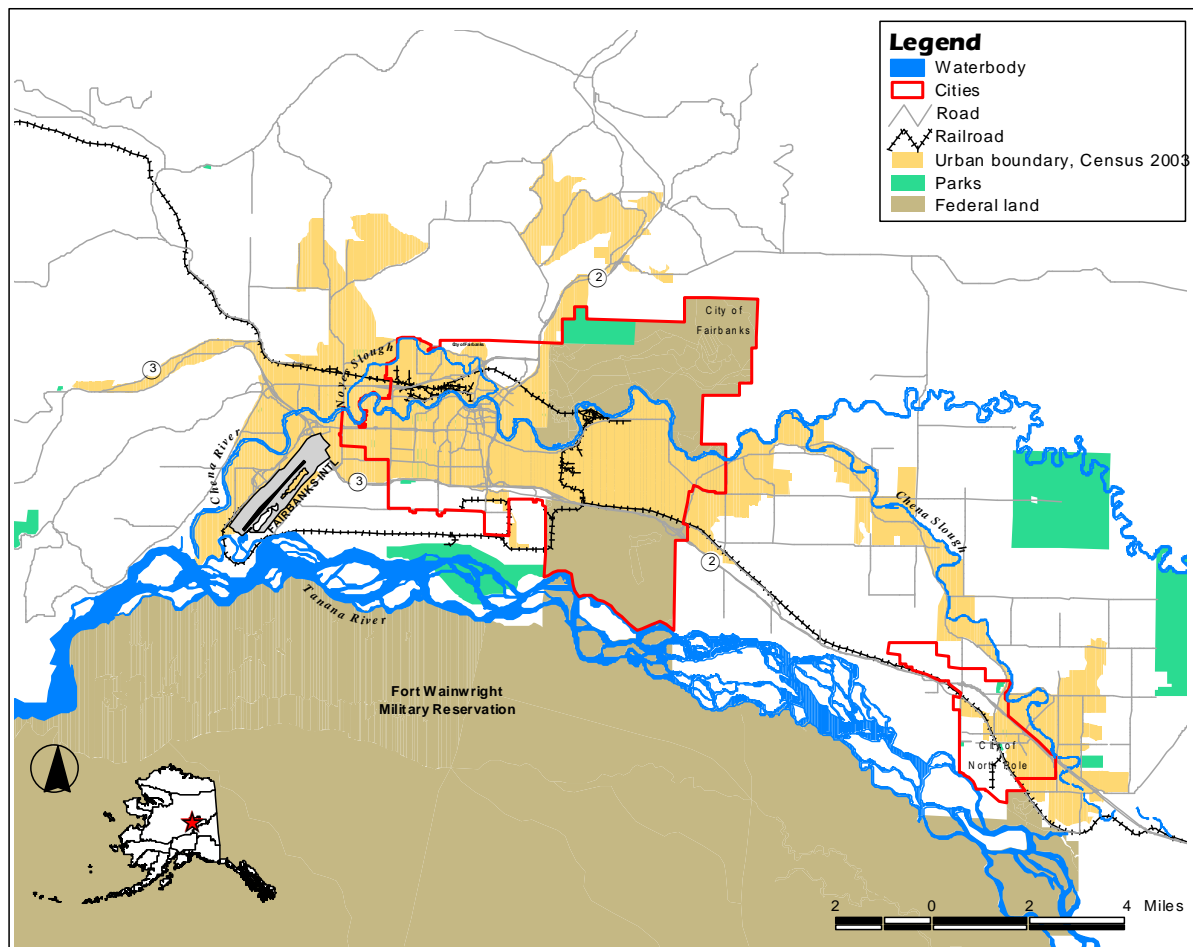


Figure 4-1. Urban area covered by Phase II MS4 stormwater permits.

