

# CITY OF NORTH BEND

KING COUNTY

WASHINGTON



## STORMWATER COMPREHENSIVE PLAN UPDATE

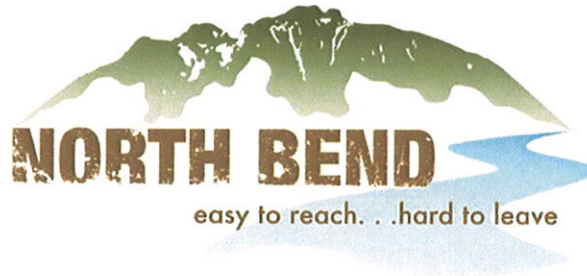
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DECEMBER 2013**



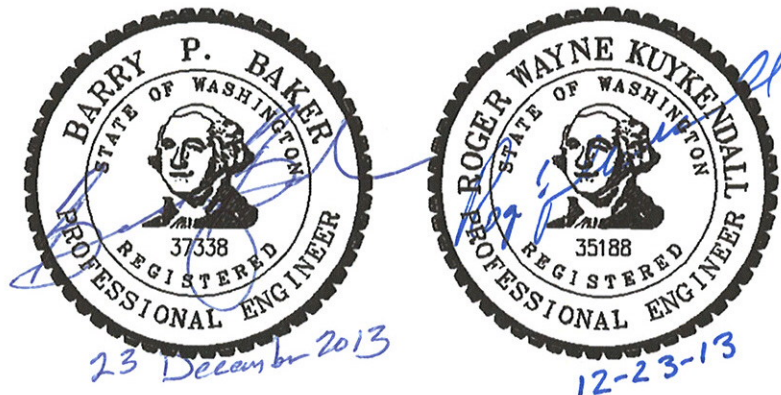
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WASHINGTON



## STORMWATER COMPREHENSIVE PLAN UPDATE



G&O #11490  
DECEMBER 2013



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## EXECUTIVE SUMMARY

This Stormwater Comprehensive Management Plan (Plan) for the City of North Bend serves as an update to the 2001 Comprehensive Stormwater Management Plan approved and adopted by the North Bend City Council in December 2001. This Plan summarizes the City's accomplishments and completed projects from the 2001 project list, identifies new issues, and discusses other pertinent matters relating to stormwater management. It will provide City staff and policy makers the necessary information to further implement the stormwater management program in a manner that is effective and compliant with current regulations. The Plan is organized to provide scope and background information in the beginning chapters and detailed information on the City's drainage system, operation and maintenance, and recommendations in the latter chapters.

As determined by the City's Geographic Information System (GIS), the City maintains approximately 26 miles of stormwater conveyance systems, six detention and/or water quality facilities, 1,600 catch basins, and 36 outfalls to river waters. In addition, there are many privately owned and maintained drainage facilities in the City. Drainage basins are determined by topography and runoff collection/conveyance facilities. Detailed information on each basin is provided in Chapter 2.

Regulatory considerations are provided in Chapter 3. In addition to the Federal, State and County regulations, the City's specific codes regarding stormwater runoff are included in the North Bend Municipal Code, Titles 13.44, 14.16, and 19.04.

To estimate the peak runoff flows produced from specific drainage basins, data was collected using existing Geographic Information System data, as-builts maps of developments, local survey, and field reconnaissance. The data was put into the Western Washington Hydrologic Model (WWHM) computer model for analysis. Chapter 4 provides background and findings of the analysis.

Chapters 5 and 6 outline nonpoint source pollution analysis and control, and conveyance systems, respectively. Maintenance activities and costs are outlined in Chapter 7 and include facility inspection, routine maintenance standards, equipment purchases, staff training, enforcement, public education and outreach, and use of best management practices.

Chapter 8 identifies the capital improvement projects, and lays out an order of project completion according to priority and budgetary limitations. For development of the Capital Improvement Plan (CIP), there were no new projects identified from the hydrologic modeling. The outstanding CIPs from the 2001 Stormwater Comprehensive Plan are discussed and reprioritized in this chapter. In addition to the Capital Projects, costs for program plan expenditures are provided. The Capital Improvement Plan construction cost estimate for the 2014-2019 6-year planning horizon is approximately \$1.08 million (2013 dollars). Please note that Project 3.3, Portable Pump Purchase (2013), is included in the 6-year CIP (2014-2019) due to the timing of the completion of

this plan update. All projects are proposed to be City funded with the exception of CIP 12.1 which will partially be funded by the King County Flood Control Zone District. A list of the capital projects included in the 6-year plan is summarized in Table E-1. For the 20-year planning horizon, the total estimated cost of the capital projects surpasses \$9.4 million (2013 dollars).

A simply cash flow budget/rate analysis showing storm drainage utility revenues and expenditures for program plan implementation is provided in Chapter 9. Stormwater utility rates are used to support the City's expenditures including both operation and maintenance as well as capital improvement projects. The current stormwater utility rate per ESU is \$9.86 per month, and the analysis does not show a need for an increase to support ongoing operations and maintenance and proposed capital projects for the next 6 years. However, the current rate is not sufficient to support operation & maintenance and completion of all capital projects identified for the 20-year planning horizon.

**TABLE E-1****2014-2019 Capital Improvement Projects (6-Year Plan)**

| <b>CIP No.</b> | <b>Title</b>                                                                                         | <b>Year</b> | <b>Cost<sup>(1)</sup></b> |
|----------------|------------------------------------------------------------------------------------------------------|-------------|---------------------------|
| 3.3            | Purchase Portable Pump                                                                               | 2013        | \$90,000                  |
| 12.1           | Ribary Creek D/S I-90                                                                                | 2014        | \$209,000                 |
| 5.1            | NE 12 <sup>th</sup> Street (Replace two 18-inch RCP culverts (50 LF) with a 48-inch culvert)         | 2015        | \$130,000                 |
| 4.2            | NE 12 <sup>th</sup> Street (Install 65 LF 48-inch culvert parallel to existing 36-inch RCP culvert ) | 2015        | \$147,000                 |
| 1.5            | Drainage swale from East 4 <sup>th</sup> Street culvert to Pond 1                                    | 2018        | \$310,000                 |
| 7.1            | Ballarat Avenue NE Culvert                                                                           | 2019        | \$190,000                 |
| <b>Total</b>   |                                                                                                      |             | <b>\$1,076,000</b>        |

(1) 2013 dollars.

# **CHAPTER 1**

## **INTRODUCTION**

Due to its location in the floodplain of the Middle and South Forks of the Snoqualmie River, the City of North Bend has a long history of flooding during high runoff events for these rivers, which can occur during storms, or a combination of rainfall and snow melt. In addition, because much of the City lies within the flat, alluvial valley of the two rivers, high precipitation events can cause localized flooding not related to the level of the rivers. The 2001 Plan identified 33 separate capital projects to replace pipes and culverts to allow the City to drain quicker. Issues relating to the rivers overflowing their banks are discussed in the update to the Flood Hazard Mitigation Plan, completed in 2011.

Prior to the late 1970s, stormwater management in the U.S. and specifically the Puget Sound region consisted primarily of conveying runoff away from developed areas in order to preserve the health and safety of citizens and protect property, both public and private. Drainage improvement projects addressed large storm events and local flooding with little thought for upstream, downstream, or environmental impacts. With the passage of the Clean Water Act in 1972, completion of the Nationwide Urban Runoff Program in 1983, and subsequently other federal and state laws, the cumulative effects of smaller storms in developed/urbanized areas were formally recognized as a major contributor to water quality and habitat degradation.

Stormwater runoff picks up and carries sediment and pollutants from exposed construction sites and agricultural areas and pollutants from residential, commercial, and industrial developments. Pollutants in stormwater runoff include metals such as lead, cadmium, and copper; oil and grease; pesticides and fertilizers; nutrients; suspended solids; and harmful bacteria. In addition, urbanization increases the amount of impervious surfaces such as rooftops, streets, and parking areas. Impervious surfaces directly relate to an increase in runoff volumes and peak flow rates. The pollutant loads and increased volumes of stormwater runoff result in negative impacts to downstream properties and surface water bodies such as lakes, streams, and wetlands and reduced infiltration to groundwater. Due to regulations required under the Clean Water Act and the listing of anadromous (salmon, trout, char) species under the Endangered Species Act, it has become increasingly important for municipalities to implement stormwater quality and quantity (flow) control measures.

## **PURPOSE**

The City of North Bend Stormwater Comprehensive Plan (Plan) is a planning document that provides guidance to minimize adverse effects of stormwater runoff on ground and surface water. It identifies water quality and quantity problems associated with stormwater runoff that may affect the environment and community, and provides

recommendations for improvements and programs including a cost analysis and implementation schedule.

The Plan identifies specific structural and nonstructural solutions to quantity and water quality problems within the City. Structural solutions include construction of capital projects such as stormwater detention and treatment facilities, infiltration facilities, pipelines, and culverts. Nonstructural solutions include stormwater management facility inspection and maintenance, public education and outreach, water quality monitoring, implementation of best management practices, and regulations encouraging vegetation preservation and low impact development. Specific components in the Scope of Work include:

- Gather background and facility information for the areas annexed since 2001, customer complaints regarding flooding and water quality, and current financial information for the stormwater program;
- Update the stormwater GIS maps;
- Create and distribute a questionnaire to the general population;
- Review current regulations and ordinances and make recommendations for revisions;
- Model the annexed areas to identify conveyance problems;
- Review the current operations and maintenance procedures and level of effort and provide recommendations for the future level of effort, with staffing and costs;
- Perform field work and solicit information regarding water quality problems;
- Identify structural and non-structural solutions for resolving the identified water quality and quantity problems;
- Conduct a public workshop;
- Update the Capital Improvement Plan;
- Review the City's stormwater utility fees and make recommendations for adjustments;
- Assist City staff in presenting the Plan to the Planning Commission and City Council; and

- Provide a final Plan to the City.

## GOALS

As additional development and redevelopment occur within the City, the amount of naturally vegetated areas will decrease while the amount of impervious surfaces will increase, leading ultimately to increased peak runoff rates and transport of more pollutants to the City's streams, wetlands, and rivers.

The primary goal of the North Bend Stormwater Comprehensive Plan is to provide guidance to the City Council, staff, and citizens to preserve and protect the water quality and hydraulic regime within the City's natural and manmade stormwater drainage system, and the major receiving waters, the Middle and South Fork Snoqualmie Rivers.

To this end, the City intends to manage land development and stormwater programs to preserve natural areas, minimize contact with contaminants, mitigate the impacts of increased runoff, enforce permit conditions and erosion control BMPs on construction sites, and to preserve fish and wildlife habitat. The City's implementation of the Plan will meet the goals to protect the health, safety, and welfare of the local citizenry and to preserve surface water resources within, and downstream of, the City.

## **CHAPTER 2**

### **DRAINAGE AREA CHARACTERISTICS**

#### **LOCATION**

The City of North Bend (City) was officially incorporated in Washington State in 1909. The City's current boundary and Urban Growth Area (UGA) respectively encompass approximately 4.4 square miles of land (boundaries shown in Figure 2-1). The City is located in King County, approximately 30 miles east of Seattle, with the nearest incorporated area of Snoqualmie adjacent to the west. Interstate 90 and State Route 202 pass through the City. Figure 2-1 provides a vicinity map of the area.

North Bend is a combination of residential and commercial communities. Per the census conducted in 2010, the current population is approximately 5,731, representing 0.3 percent of the total population of King County. The commercial and industrial use is mostly located on the west side of the City (near the downtown area) and along North Bend Way out to Truck Town. The remaining areas are designated as residential with some open space.

#### **TOPOGRAPHY**

The City of North Bend is nestled in the valley of the South and Middle Fork Snoqualmie Rivers, between Mt. Si (elevation 4,167) to the north/northeast and Rattlesnake Ridge (elevation 3,200+), to the west/southwest. As the last city along the I-90 corridor prior to reaching Snoqualmie Pass, North Bend serves as the gateway to the Cascades. The City of Snoqualmie lies to the northwest, adjacent to SR 202. To the east lays the western slopes of the Cascades.

Elevations within the City range from approximately 420 feet to 775 feet, sloping towards the rivers flowing through the City. The Snoqualmie River is moderately sloped toward Puget Sound. City topography is shown in Figure 2-2.

#### **DRAINAGE BASINS**

The City of North Bend lies within, or adjacent to, the drainage basins of two rivers, the Middle Fork Snoqualmie River and South Fork Snoqualmie River. These basins encompass approximately 154 and 82 square miles, respectively, upstream of the City. We have delineated 15 smaller drainage basins lying within, or tributary to, the City's drainage infrastructure, as shown in Figure 2-3.

## **WATERWAYS AND WATER BODIES**

The Middle Fork Snoqualmie River channel lies outside the northern City limits but portions of the City are tributary to the river. Most of the area that drains directly to the Middle Fork lays east of Mt. Si Road. The river flows north/northwest and converges with the South Fork Snoqualmie River just north of the City limits.

The South Fork Snoqualmie River is the major waterway that flows through the Tanner neighborhood and the west portion of the City. Gardiner, Ribary, and Silver Creeks all flow into this river, as well as several smaller, unnamed tributaries within the City. The river runs mainly through areas zoned as residential but also flows through open space and undeveloped and developed commercial properties. Sections of the City's waterways are channelized and maintained to protect property from flood damage.

Gardiner Creek runs near the western border of the City. The creek originates outside the City limits and flows into the southwest corner of the City and continues north behind the Outlet Mall and undeveloped commercial properties. It converges with the South Fork Snoqualmie River just north of the City limits.

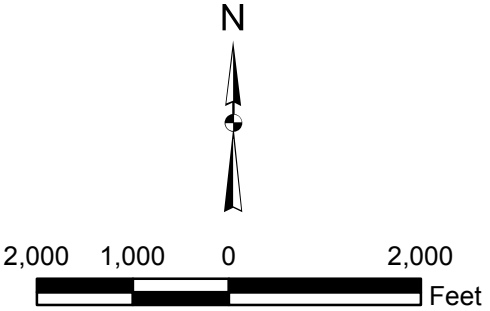
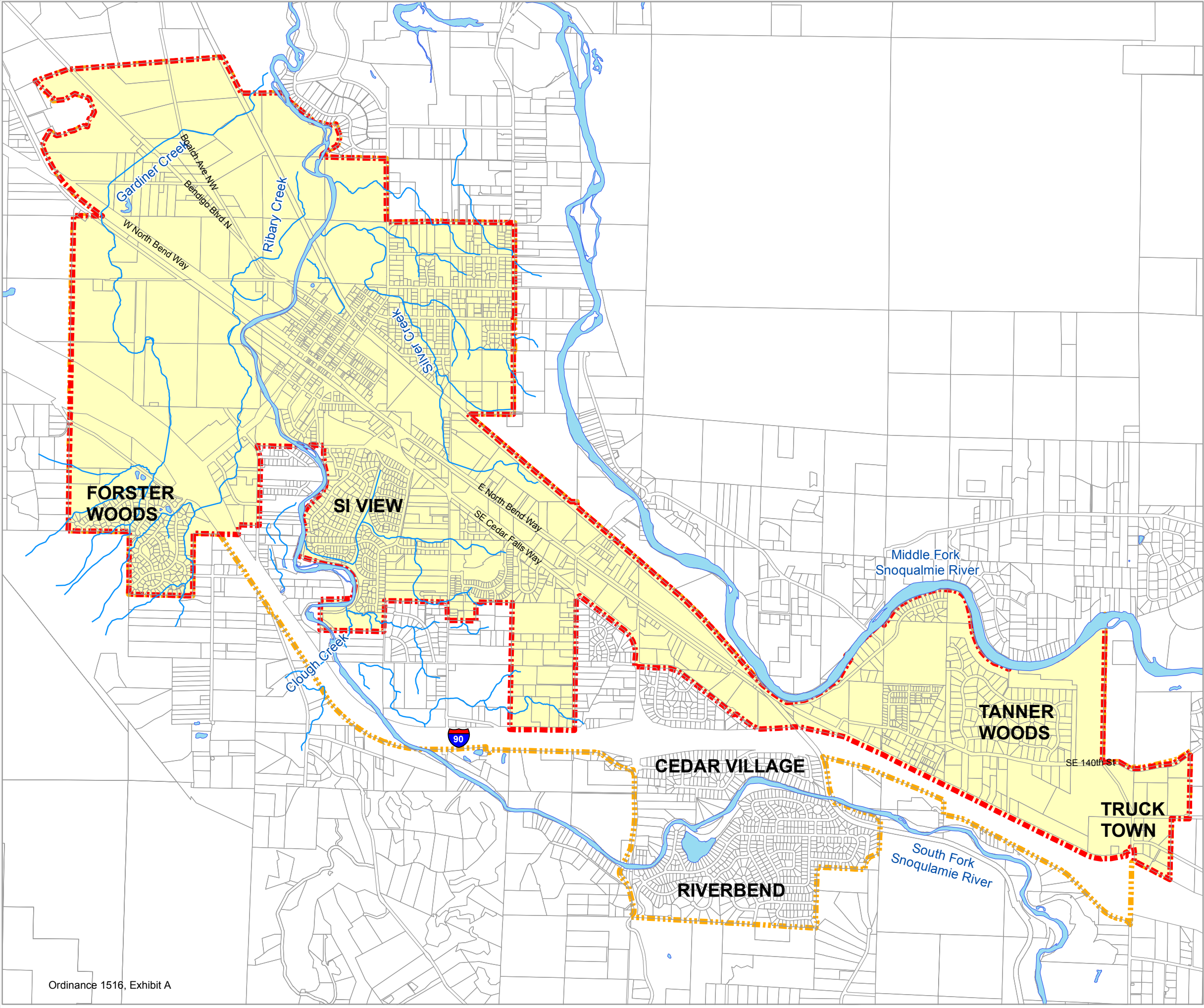
Ribary Creek also originates outside the southwest corner of the City. It runs north, parallel to the South Fork Snoqualmie River, and then converges with the river at the northern City limits, just upstream of the Gardiner Creek convergence. Both Gardiner and Ribary Creeks originate in the forested foothills outside the City and flow through some residential and commercial areas before reaching the river.

Silver Creek is in the northeast portion of the City. It flows northwest into the South Fork Snoqualmie River upstream of the Ribary Creek convergence. The drainage area of this creek is mainly residential with some open space areas.

## **SOILS**

Soils found within the City include soils comprised of till, outwash, alluvium, and volcanic ash. In general, soils within the more heavily developed areas are alluvial soils, and soils near the City limits in the forested areas are generally outwash soils. There are also glacial till and volcanic ash soils within the City limits.

The soils of King County were surveyed by the Soil Conservation Service (SCS). The SCS website indicates 11 soil types (e.g., silt loam, gravelly sandy loam, muck, etc.,) within the general UGA of North Bend, as shown in Figure 2-4 and Table 2-1. The areas mapped using the SCS mapping tool are not exactly aligned with the City limits or UGA for North Bend, so exact acreages are not available. Also, several of these soil types represent fractions of one percent of the soil within North Bend. The SCS classifies soils, from A to D, according to runoff potential. Type A has low runoff potential and type D has high runoff potential. The SCS also provides information pertaining to the physical and chemical properties of the soils, including drainage class. Table 2-1 summarizes the



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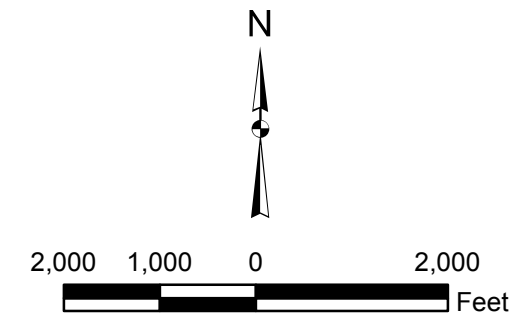
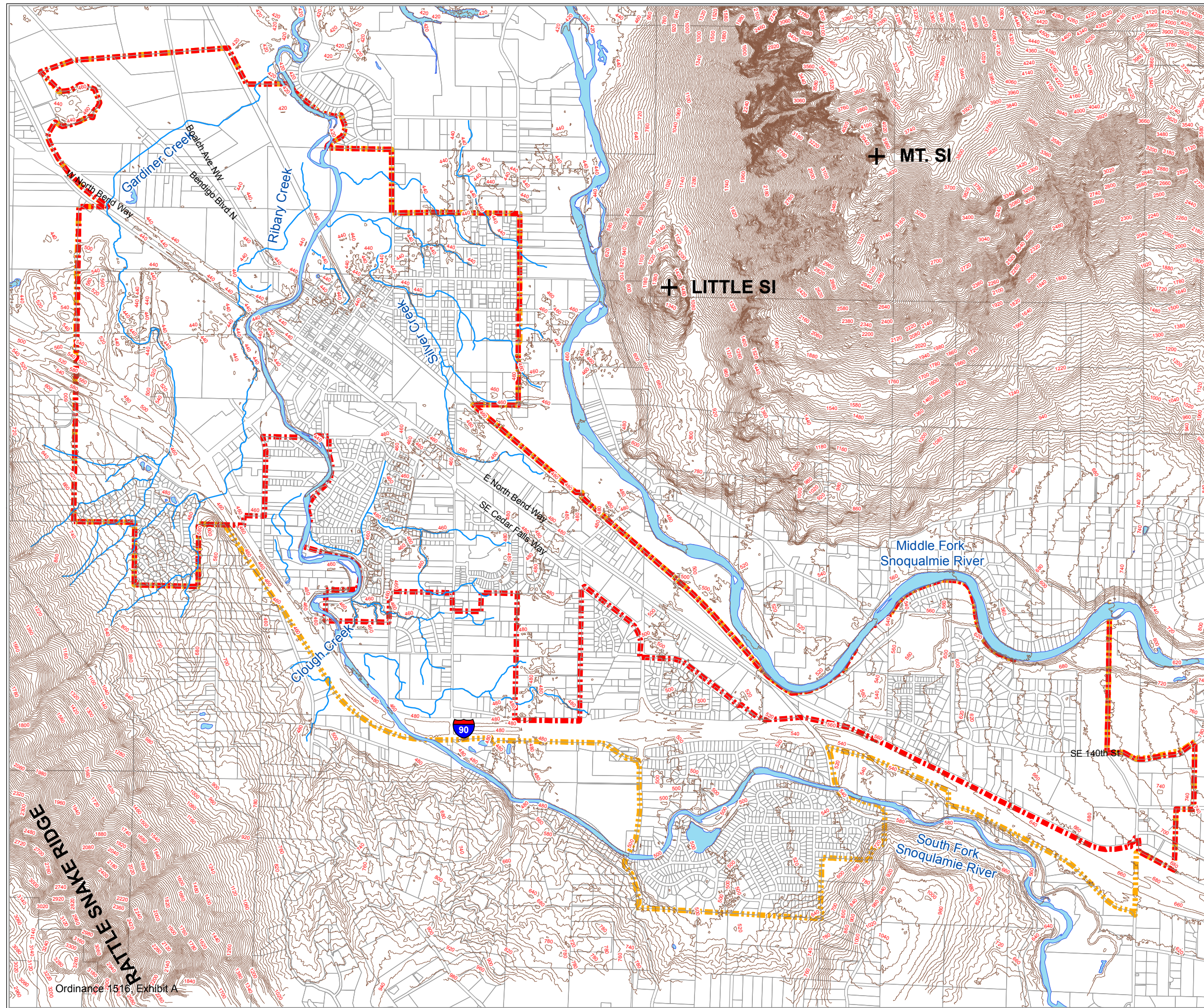
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-  UGA LIMITS
-  RIVERS
-  STREAMS
-  PARCELS