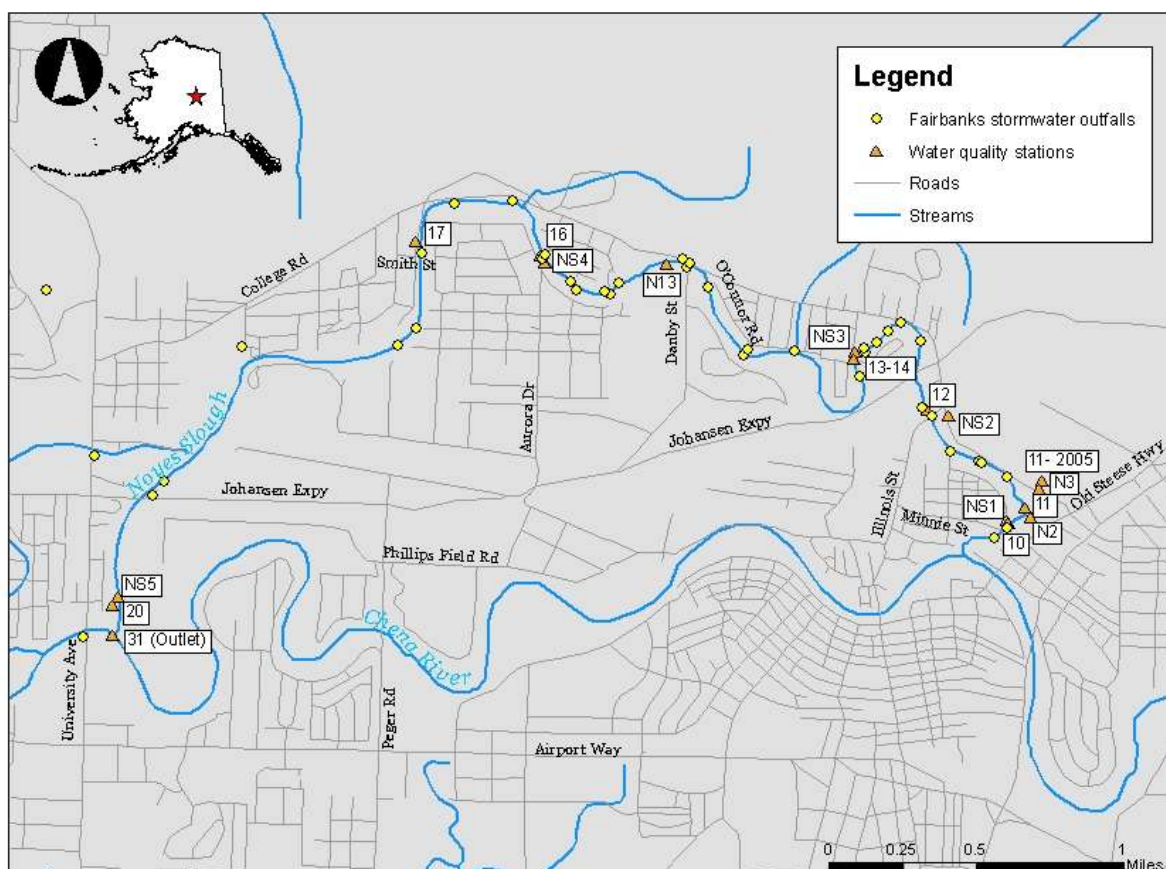


Figure 4-2. Locations of stormwater outfalls in Noyes Slough (Source: FNSB et al. 2008).

4.2. Contaminated Sites

There are several privately owned contaminated sites in the City of Fairbanks and the Fairbanks North Star Borough that are impacted with petroleum-related pollutants. DEC's Division of Spill Prevention and Response, Contaminated Sites Program is responsible for managing clean-up operations at contaminated sites in the state. A recent Brownfield Assessment (Oasis 2008) compiled information on environmental impacts to Noyes Slough, including those from contaminated sites. This particular assessment reviewed files for contaminated sites within $\frac{1}{2}$ mile of the slough and identified sites where there was a high potential for the contaminants to reach the slough. Table 4-1 presents descriptions of the sites impacted with petroleum products and Figure 4-3 shows the locations. There are several additional sites contaminated by petroleum products outside of the $\frac{1}{2}$ mile boundary used in the Oasis assessment, but the likelihood of contributions to the slough has not been assessed.

Table 4-1. Petroleum Contaminated Sites near Noyes Slough

Site name	Location	File ID	Problem Description
GVEA Gas Turbine Building	758 Illinois Street	103.38.001	DEC learned 8/9/91 of a diesel contaminated site which was occupied by four diesel powered generators which were removed in 1989. Soil-contaminated area estimated at 60 x 120 feet; capped in 1990's. Down gradient monitoring well indicates benzene levels below MCLs, 2.2ppb, but solvents were detected on north portion of the property. The source of solvents may be upgradient of the site, but this has not been determined. Long-term monitoring in place for petroleum and solvents. (Illinois-Minnie)
US Travel Systems, Former	230 Old Steese Hwy	102.26.046	Prior to 1983 two dispenser islands, five 4,000-gallon gasoline USTs and one 500-gallon waste oil UST were removed without documentation and sampling. The excavation was reportedly backfilled with clean gravel. From January 1995 to December 2003, an air sparge/soil vapor extraction (AS/SVE) system was operated to remediate soil and groundwater at the site. Chevron assumed environmental responsibility for the remaining soil and groundwater cleanup associated with the Texaco operations at the site in 2005.
Office Place	116 Minnie St.	102.26.033	Petroleum contamination near slough; associated with heating oil tank.