**CITY OF NORTH BEND**

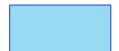
STORMWATER COMPREHENSIVE PLAN  
FIGURE 2-1  
VICINITY MAP







### LEGEND:

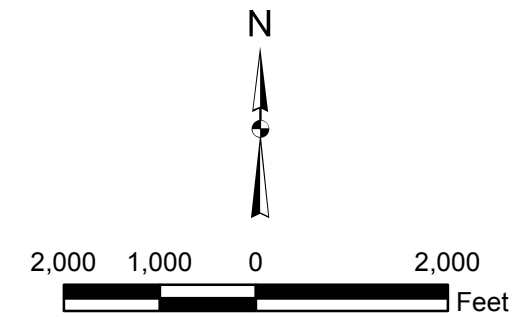
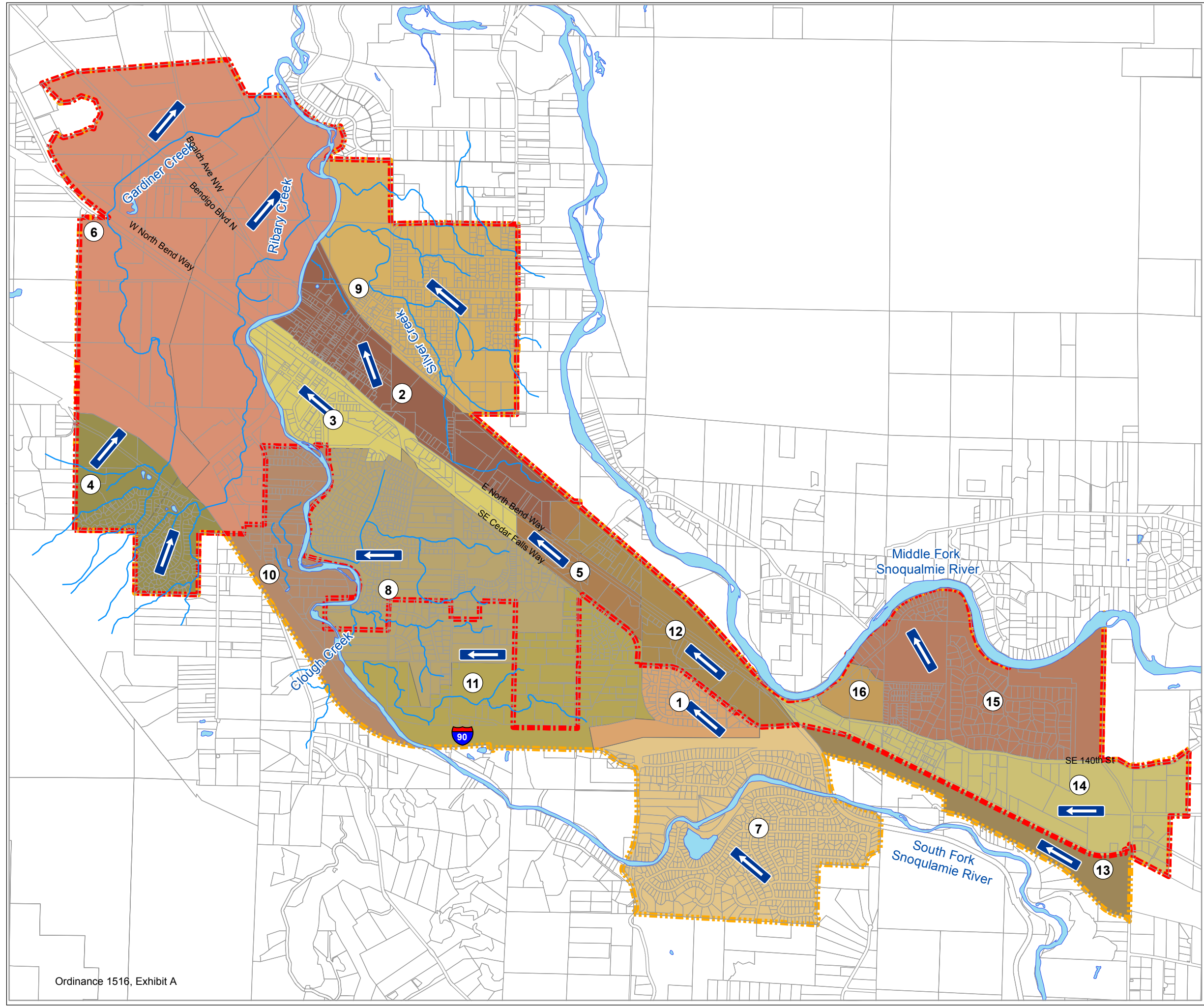
-  CITY LIMITS
-  UGA LIMITS
-  RIVERS
-  STREAMS
-  PARCELS
-  20 FOOT CONTOURS - LIDAR

### CITY OF NORTH BEND

STORMWATER COMPREHENSIVE PLAN  
FIGURE 2-2  
TOPOGRAPHY MAP







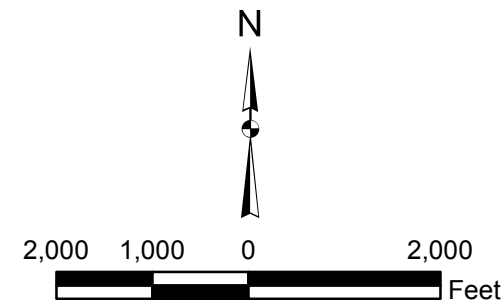
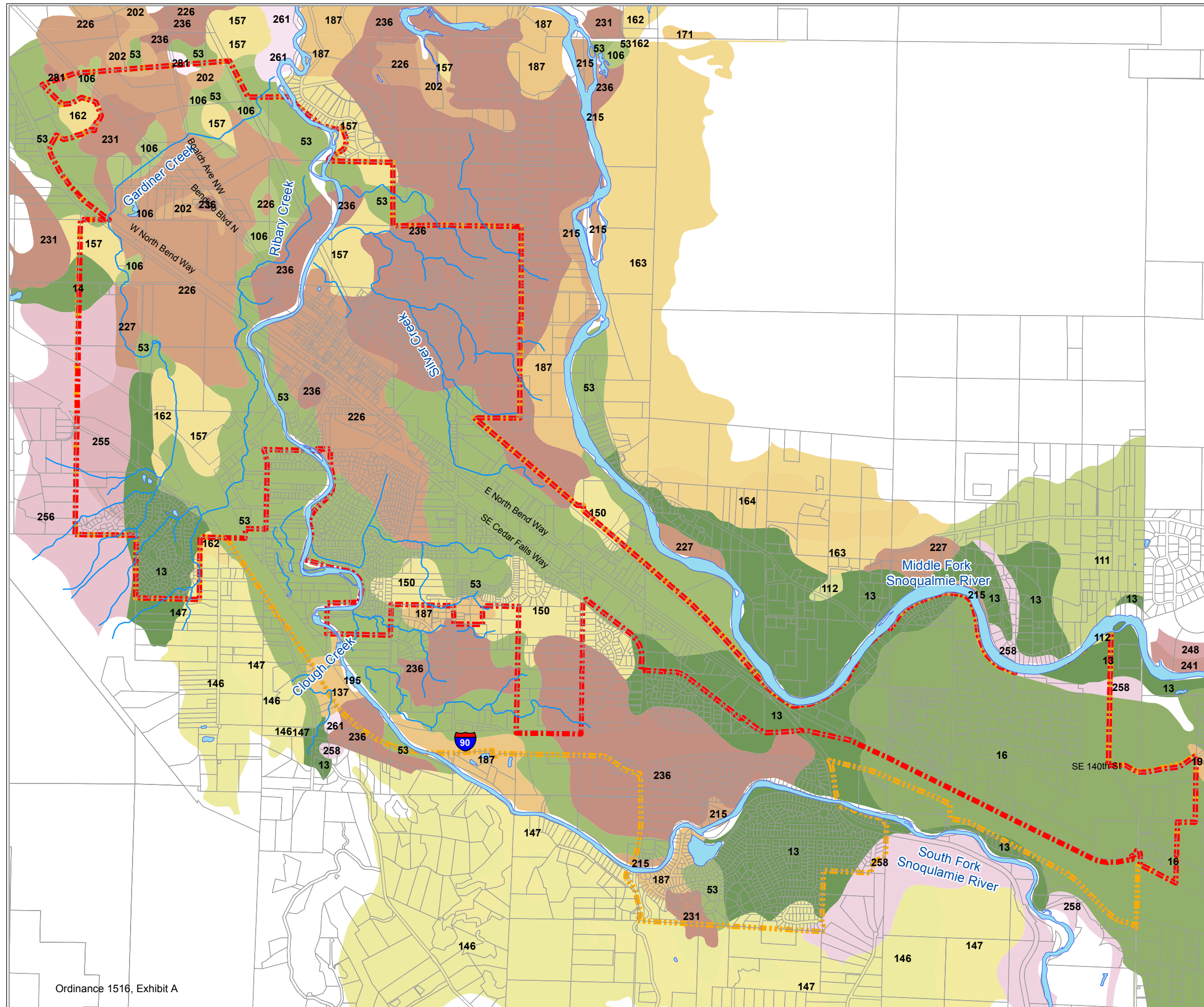
- LEGEND:**
- STORM DRAINAGE FLOW
  - CITY LIMITS
  - UGA LIMITS
  - RIVERS
  - STREAMS
  - PARCELS
- DRAINAGE BASINS:**
- 1 Alpine Estates
  - 2 Central Business District North (CBDN)
  - 3 Central Business District South (CBDS)
  - 4 Forster Woods Southwest (FWSW)
  - 5 Mt Si Vista
  - 6 Ribary/Gardiner Creek West (RGCW)
  - 7 Riverbend South
  - 8 Si View Southeast (SVSE)
  - 9 Silver Creek Northeast (SCNE)
  - 10 South Fork
  - 11 South Si View
  - 12 Tanner Landing
  - 13 Tanner South
  - 14 Tanner West
  - 15 Tanner Woods North
  - 16 Thorton

**CITY OF NORTH BEND**

STORMWATER COMPREHENSIVE PLAN  
FIGURE 2-3  
HYDROLOGY MAP

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**LEGEND:**

- SOIL MAP UNITS**
- 13
  - 14
  - 16
  - 53
  - 106
  - 111
  - 112
  - 146
  - 147
  - 150
  - 157
  - 162
  - 163
  - 164
  - 171
  - 187
  - 195
  - 202
  - 215
  - 226
  - 227
  - 231
  - 236
  - 241
  - 248
  - 255
  - 256
  - 258
  - 261
  - 281
- CITY LIMITS
- UGA LIMITS
- RIVERS
- STREAMS
- PARCELS

**CITY OF NORTH BEND**

STORMWATER COMPREHENSIVE PLAN  
FIGURE 2-4  
SOILS MAP



significant soil groups and drainage class of the soils found within North Bend's UGA. Appendix A contains the full soil descriptions for all soils listed below.

**TABLE 2-1****Soil Characteristics**

| <b>Soil</b>                   | <b>Hydrologic Soil Group</b> | <b>Drainage Class Rating</b> |
|-------------------------------|------------------------------|------------------------------|
| Barneston gravelly sandy loam | C                            | Somewhat excessively drained |
| Edgewick silt loam            | C                            | Well drained                 |
| Klaber silt loam              | A                            | Poorly drained               |
| Klaus sandy loam              | C                            | Well drained                 |
| Nargar fine sandy loam        | A                            | Well drained                 |
| Neilton gravelly loamy sand   | A                            | Excessively drained          |
| Nooksack silt loam            | C                            | Moderately well drained      |
| Ogarty gravelly loam          | C                            | Well drained                 |
| Pilchuck loamy fine sand      | C                            | Somewhat excessively drained |
| Puget silty clay loam         | D                            | Poorly drained               |
| Riverwash                     | N/A                          | N/A - Floodplain             |
| Salal silt loam               | C                            | Moderately well drained      |
| Sauk silt loam                | B                            | Well drained                 |
| Seattle muck                  | D                            | Very poorly drained          |
| Si silt loam                  | C                            | Moderately well drained      |
| Tokul gravelly loam           | C                            | Moderately well drained      |
| Tokul-Pastik complex          | C                            | Moderately well drained      |
| Woodinville silt loam         | C                            | Moderately well drained      |

**ZONING AND LAND USE**

City land use and zoning is shown in Figure 2-5 and Figure 2-6, respectively. The City has a combination of residential, commercial, industrial and open space zoning. There are four types of commercial zoning: Downtown, Interchange, Interchange Mixed Use and Neighborhood Business. These commercially zoned areas are located primarily on the west side of the City near the downtown area and also along North Bend Way. The open space areas are mainly located at the northwest corner of the City. There is a commercially zoned Neighborhood Business area located within the open space area. Public facilities include the City Hall, a public works complex, the wastewater treatment plant, community center, post office, fire/rescue station, police station, park facilities, library, and schools.

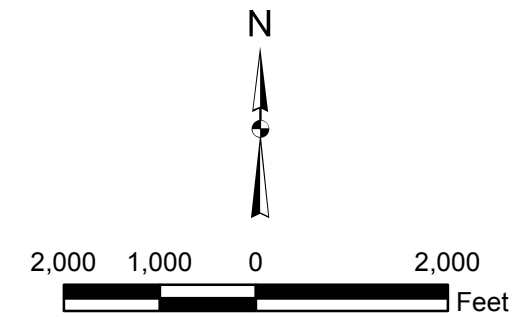
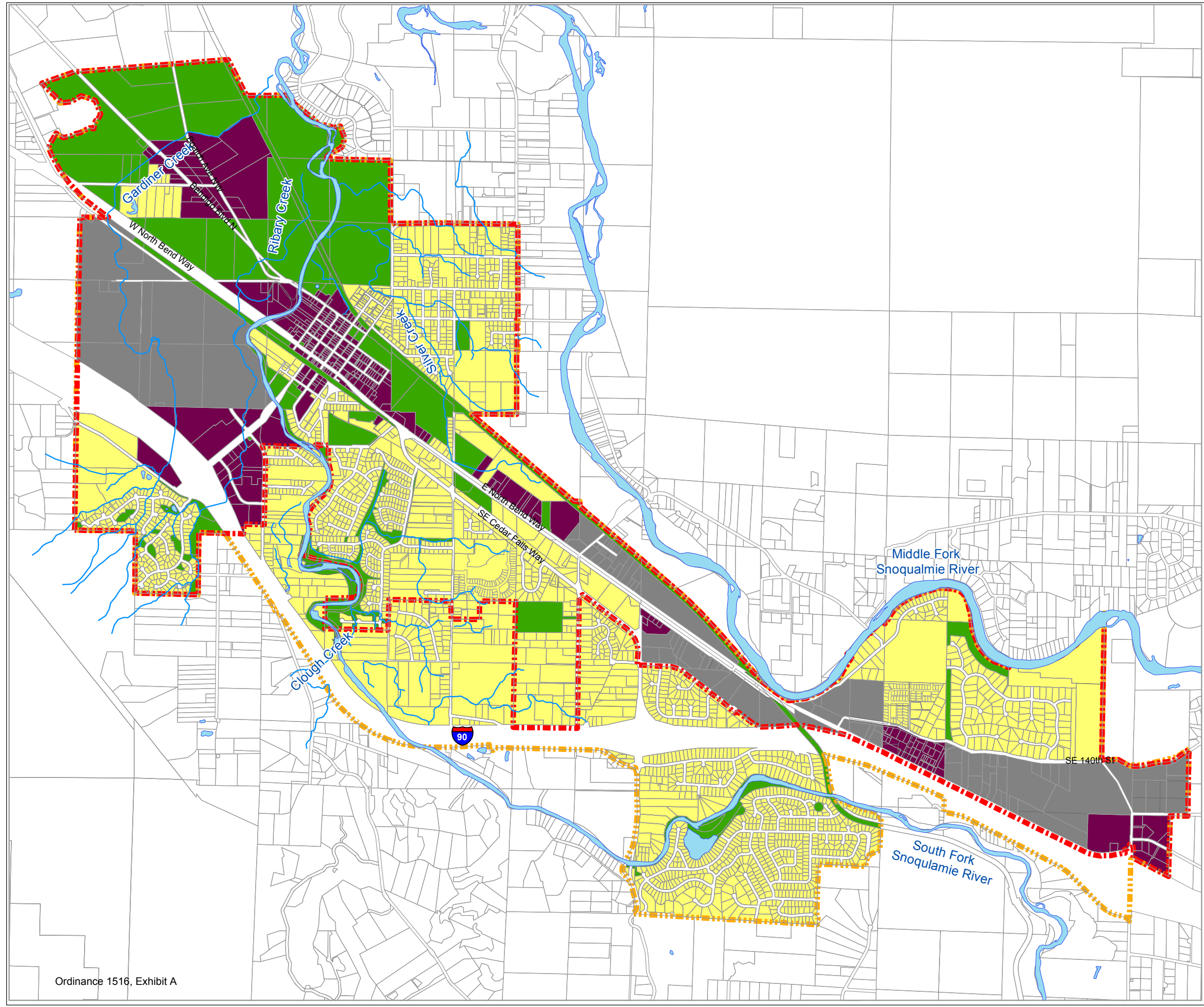
Per the 2010 census, the population in North Bend was 5,731, growing approximately 20 percent between years 2000 and 2010 due mostly to annexations. Land use and zoning play an important role in determining growth patterns, and therefore the potential

locations of future storm water facilities. Future land use and changing population densities, as directed by applicable zoning ordinances, can significantly impact a system's ability to provide adequate services to specific areas.

The following classifications identify the main types of zoned land uses within the City:

- Low Density Residential (LDR): Single-family residential dwelling units (du) with a maximum density of 4 units per acre.
- High Density Residential (HDR): Multi-family residential dwelling units with a density of 9 to 18 units per acre.
- Cottage Residential (CR): Smaller, detached single-family dwelling unit designed to look like larger single-family dwelling units.
- Downtown Commercial: Any single commercial use building, excluding full-service supermarkets and hotels/motels, with a gross floor area of 5,000 square feet or less, or a shopping complex with a single building, excluding full-service supermarkets, 8,000 square feet or less and a cumulative square footage of less than 20,000 square feet gross floor area. Individual downtown commercial buildings may be up to 10,000 square feet if considered "anchors."
- Interchange Commercial: Any single commercial use building with a gross floor area over 10,000 or a shopping complex with any single building over 8,000 square feet gross floor area, and a cumulative square footage of 20,000 square feet gross floor area or greater. For permitted land uses interchange-commercial may include buildings and/or shopping complexes less than 10,000 square foot gross floor area and 20,000 square foot gross floor area, respectively.
- Interchange Mixed Use: Any single mixed use building with a gross floor area over 10,000 or a shopping complex with any single building over 8,000 square feet gross floor area, and a cumulative square footage of 20,000 square feet gross floor area or greater. For permitted land uses interchange-mixed use may include buildings less than 10,000 square foot gross floor area and 20,000 square foot gross floor area, respectively.
- Employment Park Land Uses: Office parks, high technology business parks, warehouses, heavy industrial, and manufacturing businesses.
- Neighborhood Business: Any single commercial use building with a gross floor area of 5,000 square feet or less, or a shopping complex with any single building 5,000 square feet gross floor area or less, and a cumulative square footage of less than 12,500 square foot floor area.