**Figure 4-3. Locations of contaminated sites near Noyes Slough.**

4.3. Nonpoint Sources

Possible sources of the sheens in Noyes Slough are indirect inputs from residential, commercial, and industrial areas brought into the slough through urban runoff. Other sources could include direct inputs (from sunken drums or contaminated garbage) or groundwater from contaminated sites. In some areas, snow removal activities on streets and parking lots adjacent to the slough cause oil and grease to be placed in the flood plain and on the banks of the creek where it enters the creek upon snowmelt. Some oil and grease may originate in areas north of the slough that are not included within the urban area boundary; however, it is unlikely that these are significant inputs since it is a relatively undisturbed landscape.

As mentioned in the previous section, some portion of the oil and grease carried to the slough through surface runoff might originate in areas outside of the MS4 areas. However, it is impossible to determine which portion is delivered from the MS4 and non-MS4 areas.

5. TMDL Allocations

A TMDL represents the total amount of a pollutant that can be assimilated by a receiving water while still achieving water quality standards. A TMDL is composed of the sum of individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background loads. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is denoted by the equation

$$\text{TMDL} = \Sigma \text{WLAs} + \Sigma \text{LAs} + \text{MOS}$$

The impairment to Noyes Slough does not fit the model for the typical loading capacity determination because the nature of sheens does not lend well to quantitative analysis. However, because Alaska water quality standards do not allow for any visible sheens on surface water, no loading calculation is necessary. The TMDL will be set to prohibit inputs that cause visible sheens on the surface of the water, and the TMDL document will focus on implementation of strategies that will help keep petroleum hydrocarbons, oils and grease out of the slough and allow it to meet the applicable water quality standards.

5.1. Loading Capacity

The loading capacity for a given pollutant is the greatest amount of pollutant that a waterbody can receive without violating the applicable water quality standard. For Noyes Slough, the pollutant is petroleum hydrocarbons, oils and grease in the form of sheens. The loading capacity for Noyes Slough is derived directly from the water quality standards, which require no visible sheens on surface waters. As such, the loading capacity of Noyes Slough for petroleum hydrocarbons, oils and grease is no petroleum inputs that cause visible sheens.

5.2. Wasteload Allocation

The WLA is the portion of the TMDL that is allocated to point sources. The State of Alaska prohibits the discharge of petroleum hydrocarbons, oils and grease into surface waters such that it would result in a visible sheen. The WLA for petroleum hydrocarbons, oils and grease is no petroleum inputs that cause visible sheens in Noyes Slough.

5.3. Load Allocation

The LA is the portion of the TMDL that is allocated to nonpoint sources and background levels. Since there are no background sources of petroleum hydrocarbons, oils and grease and water quality standards do not allow for any sheens, the LA for petroleum hydrocarbons, oils and grease is no petroleum inputs that cause visible sheens in Noyes Slough.

5.4. Daily Load

The Noyes Slough TMDL's loading capacity, wasteload, and load allocations are described as "no visible petroleum sheens on the surface of the water." Therefore, prohibited loads are applicable at all times and can be applied on a daily basis. This is consistent with the requirement to express TMDLs on a daily time increment.

5.5. Margin of Safety

Clean Water Act section 303(d) requires that a TMDL incorporate a MOS to account for uncertainty or lack of knowledge concerning the relationship between pollutant loading and water quality. The MOS can be implicit (e.g., incorporated into the TMDL analysis through conservative assumptions) or explicit (e.g., expressed in the TMDL as a portion of the loadings) or a combination of both. Because the loading capacity determined from water quality standards allows no visible petroleum sheens in the slough, there is neither a load nor wasteload of petroleum hydrocarbons, oils and grease allocated for Noyes Slough, and the explicit MOS for sheens is for no inputs that cause visible sheens.

5.6. Seasonal Variation

TMDLs must be developed with consideration of seasonal variation and critical conditions. Seasonal variation and critical conditions associated with pollutant loadings, waterbody response, and impairment conditions can affect the development and expression of a TMDL. A TMDL should be developed to ensure the waterbody will maintain water quality standards under all expected conditions.

The impairment in Noyes Slough is not thought to be associated with a particular season or environmental condition. The impairment is likely a result of year-round urban runoff, possibly with increased delivery during spring snowmelt. In addition, the loading capacity is set to allow no inputs of petroleum hydrocarbons, oils and grease that cause visible sheens, and applies at all times. Therefore, development of the TMDL for specific seasons and conditions is not necessary.

5.7. Reasonable Assurance

In watersheds impaired by both point and nonpoint sources, EPA's 1991 TMDL guidance (USEPA 1991) provides that where any WLA to a point source is increased based on an assumption that loads from nonpoint sources will be reduced, the state must provide "reasonable assurance" that the nonpoint source LAs will in fact be achieved. Because the WLAs and LAs for petroleum hydrocarbons, oil, and grease in Noyes Slough are set at zero, the WLA and associated level of control is not dependent on the LA. While the TMDL does not warrant the need for reasonable assurance as outlined in EPA guidance, the Implementation section of this report does discuss the available mechanisms and activities that will be used to implement the TMDL and control inputs to Noyes Slough.

6. Implementation

Petroleum hydrocarbons, oil and grease that cause sheens in Noyes Slough could be originating from residential, commercial and industrial activities that contribute petroleum products to urban runoff and from contaminated sites throughout the watershed. Therefore, reducing sheens in the slough relies on preventing petroleum hydrocarbons, oils and grease from entering the waterbody as well as continued clean-up activities. Activities that could introduce petroleum hydrocarbons, oils and grease to urban runoff include improper vehicle maintenance or use, improper handling or storage of petroleum products, accidental spills and illegal dumping or disposal. Increased public awareness of the importance of Noyes Slough as a resource and increased enforcement of local ordinances can help to reduce occurrence of sheens in the slough.

The objective of this TMDL and the following implementation measures will be to reduce contributions of petroleum hydrocarbons, oils, and grease to the slough so that visible sheen occurrence is no longer persistent and chronic.

There are a number of local groups already working toward the goal of reducing pollutants in the slough, including the Tanana Valley Watershed Association (TVWA), the co-permittees of the Fairbanks MS4 permit and Fairbanks North Star Borough. Some of the activities being led by these groups are described in Sections 6.1 through 6.5. Note that the requirements of the MS4 permits described in Section 6.2 are directed at general storm water education, not Noyes Slough specifically.

6.1. Watershed Groups

The TVWA is a local non-profit organization that seeks to ensure the recreational and economic benefits of the Tanana River and its tributaries, including Noyes Slough (TVWA 2007). The goal of the TVWA is to promote and improve the health of the Tanana Valley watershed through education, restoration, collaborative research, and community involvement. The TVWA would like to restore Noyes Slough to a natural recreational asset to the community of Fairbanks (Oasis 2008). TVWA is currently organizing an adopt-a-stream program, which is a volunteer-based effort. The goal of the program is to get residents and local businesses involved in monitoring the water quality and fish and wildlife habitat of local streams.

The TVWA applied for and received assistance from EPA for a Targeted Brownfield Assessment (TBA) of Noyes Slough. URS Corporation (URS) performed the environmental sampling in 2009 for the TVWA (URS 2010) (see results in Section 3.2). The TVWA has also received funding and technical support from the U.S. Fish and Wildlife Service and the National Park Service to develop a riparian management plan. The TVWA is partnering with the Fairbanks North Star Borough's Planning Department to develop the riparian management plan to address riparian set-back and low impact development Best Management Practices (BMPs).

6.2. MS4 Permits

6.2.1. Permit for the City of Fairbanks, City of North Pole, University of Alaska – Fairbanks, Alaska Department of Transportation and Public Facilities – Northern Regional Office

The MS4 permit for the co-permittees of the City of Fairbanks, the City of North Pole, the University of Alaska - Fairbanks, and the Alaska Department of Transportation and Public Facilities (AKS-053406) requires a Stormwater Management Plan (SWMP). The SWMP must include “BMPs, control techniques,

system design, engineering methods, and other provisions the co-permittees or EPA determines appropriate for the control of pollutants in discharges from the MS4” (USEPA 2005a).