- LEGEND:**
- CITY LIMITS
  - UGA LIMITS
  - LAND USE:**
  - 1 - RESIDENTIAL
  - 2 - PARKS/OPEN SPACE OR PUBLIC FACILITIES
  - 3 - EMPLOYMENT PARK
  - 4 - COMMERCIAL
  - RIVERS
  - STREAMS
  - PARCELS

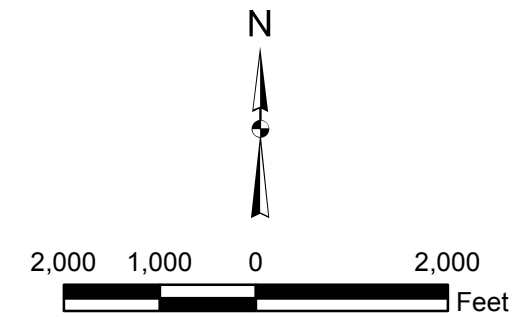
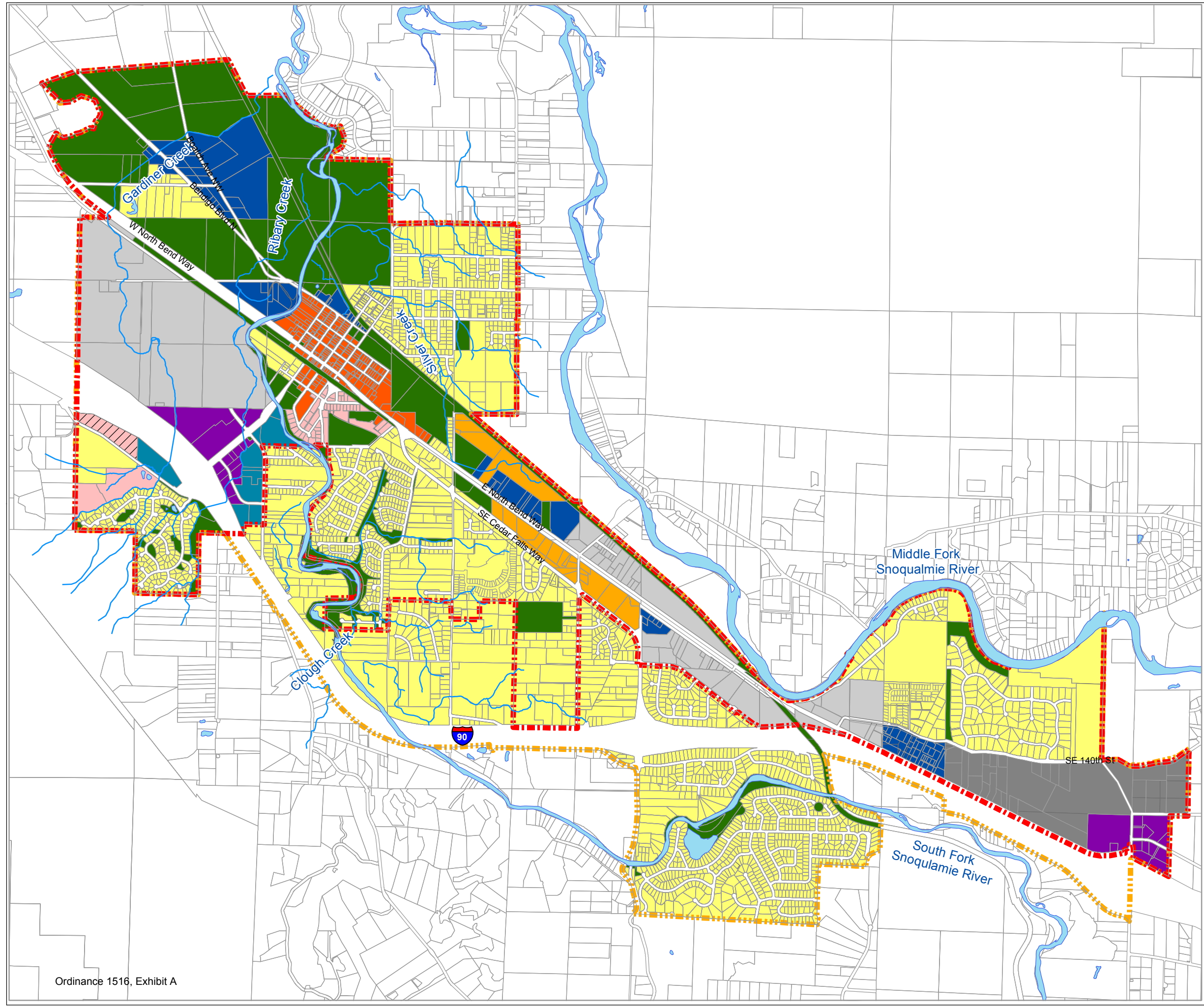
**CITY OF NORTH BEND**

STORMWATER COMPREHENSIVE PLAN  
FIGURE 2-5  
LAND USE DESIGNATION MAP



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CONSULTING ENGINEERS





**LEGEND:**

- CITY LIMITS
- UGA LIMITS
- RIVERS
- STREAMS
- PARCELS
  
- ZONING:**
- LDR - LOW DENSITY RESIDENTIAL  
4 UNITS/ACRE
- CR - COTTAGE RESIDENTIAL
- HDR - HIGH DENSITY RESIDENTIAL
- HDR - HIGH DENSITY RESIDENTIAL  
WITH DENSITY RESTRICTIONS
- DC - DOWNTOWN COMMERCIAL
- IC - INTERCHANGE COMMERCIAL
- IMU - INTERCHANGE MIXED USE
- NB - NEIGHBORHOOD BUSINESS
- EP-1 - EMPLOYMENT PARK-1
- EP-2 - EMPLOYMENT PARK-2
- POSPF - PARK/OPEN SPACE  
OR PUBLIC FACILITIES

**CITY OF NORTH BEND**

STORMWATER COMPREHENSIVE PLAN  
FIGURE 2-6  
ZONING MAP



**Gray & Osborne, Inc.**  
CONSULTING ENGINEERS

- **Parks/Open Space or Public Facilities:** Active or passive open space within or related to a development that is designed and intended for the common use of the residents of the development. In some cases, common open space may be dedicated to the City and/or made available for the use of all city residents if part of a greenbelt network. Includes parks, green belts, government uses, schools, churches, etc.

The Comprehensive Plan estimates that within the UGA, 43 percent of the land is residential, 22 percent is employment, business, and commercially zoned, 16 percent is dedicated open space and public facilities areas, and the remaining 19 percent is public rights-of-way or open water.

## CLIMATE

The climate of the City is heavily influenced by the adjacent mountain ranges. The mountains moderate the climate by shielding the area from cold arctic air masses and increasing rainfall incidents. Precipitation within the area is high in volume in the winter and low in volume during summer. Summers are generally dry. The annual average precipitation level is approximately 62 inches, with the majority of the precipitation falling as rain.

Table 2-2 summarizes the historical average climate and rainfall data for the North Bend area, according to NOAA records from the station at Snoqualmie Falls.

**TABLE 2-2**

### Average Monthly Climate Data

| <b>Month</b> | <b>High Temp.</b> | <b>Low Temp.</b> | <b>Precipitation (in.)</b> |
|--------------|-------------------|------------------|----------------------------|
| Jan          | 47°F              | 35°F             | 8.80                       |
| Feb          | 49°F              | 34°F             | 5.39                       |
| Mar          | 54°F              | 36°F             | 6.26                       |
| Apr          | 58°F              | 39°F             | 4.80                       |
| May          | 64°F              | 47°F             | 4.00                       |
| Jun          | 69°F              | 49°F             | 3.07                       |
| Jul          | 75°F              | 53°F             | 1.35                       |
| Aug          | 76°F              | 52°F             | 1.29                       |
| Sep          | 70°F              | 47°F             | 2.73                       |
| Oct          | 60°F              | 41°F             | 5.54                       |
| Nov          | 51°F              | 37°F             | 10.13                      |
| Dec          | 45°F              | 34°F             | 8.29                       |
| <b>Total</b> |                   |                  | <b>61.65</b>               |



## **CRITICAL AREAS**

Discussed below are types of critical areas identified by the Growth Management Act, and found within the City. Their presence can dictate where facilities should or should not be located. These areas include critical aquifer recharge areas, frequently flooded areas, wetlands, fish and wildlife habitat areas, and geologically hazardous areas. In addition, the North Bend Municipal Code designates and regulates the following critical areas:

- Frequently Flooded areas
- Wetland areas
- Critical Aquifer Recharge areas
- Rivers and Streams
- Fish and Wildlife Habitat Conservation areas
- Geologically Hazardous areas

## **FREQUENTLY FLOODED AREAS**

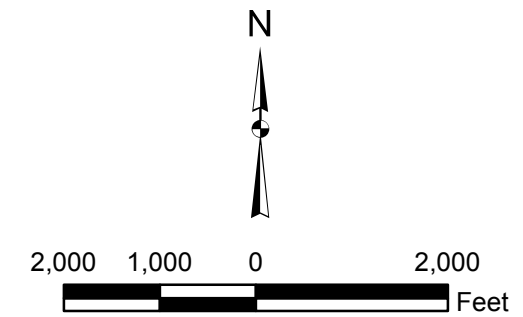
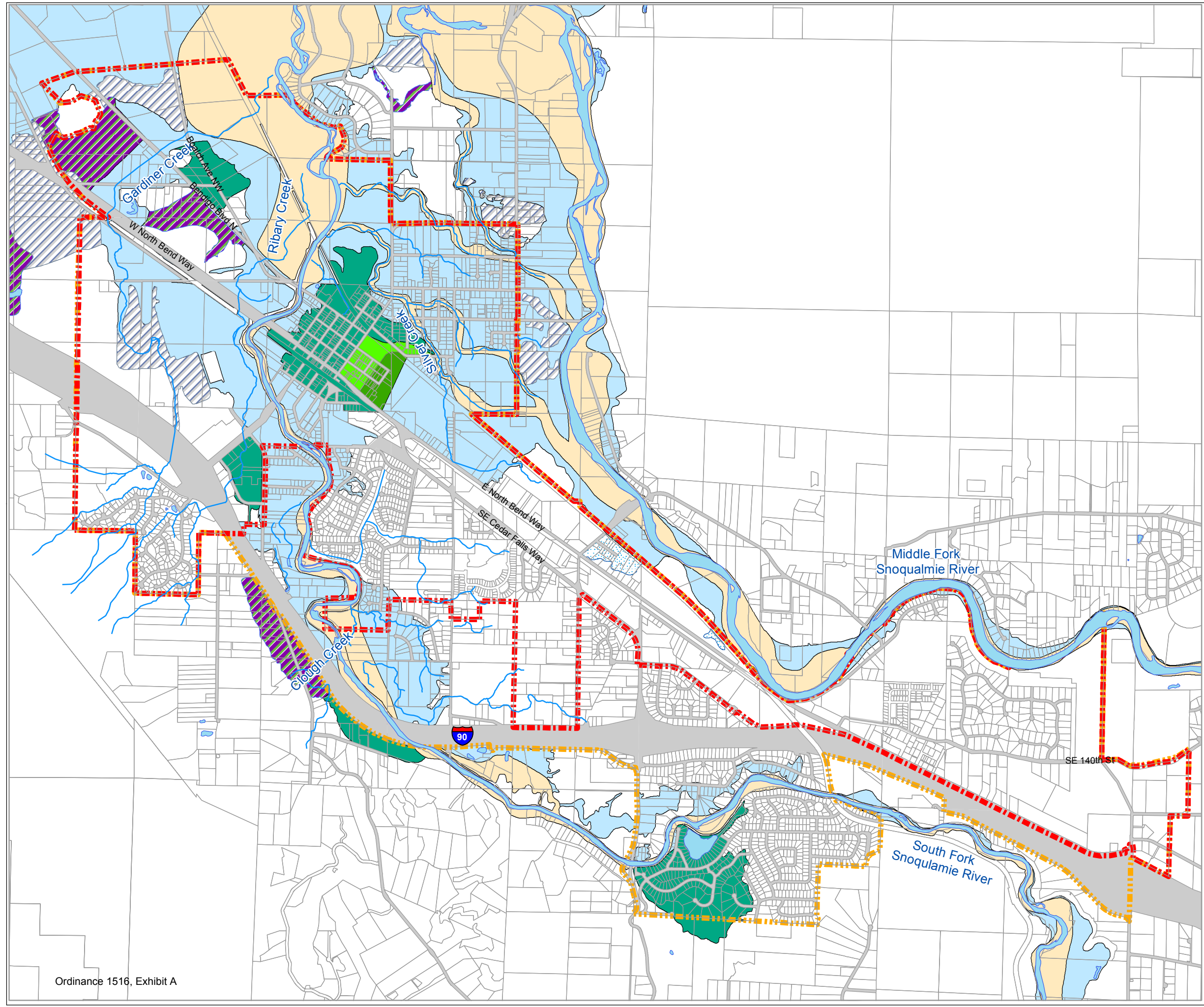
The City of North Bend is located in the Upper Snoqualmie River system, near the confluence of three rivers. As such, the valley floor is very susceptible to flood events. Major floods have occurred at least 14 times in the last 80 years, causing significant property damage and injury. In accordance with the federal National Flood Insurance Program and North Bend Municipal Code, land development is regulated to prevent and/or discourage development within the flood plain, in order to avoid future losses due to flood events.