The MS4 permit includes the following six minimum control measures:

1. Public education and outreach
2. Public involvement/participation
3. Illicit discharge detection and elimination
4. Construction site storm water runoff control
5. Post-construction storm water management in new development and redevelopment
6. Pollution prevention and good housekeeping for municipal operations

The minimum measures that are most relevant to controlling sheens in Noyes Slough are public education/outreach, public involvement/participation, illicit discharge detection and elimination, and pollution prevention and good housekeeping from municipal operations.

Public education and outreach is a tool that can be used to help reduce the occurrence of sheens in Noyes Slough. The MS4 permit requires stormwater education materials to be distributed annually. Educational items might include fliers, posters, magnets, and other items to promote interest. The MS4 permit also requires public service announcements (PSAs) to run annually in April. Newspaper, radio, and television can be used to show the public the impacts of stormwater pollution. Local newspapers can and are being used to highlight pollution issues in Noyes Slough including articles on local individuals working to prevent pollution and articles showing sources of the pollution. Stormwater issues can also be discussed on local radio talk shows in addition to radio PSAs. Public education and outreach activities completed during the 2009/2010 reporting year included hosting two stream cleanup events, implementing ongoing Volunteer Water Quality Monitoring and Adopt-A-Stream Programs, implementing a Storm Drain Stenciling Program, and convening monthly Fairbanks Stormwater Advisory Committee (FSWAC) meetings open to the public (COF 2010).

The MS4 co-permittees in collaboration with the FNSB also host an educational event each year called “Stormwater is Cool” in which a presentation is given in local elementary schools to deliver the message of how storm water can carry pollutants into surface waters and how those pollutants adversely affect the flora and fauna in local water bodies (COF 2010). It is estimated that in the spring of 2010 more than 500 students at eight elementary schools attended the presentation of “Stormwater is Cool.” There is one elementary school directly adjacent to Noyes Slough (Ann Wien Elementary). In 2011 the presentation will also be adapted for middle school students.

The public involvement and participation measure of the MS4 permit requires the co-permittees to implement a volunteer monitoring program (Shannon & Wilson, Inc. 2003). Volunteer monitoring of Noyes Slough and the urban runoff entering the slough is an effective way to increase the amount of water quality data collected while increasing public awareness of water quality issues. The FSWAC entered into a Memorandum of Agreement with the TVWA in April 2008 to implement the Volunteer Water Quality Monitoring and Adopt-A-Stream Programs on behalf of the FSWAC. The 2010 Annual Report (COF 2010) cites noteworthy program accomplishments from 2009 including two water quality sampling training sessions, the training of 13 new water quality monitoring volunteers, and a total of 21 sites sampled, some of which are in Noyes Slough.

The illicit discharge detection and elimination minimum controls include dry-weather screening of outfalls in high-priority areas (i.e., heavy industrial and commercial areas). The co-permittees survey outfalls within their respective jurisdictions during the summer.

The purpose of pollution prevention and good housekeeping is to develop and implement an operation and maintenance program (Shannon & Wilson, Inc. 2003). Each co-permittee is responsible for snow removal and street sanding operations during the winter months and street sweeping and storm drain cleaning operations during the summer months. Beginning in 2006, the co-permittees instituted an information tracking system for these activities to assist with reducing the discharge of pollutants to the MS4 (COF 2010).

6.2.2. Fairbanks North Star Borough Permit

The general requirements of the Fairbanks North Star Borough MS4 permit (AKS-053414) indicate that the Borough must submit DEC a written description of how Stormwater Management Program (SWMP) activities control the discharge of sediment, petroleum products, and debris to waters of the United States from MS4s.

As with the City of Fairbanks, City of North Pole, University of Alaska - Fairbanks, and Alaska Department of Transportation and Public Facilities MS4 permit (AKS-053406) described above, the Borough's permit requires the six minimum control measures (public education and outreach; public involvement/participation; illicit discharge detection and elimination; construction site storm water runoff control; post-construction storm water management in new development and redevelopment; and pollution prevention and good housekeeping for municipal operations).

The public education and participation requirements of the permit include

- Planning and implementing a public education program for local audiences
- Distributing stormwater education materials to target audiences
- Preparing and distributing outreach material to local print and broadcast media
- Organizing and hosting an annual "Stream Clean-up day"
- Developing an appropriate and ongoing means of providing stormwater information to the public and for receiving information from the public such as a website or staffed telephone hotline
- Convening and participating in a volunteer citizen committee to guide and advise the Borough on its stormwater activities.

The Borough is working with the City of Fairbanks, City of North Pole, University of Alaska – Fairbanks, and Alaska Department of Transportation and Public Facilities - Northern Region (i.e., co-permittees of the other MS4 permit in the watershed) to meet the public education and participation requirements of their permit (FNSB 2010a).

The Borough's MS4 permit requires the adoption of an ordinance or other control measure to prohibit any non-stormwater discharges to the stormwater system and implement appropriate enforcement procedures and actions. In 2008, the Borough adopted Ordinance 2008-22, which prohibits illicit discharges to the MS4 through stormwater, direct dumping, or snow clearance operations and requires immediate notification upon identifying a violation (see Section 6.3). The permit also outlines a plan to detect and address non-stormwater discharges. The plan includes informing public employees, businesses, and the general public of the hazards associated with illegal discharges and improper waste disposal (FNSB 2010a).

6.3. Local Ordinances

In addition to the requirements of the MS4 permits, both the City of Fairbanks and the Fairbanks North Star Borough have ordinances that address illicit discharges. The City of Fairbanks's illicit discharge ordinance prohibits the deposition of any solid waste, garbage, rubbish, junk, fill, dirt, snow or other

material in such a manner as to obstruct, impound, pollute, or cause siltation of any waterbody unless allowed by federal, state, or local permit. FNSB's illicit discharge ordinance considers oil or other substances in amounts sufficient to create a visible film or sheen on the receiving waters to be a pollutant. No person shall deposit, dump, abandon, throw, scatter, or transport solid waste, garbage, rubbish, junk, fill, soil, dirt, or other material in such a manner as to obstruct, impound, or cause siltation to the MS4 except as otherwise allowed by valid federal, state, or local permits. No person shall dispose of snow directly into the MS4.

If the City of Fairbanks finds that this ordinance has been violated, the responsible party might be responsible for the following:

1. the performance of monitoring, analyses, and reporting;
2. the elimination of illicit connections or discharges;
3. violating discharges, practices, or operations shall cease and desist;
4. the abatement or remediation of storm water pollution or contamination hazards and the restoration of any affected property; and
5. payment of a fine to cover administrative and remediation costs; and
6. the implementation of source control or treatment BMPs.

Increased enforcement of the City of Fairbanks's and FNSB's ordinances is important to reducing the occurrence of sheens in Noyes Slough.

6.4. Best Management Practices

6.4.1. Stormwater Management Guides

The Cities of Fairbanks and North Pole as well as the Fairbanks North Star Borough (FNSB) have stormwater management guides that provide an overview of the stormwater management design and construction requirements for new development and redevelopment projects regulated by the City of Fairbanks and City of North Pole and the FNSB (COF and CONP 2010; FNSB 2010b). The guides are part of a collaborative effort by the two cities and the FNSB to educate developers, engineers, contractors, and the general public about local stormwater pollution control laws. The guides include information regarding effective BMPs for the Fairbanks Urbanized Area (Figure 4-1) used to control the adverse water quality impacts associated with stormwater runoff.

New development and redevelopment projects that result in a ground disturbance of greater than or equal to one acre (when constructed) 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 stormwater BMPs approved prior to construction.

Developers must ensure the project design and construction site controls adhere to all approved TMDLs, as well as identify other potential pollutants of concern so appropriate BMPs are selected to address those pollutants. The stormwater management guides specifically identify the following potential sources of oil and grease: residential and commercial development, car wash facilities, gas stations/automotive repair shops, shopping centers, and streets and highways.

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. The stormwater guides list recommended non-structural BMPs (management practices that can be implemented without constructing physical improvements) and structural BMPs (physical improvements) for use in the urbanized area. Examples of non-structural and structural BMPs that address oil and grease runoff are presented in Table 6-1.