The Federal Emergency Management Agency (FEMA) documented areas that are subject to 100- and 500-year floods within the City, updated in 2005. The 100-year flood has been adopted as the base flood for purposes of floodplain management. A 100-year flood area is defined as those lands, which are subject to a one percent or greater chance of flooding in any one year. Figure 2-7 delineates the 100-year floodplain boundaries within the City of North Bend.

## **WETLANDS**

Wetlands and riparian corridors perform valuable functions within the ecosystem. Clearing of vegetation, grading, filling, draining, and other activities associated with land development may decrease the ability of the riparian zone to provide drainage, stabilize stream banks, provide wildlife habitat, and filter pollutants from runoff. Wetlands receiving surface water from surrounding areas, can filter entering pollutants by a combination of physical, chemical, and biological processes.

Wetlands also play a major role in flood control. During flooding, rivers and streams overflow their banks and spread out across the flood plain. Wetlands attenuate the peak flows from storm events by storing water during wet periods and discharging this stored



**LEGEND:**

- CITY LIMITS
- UGA LIMITS
- RIVERS
- STREAMS
- PARCELS

**FEMA FLOOD HAZARD ZONES:**

- AO-3
- AO-2
- AO-1
- SH-X
- F-AE
- A
- AE
- AH

**CITY OF NORTH BEND**

STORMWATER COMPREHENSIVE PLAN  
FIGURE 2-7  
FLOOD HAZARD AREA MAP

**Gray & Osborne, Inc.**  
CONSULTING ENGINEERS

water later during drier periods. Wetlands also provide habitat and a source of food for fish and wildlife.

According to the National Wetlands Inventory, the majority of wetlands in the City are located in the north and west areas of the City within the undeveloped and open space regions. Figure 2-8 shows the approximate location of wetlands within the city limits as identified by the National Wetlands Inventory. The inventory (completed in the early 1980s) only identified large wetlands and the map is not intended to show all such areas. Smaller wetlands throughout the City continue to provide varying degrees of ecological functions such as peak flow attenuation, natural water quality treatment, and wildlife habitat. When development proposals are submitted to the City, it is required that wetlands (and other critical areas) be identified.

### **AQUIFER RECHARGE AREAS**

Currently, the City has three potable water reservoirs with capacities of 2.0 million gallons (MG) (Nintendo), 0.75 MG (Forster Woods) and 0.5 MG (I-90). The City obtains its public water supply from the Mt. Si Springs and its Centennial Well. The Mt. Si Springs intake facilities and pump station are located within a 6-acre parcel owned by the City at the base of Mt. Si. The Centennial Well is located adjacent to the City's Public Works Shop at 1155 East North Bend Way. Nearly all housing units in the City are served by the public water systems.

The Growth Management Act requires that potable water sources such as wells be mapped and assessed for vulnerability to ground or surface water contamination. Depending on the depth of the well, soil porosity, and other parameters, certain land uses may have a negative effect on water quality or replenishment for a specific well. The City's Wellhead Protection Program is included in Chapter 6 of the City's October 2010 Water System Plan. According to the City's Comprehensive Plan, most of the City resides within a Category 2 Critical Aquifer Recharge Area, meaning there is a high to moderate risk of groundwater contamination. Critical Aquifer Recharge Areas are shown in Figure 2-9.

### **FISH AND WILDLIFE HABITAT AREAS**

The main areas of habitat within the city are within riparian corridors, located along waterways and wetlands. Some of the City's natural landscape has been converted to urban uses. Converted areas sustain commercially available landscape plants typically associated with urban residential development.

Because of human activity and limited biological diversity, the habitat value of these areas is low, relative to natural communities. Areas that have been cleared but left vacant are often invaded by non-native species such as Himalayan blackberry; scotch broom, and reed canary grass.

Non-game wildlife species are found throughout North Bend. Common wildlife species found in mixed lowland forest are black-tail deer, opossum, raccoon, pileated woodpecker, northern flicker, Stellar's jay, common crow, eastern gray squirrel, and other small mammals and passerine birds. Red foxes, screech and great horned owls, and coyotes are also occasionally sighted or heard in these areas. Many of these species, especially those that adapt to urban areas, can be observed in North Bend's residential neighborhoods.

## **GEOLOGICALLY HAZARDOUS AREAS**

Geologically hazardous areas are defined in the City's Comprehensive Plan as lands susceptible to hazards associated with the underlying soils and geology. These include areas characterized as subject to erosion, landslides, steep slope hazards, and seismic movement. Generally, these areas warrant additional engineering investigation to assess the level of hazard and would typically require setbacks from these areas, special construction techniques, or outright prohibition with respect to land disturbance and development.

Due to the relatively flat topography in North Bend, few areas are identified as erosion hazards, although all construction sites where the vegetation has been removed become hazards, and require adherence to construction best management practices to avoid the mobilization and transport of sediments into the storm drainage system. However, there are areas outside the City, specifically upper Ribary and Gardiner Creeks, that are susceptible to severe erosion and transport of sediment and debris downstream and into the City. Soil liquefaction risk during an earthquake is considered to be moderate to high in most areas of the City due to the presence of alluvial soils. However, land use planning strategies and building codes can be used to reduce the health and safety risk in the City, and allow development to proceed.

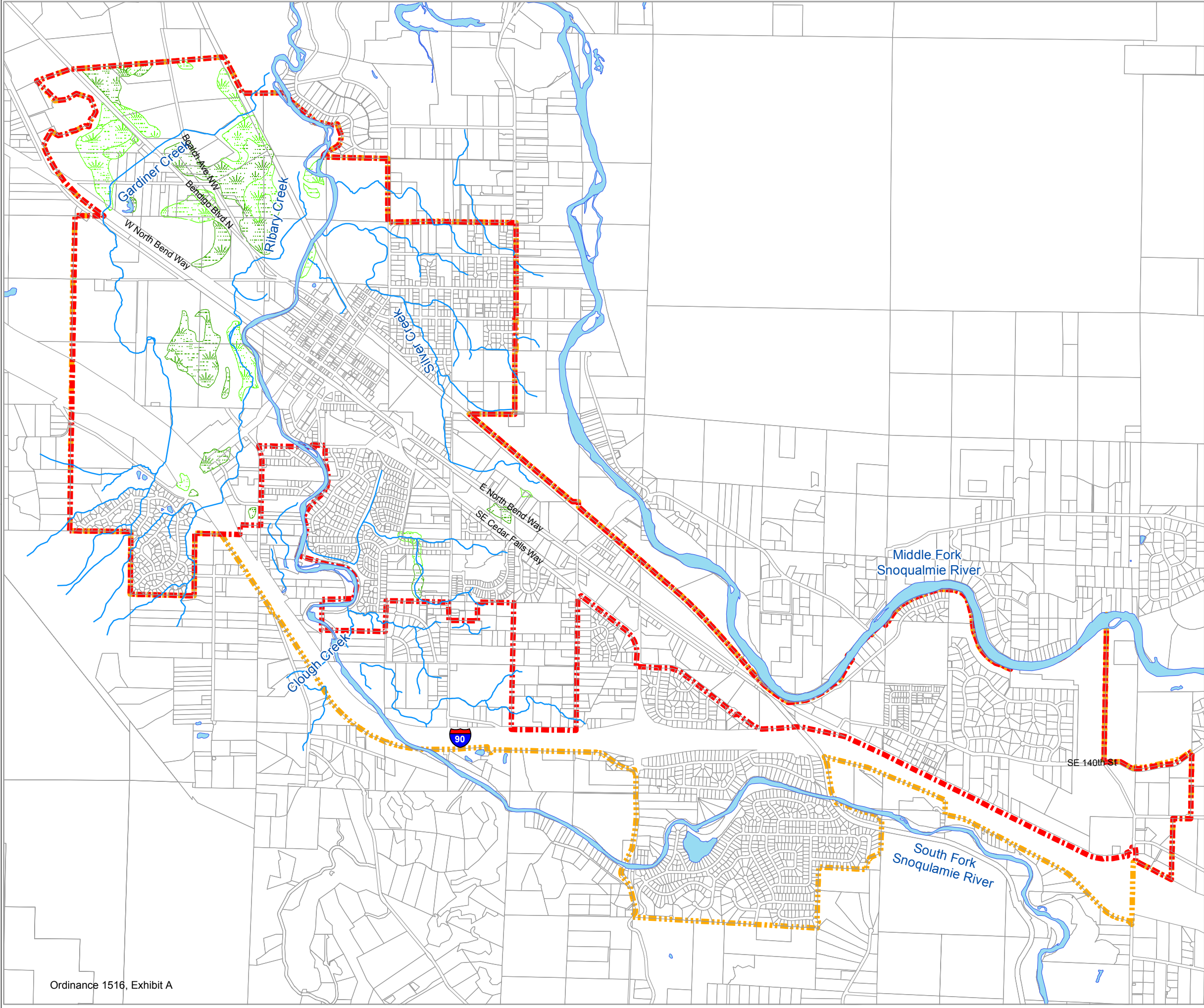
## **POPULATION TRENDS**

Residential population for the City is estimated by the United States 2010 Census to be 5,731. The 2011 Washington Office of Financial Management (OFM) April population estimate is 5,830.

The City's Comprehensive Plan developed population projections for the City. Per the 2007 Comprehensive Plan, the City, together with King County, created a 20-year population and employment growth target for North Bend. Available land areas and existing zoning classifications within the City and UGA provided basis for the growth rate, while census data, proposed new residential units and sensitive areas factored into the development of the growth rate.

Table 2-3 summarizes the historic population estimates for the years 1980, 1990, 2000, 2010 based on the U.S. census and the forecasted population estimates from the City's Comprehensive Plan.