Table 6-1. Examples of Non-structural and Structural BMPs

Non-structural/ Structural	Type of BMP	Examples of BMPs
Non-structural	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
Structural BMPs	Erosion Control or Stabilization	Mark clearing limits
		Surface roughening and terracing
		Mulching
		Temporary seeding or sodding
		Use of manufactured rolled products (nets, blankets, etc.)
	Treatment Practices	Bioretention
		Infiltration
		Filtering practices
		Dry ponds
		Grass channels
		Filter strips

Sources: COF and CONP 2010; FNSB 2010b

The stormwater management guides also specifically mention BMPs for snow removal and parking lots, which are both potential sources of oil and grease to Noyes Slough. Snow removed from roads and parking lots contains various pollutants including oil and grease from automotive fluids. These pollutants are easily transported with snowmelt runoff; therefore, it is important to carefully dispose of the collected snow. The DEC has developed Snow Disposal Area Siting Guidance for the selection, preparation, and maintenance of snow disposal sites². DEC's snow disposal guide should be used for all new development or redevelopment projects regulated by the City of Fairbanks and City of North Pole or FNSB that include a constructed snow disposal facility.

Parking lots can collect many types of pollutants including oil and grease. These pollutants are often released in large concentrations from parking lots during spring break-up and summer rain events, causing a threat to nearby waterbodies. The cities of Fairbanks and North Pole and the FNSB require that permanent stormwater treatment BMPs are included in the Permanent Stormwater Control Plan (PSWCP) for parking areas that serve commercial developments or multi-family residential lots. Parking lot maintenance practices, such as sweeping, must also be addressed (COF and CONP 2010; FNSB 2010b).

² http://www.dec.state.ak.us/water/wnpssc/pdfs/dec_snowdisposal_siting_guidance_2007.pdf

6.4.2. Green Infrastructure BMPs

In 2009 the City of Fairbanks, the Cold Climate Housing Research Center (CCHRC), GW Scientific (GWS), and Fairbanks Soil & Water Conservation District (FSWCD) received a grant from the Alaska Department of Natural Resources to develop the *Green Infrastructure Resource Guide* for homeowners in the Fairbanks area as part of an effort to prevent water pollution and improve water quality in their communities (Heinchon and Murray 2010).

The *Green Infrastructure Resource Guide* contains information about green infrastructure BMPs that can be used to manage wet weather runoff through infiltration, evapotranspiration, capture, and reuse of water from rain and melting snow. The *Green Infrastructure Resource Guide* is intended to be a resource for homeowners in the Fairbanks area who wish to construct these types of BMPs on their properties for the purpose of mitigating the urban runoff and associated pollutants that flow into the Chena River and Noyes Slough.

Ten BMPs are included in the Guide as appropriate for residential use in the Fairbanks area based on the feasibility, cost-effectiveness, ease of installation, and level of maintenance. The ten BMPs include rain barrels, rain gardens, tree pits, infiltration and flow-through planters, dry wells, swales and berms, green roofs, permeable pavers, grass reinforcement mesh, and riparian buffers.

Handouts were produced for homeowners to help them choose BMPs that are appropriate for their property and lifestyle. Each handout includes: an explanation of the BMP; installation difficulty; cold climate considerations for the BMP; materials list; tools required; installation steps; a diagram of the BMP; expected maintenance; cost estimate; time estimate; pros and cons of the BMP; and a list of sources for more information. The *Green Infrastructure Resource Guide* can be found at: www.cchrc.org/green-infrastructure.

7. Monitoring

Future monitoring will need to occur on Noyes Slough to allow DEC to track changes in sheen occurrence and determine whether acceptable progress is being made. DEC will work with the City of Fairbanks and co-permittees, the Fairbanks North Star Borough, and other interested parties to include a record of observations of sheens as part of the stormwater outfall monitoring program. The Adopt-a-Stream volunteer water quality monitoring program for sites on Noyes Slough may also conduct observations. Both monitoring programs are components of the MS4 permit. Future monitoring should include sites where data already exist and, at a minimum, observations should occur monthly during the open water season during periods of both wet and dry weather. DEC will provide information on the differences between petroleum sheens and naturally occurring sheens and suggestions for what information monitors will need to record. Monitoring should also include further evaluation of potential sources of sheen to the slough.

8. Public Comments

Federal regulations require EPA to notify the public and seek comment concerning TMDLs it prepares. This TMDL was developed under contract to EPA, and a public review period will be held seeking comments, information, and data from the public and any other interested party. The notice for the public review period was posted on August 22, 2011, and the review period closed on September 22, 2011. A public meeting regarding the Noyes Slough petroleum hydrocarbons, oils and grease TMDL was also held on September 15, 2011 at DEC in Fairbanks.

Comments on the TMDL were received from the City of Fairbanks, the Alaska Department of Transportation and Public Facilities, and the EPA. Comments and additional information submitted during this public comment period were used to inform or revise this TMDL document.

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