**LEGEND:**

- CITY LIMITS
- UGA LIMITS
- RIVERS
- STREAMS
- PARCELS

**NWI WETLANDS:**

- FRESHWATER EMERGENT
- FRESHWATER FORESTED/ SHRUB

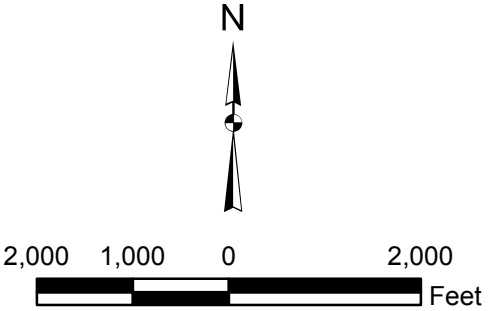
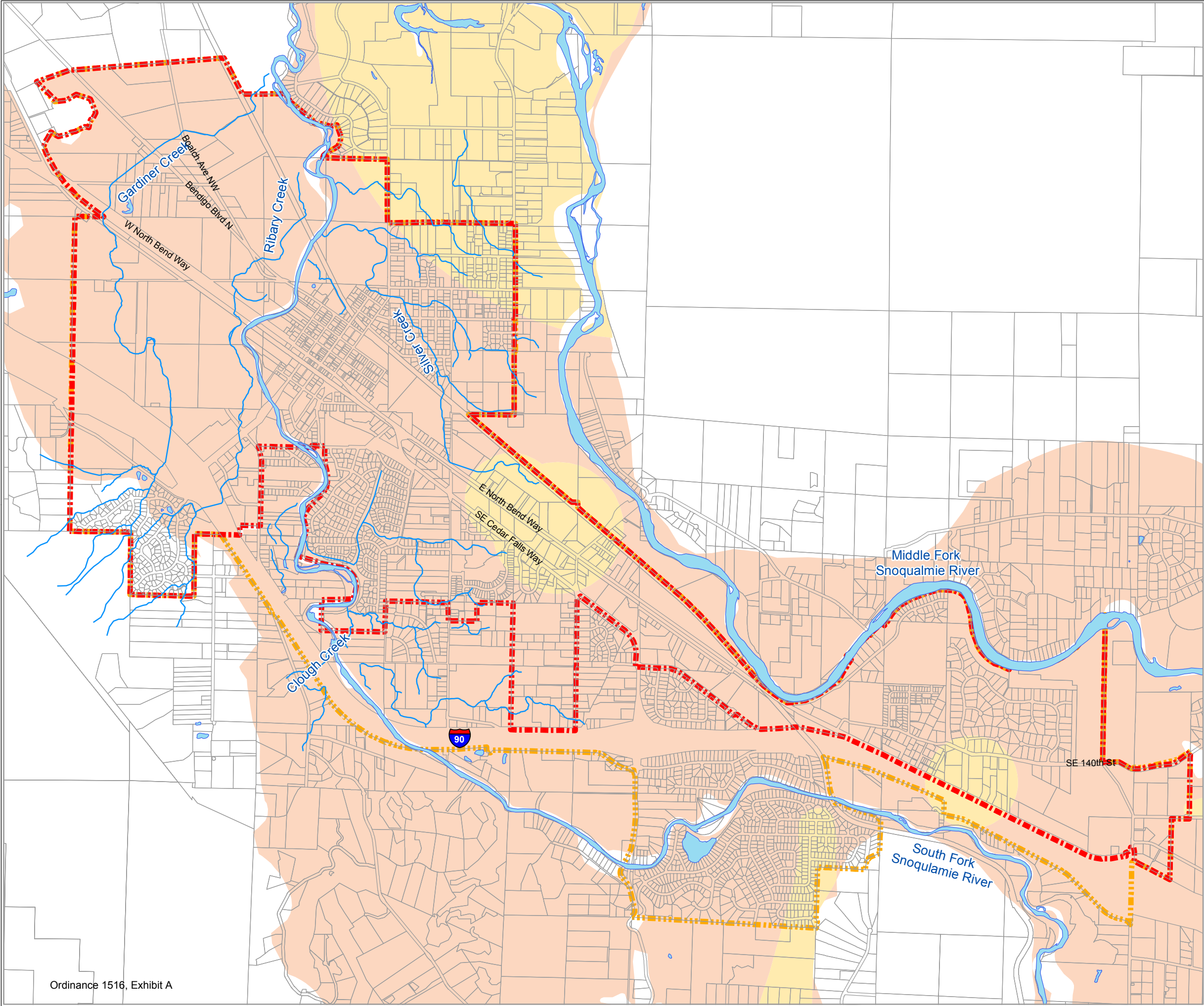
WETLAND LOCATION SOURCE: NATIONAL WETLANDS INVENTORY

**CITY OF NORTH BEND**

STORMWATER COMPREHENSIVE PLAN  
FIGURE 2-8  
WETLAND LOCATIONS







**LEGEND:**

- CITY LIMITS
- UGA LIMITS
- RIVERS
- STREAMS
- PARCELS

**CRITICAL AQUIFER RECHARGE AREA CLASSIFICATION**

- CATEGORY I CRITICAL AQUIFER RECHARGE AREA
- CATEGORY II CRITICAL AQUIFER RECHARGE AREA

CITY OF NORTH BEND

STORMWATER COMPREHENSIVE PLAN

FIGURE 2-9

CRITICAL AQUIFER RECHARGE AREA MAP

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**TABLE 2-3**

**Population**

| <b>Year</b> | <b>Population</b> |
|-------------|-------------------|
| 1980        | 1,701             |
| 1990        | 2,578             |
| 2000        | 4,746             |
| 2010        | 5,731             |
| 2022        | 7,119 (projected) |

**UTILITY SERVICES**

The City of North Bend currently has City-owned utilities for its water, sewer, and storm drainage utilities. Telephone service is provided by Frontier. Natural gas is provided by Puget Sound Energy and electric power is provided by both Puget Sound Energy and Tanner Electric.

## **CHAPTER 3**

### **REGULATORY CONSIDERATIONS**

#### **INTRODUCTION**

Stormwater drainage planning and construction has historically been provided for the purposes of keeping stormwater away from structures and property so that the property can be drained and protected from damage. Local and state governments have installed the majority of existing stormwater facilities to drain roadways. Private property owners have installed facilities to drain their property, discharging either directly to a receiving water (i.e., lake, stream, or groundwater) or into the public drainage system (i.e., roadway drainage system), and eventually into a receiving water. Historically, very few water quality facilities have been constructed in North Bend. However, over the last 30 years, new regulations have required protection of the natural environment from the increasing flows and pollution contained in stormwater runoff. Chapter 5 describes many of the water quality and quantity problems associated with today's urban stormwater runoff.

Through the Clean Water Act and other legislation, the Federal government has delegated to Washington State the authority to implement rules and regulations within the state that meet the goals of the Act. Subsequently, the State has delegated some of this authority to local agencies: cities, counties, and drainage districts. Permits may be issued by all three levels of government depending on the type of project and the impacts it may have on the natural drainage systems, which may include streams (intermittent or year-around flows), wetlands, lakes, ponds, rivers, estuaries, marine waters, and groundwater.

The role of Federal, State, and local stormwater regulations is to provide minimum standards for the drainage and discharge of stormwater runoff from developed and developing areas. Specifically, the goal of these regulations is to protect the natural receiving waters from the damaging effects of increased and polluted runoff. More specifically, the regulations strive to reduce runoff rates and volumes, prevent pollutants from getting into runoff, and remove the pollutants that become entrained in the runoff.

Because of changing administrations, conditions, and technology, all of these policies, rules, and regulations are subject to significant change over time.

#### **FEDERAL REGULATIONS**

The Federal government regulates stormwater through several different programs. Responsibility for implementing the policies of the programs is often delegated to the state and local agencies through various rules, regulations, and permitting policies. The federal government does, however, maintain some of the responsibilities for those activities that are deemed of national interest.



## **FEDERAL WATER POLLUTION CONTROL ACT (CLEAN WATER ACT)**

The Clean Water Act (CWA) is a 1977 amendment to the Federal Water Pollution Control Act of 1972, which set the basic structure for regulating discharges of pollutants to waters of the United States. The CWA gave the Environmental Protection Agency (EPA) the authority to set effluent standards based on the performance of treatment and control technologies, and extended the requirements of the original Act to set water quality standards for all contaminants in surface waters. The CWA makes it unlawful for any person to discharge any pollutant from a point source into waters of the United States unless a National Pollutant Discharge Elimination System (NPDES) permit is obtained.

The CWA provides for the delegation by EPA of many permitting, administrative, and enforcement aspects of the law to state governments. In states with the authority to implement CWA programs, EPA still retains oversight responsibilities.

Provisions of the CWA directly apply to the purpose and creation of the non-point source management program. Non-point pollution is pollution from many diffuse sources. It is caused by runoff from rainfall and snowmelt transporting the pollutants from their source. Under the CWA, stormwater control was established as part of the NPDES permit program (Section 402 of CWA).

Section 303(d) of the CWA mandates that states develop a list of waters that do not meet Federal and State water quality standards and then develop Total Maximum Daily Load (TMDL) studies and cleanup plans to restore waters to support beneficial uses. In Washington State, the Department of Ecology is charged with administering these requirements.

### **Phase I National Pollutant Discharge Elimination System Stormwater Permits**

The EPA set regulations for Phase I stormwater permits in 1991 for large and medium municipalities, as well as industries and construction sites. The National Pollutant Discharge Elimination System (NPDES) permit program was originally designed to reduce pollution from point sources such as domestic and industrial wastewater discharges. Section 402 of the Clean Water Act, establishes a regulatory program for point sources of pollution but exempts most agricultural activities. Phase I of the program included runoff discharges from specific industrial activities, including runoff discharges operated by local government with a population over 100,000, and construction sites that disturb more than one acre of land. Compliance with the Phase I NPDES permit requires that a plan to reduce the discharge of pollutants to the “Maximum Extent Practicable,” protect water quality, and satisfy the appropriate water quality requirements of the Clean Water Act be developed and implemented.

## **Phase II National Pollutant Discharge Elimination System Stormwater Permits**

In January 2007, Ecology issued the first general permit that covers all urban areas and areas with populations greater than 10,000 or located in a federally designated urbanizing area, not initially covered by Phase I regulations under a general Phase II permit. A second general permit was issued in 2012. Ecology included explicit requirements or best management practices (BMPs) as part of the municipal stormwater permit. The permit requires that Phase II NPDES permittees adopt either Ecology's 2012 Stormwater Management Manual for Western Washington or an equivalent manual. The City of North Bend is not subject to the Phase II NPDES requirements, but has adopted the 2009 King County Surface Water Design Manual (approved as equivalent by Ecology) for regulating development with respect to storm drainage.

## **ENDANGERED SPECIES ACT**

The Endangered Species Act (ESA) was passed in 1973 and provides a program for protection of endangered and threatened species by conserving the ecosystems which such species depend on. The ESA prohibits the "take" of all listed species, which is defined as harming, harassing, pursuing, hunting, shooting, wounding, killing, trapping or collecting a listed species. The U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) maintain ESA listings for threatened or endangered species. Puget Sound Chinook salmon, Puget Sound steelhead and Coastal-Puget Sound bull trout are currently listed as threatened or endangered.

The ESA applies when activities either directly or indirectly modify habitat or injure listed species such as the following activities related to stormwater management:

- Constructing barriers that eliminate or impede a listed species' access to habitat;
- Removing, poisoning or contaminating plants, fish, wildlife required by the listed species for survival;
- Discharging pollutants into a listed species' habitat;
- Removing or altering rocks, soil, gravel, vegetation, or other physical structures that are essential to the integrity and function of a listed species' habitat;
- Removing water or otherwise altering stream flow in a manner that significantly impairs spawning, migration, feeding, or other essential behavioral patterns.

## **National Marine Fisheries Service**

Under the Endangered Species Act, the National Marine Fisheries Service is responsible for the protection of marine life, including anadromous salmon such as Puget Sound

Chinook salmon and Puget Sound steelhead. The threatened status of Puget Sound Chinook and steelhead allowed the National Marine Fisheries Service to establish regulations designed to protect these species under Section 4(d) rule.

Anadromous fish cannot move upstream beyond Snoqualmie Falls as it acts as a natural migration barrier. Snoqualmie Falls is located downstream of North Bend, therefore, projects in the upper Snoqualmie Basin will not directly impact the migration or spawning of Chinook or other salmon species.

### **United States Fish and Wildlife Service**

Under the Endangered Species Act, the United States Fish and Wildlife Service is responsible for the protection of bull trout, which was listed as threatened in 1999.

## **WASHINGTON STATE STORMWATER REGULATIONS**

The principal State programs related to stormwater management include the Stormwater Management Manual for Western Washington, Hydraulic Project Approval, the Growth Management Act, State Water Quality Standards and the Shorelines Management Act.

### **ECOLOGY STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON**

The Washington State Department of Ecology has been delegated by the EPA to implement portions of the Clean Water Act relating to storm water. This is accomplished through the issuance and enforcement of Phase 2 NPDES permits to qualifying jurisdictions. The Ecology Manual contains thresholds and minimum requirements for implementing stormwater controls for both water quality and flow control for land development activities. The City of North Bend is not required, under current law, to obtain a Phase 2 NPDES permit.

### **HYDRAULIC PROJECT APPROVAL (HPA)**

The Washington State Department of Fish and Wildlife (WDFW) requires Hydraulic Project Approval (HPA) for construction activities that will use, divert, obstruct or change the bed or flow of State waters. The law came from the recognition that virtually any construction that affects the bed or flow of the waters of the State has the potential to cause habitat damage. The law's purpose is to see that needed construction is done in a manner to prevent damage to the State's fish, shellfish, and their habitat. Any construction activities, such as channel widening or culvert improvements, that occur within the ordinary high water mark of any stream must comply with HPA requirements. However WDFW generally does not exert jurisdiction over stormwater system repairs outside of the stream channel.

## **GROWTH MANAGEMENT ACT**

The Growth Management Act (GMA) was written in response to the realization that uncoordinated and unplanned growth posed a threat to the environment, sustainable economic development, and the quality of life in Washington. It was adopted by the Washington State Legislature in 1990 and has been amended several times since. The GMA requires that local governments manage growth by identifying and protecting critical areas and natural resource lands, designating Urban Growth Areas (UGAs), and preparing and implementing comprehensive plans. Per the North Bend Municipal Code, wetland buffers range from 35 to 200 feet depending on the wetland category and adjacent land use intensity (Chapter 14.06.030). Stream buffers are determined by the classification of the stream and have up to a 100-foot buffer (Chapter 14.08.030).

## **STATE WATER QUALITY STANDARDS**

The CWA requires that states establish water quality standards that identify the maximum level of pollutants allowed in state waters in order to protect uses within those waters. It also requires that the state protect those waters of quality that are higher than the standards requirement through an anti-degradation policy. The Washington State water quality standards can be found in Washington Administration Code (WAC) Chapter 173-201A. The standards set limits on pollution in lakes, rivers, and marine waters to protect beneficial uses such as aquatic life, swimming, and fishing.

The section of the South Fork Snoqualmie River that runs through the City has Category 2 and 4A classifications assigned to it. The parameter for both categories is fecal coliform. The classification of a Category 2 water is for when there is insufficient data for listing a water body segment as impaired but may still raise a concern about water quality. Category 4A is for waters where the data show that a characteristic use is impaired by a pollutant, but a TMDL addressing that impairment has already been developed and been approved by the US EPA. For waters to be 303(d) listed they must be have a Category 5 classification which is when waters with at least one characteristic or designated use is impaired, as evidenced by failure to attain the applicable water quality standard for one or more pollutants. There are no 303(d) listed waters within the City.

## **STATE OF WASHINGTON SHORELINE MANAGEMENT ACT**

The Shoreline Management Act (SMA) is outlined in WAC 173-18 through 173-26 and requires municipalities to develop shoreline master programs (SMP) that include consideration of water quality and critical areas and wildlife habitat areas. The City's SMP provides environmental protection to designated shorelines, preserves and enhances public access to the shorelines and encourages appropriate water oriented development. It combines features of a comprehensive plan with regulations that guide the development in shoreline areas.



The SMP also contains general management policies for shorelines, as well as regulations for particular areas and specific development activities. Shoreline rules apply to land use activity that occurs within the shoreline jurisdiction as defined in the SMP.

The City's first Shoreline Master Program was adopted in 1990. An update to the SMP was adopted by the Council on December 4, 2012 (North Bend Municipal Code Chapter 14.20).

## **CITY OF NORTH BEND STORMWATER REGULATIONS**

Local jurisdictions are typically responsible for implementing and enforcing regulations passed down from the State and Federal governments and for enacting additional policies, procedures and regulations based on local conditions and desires of the citizens.

North Bend Municipal Code (NBMC) Title 14, *Environmental Protection*, includes requirements for critical areas and stormwater management. Title 14.16.030 specifically adopts, by reference, the current edition of the King County Surface Water Design Manual as the City's regulations, standards, and design criteria for drainage. Title 14.16.070 requires that new development consider low impact development (LID) techniques as much as possible and also adopts the King County Stormwater Pollution Control Manual (BMP Manual). Title 19, *Development Standards*, provides the requirements for clearing and grading, including best management practices for controlling erosion and sedimentation from construction sites.

## **KING COUNTY SURFACE WATER DESIGN MANUAL**

The City of North Bend has adopted the 2009 King County Surface Water Design Manual (Manual). The Manual is intended for guidance with the overall goal of mitigating the impacts of new development and redevelopment on natural and existing manmade drainage systems. The Manual establishes the minimum requirements for stormwater control and site development requirements for all new development and redevelopment, including water quality design criteria, water quality controls, erosion and sediment control practices and site development. The first edition of the King County manual was released in 1979 and generally set minimum requirements for the construction of storm conveyance systems, including flow control facilities. Major revisions to the Manual occurred in 1990, 1998, 2005, and 2009.

The intent and purpose of the Manual is to provide for the following elements:

- Regulate proposed development projects through a mixture of requirements, performance standards, and design standards;
- Establish criteria for review and analysis of all development;

- Manage stormwater to protect the value of surface water features such as lakes, wetlands, streams, and Puget Sound; and
- Minimize the impacts of development to natural resources, the public, and property.

The King County Surface Water Design Manual minimum requirements and technical guidance become required through:

- Ordinance and rules established by local governments; and
- Permits and other authorizations issued by local, state and federal authorities.

The City is allowed to adopt and apply all or a portion of the minimum requirements, thresholds, definitions, Best Management Practices selection processes, and Best Management Practices design criteria of the Manual through local ordinances. The City has adopted the Manual in full, and has not elected to modify any of the requirements in the Manual.

## **NORTH BEND COMPREHENSIVE PLAN**

North Bend adopted its current Comprehensive Plan in 2007. The Comprehensive Plan is a planning document with goals, policies, and strategies that are implemented by City actions, including adoption of City development regulations. The Comprehensive Plan elements contain discussion and numerous goals and policies related to stormwater management.

### **Land Use Element**

While the Comprehensive Plan Land Use element is not a stormwater management regulation, it guides how land is developed, specifically the location of commercial development, residential densities, and open space requirements. These policies in turn have a direct impact on the water quantity and quality of runoff from a particular area. An effective way to control stormwater is to preserve the natural environment and the hydrologic functions of land as much as possible.

## **CHAPTER 4**

### **EXISTING STORM DRAINAGE SYSTEM**

#### **EXISTING STORMWATER CONVEYANCE SYSTEM**

The City of North Bend's existing stormwater conveyance system consists of a combination of open ditches, pipes, catch basins, culverts, detention ponds, bioswales and water quality treatment ponds. A base map showing drainage facilities within the City is shown in Figure 4-1. A large fold-out map is also included in the back map pocket of this Plan.

#### **DRAINAGE BASINS**

The City is within the Middle and South Fork Snoqualmie River Drainage Basins. The South Fork Snoqualmie River flows through the City limits and the Middle Fork Snoqualmie River flows along the eastern City limits. These rivers merge with the North Fork approximately one mile downstream of the City and form the Snoqualmie River, which merges with the Skykomish River further downstream, forming the Snohomish River and eventually flows into the Puget Sound. Figure 4-2 delineates the general drainage basins within the City limits.

The Middle Fork Snoqualmie River is approximately 41 miles long with a drainage basin of approximately 154 square miles, reaching the crest of the Cascades. Tributary rivers include the Pratt and Taylor Rivers. The majority of the drainage basin is forested.

The South Fork Snoqualmie River is approximately 31 miles long with a drainage basin of approximately 82 square miles, also reaching the crest of the Cascades. Most of the residential area of the City is contained within this basin. Most of the basin is forested.

#### **CITY IDENTIFIED STORMWATER CONVEYANCE PROBLEMS**

The City's stormwater conveyance system has areas of older and newer drainage networks and facilities. Properties in the older part of the City are not equipped with stormwater runoff detention or treatment facilities, but development occurring since 1991 has been required to provide such facilities.

Based on the modeling performed as part of this plan, and discussions with City staff, the City is not experiencing any new problems (since the 2001 Plan) with the newer or older conveyance networks.

## MODELING

Hydrologic and hydraulic analysis of selected portions of the City's stormwater system was performed using the Western Washington Hydrology Model (WWHM) continuous simulation computer model. The WWHM computer program is capable of modeling existing basin conditions as well as future land use conditions to estimate existing and anticipated stormwater runoff. It is also capable of modeling the hydraulic capability of open channels and detention/retention systems. The hydrologic/hydraulic model for the project area was developed to assess the capacity of the stormwater conveyance system under existing land use conditions.

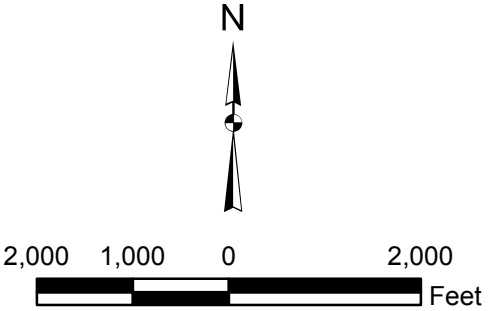
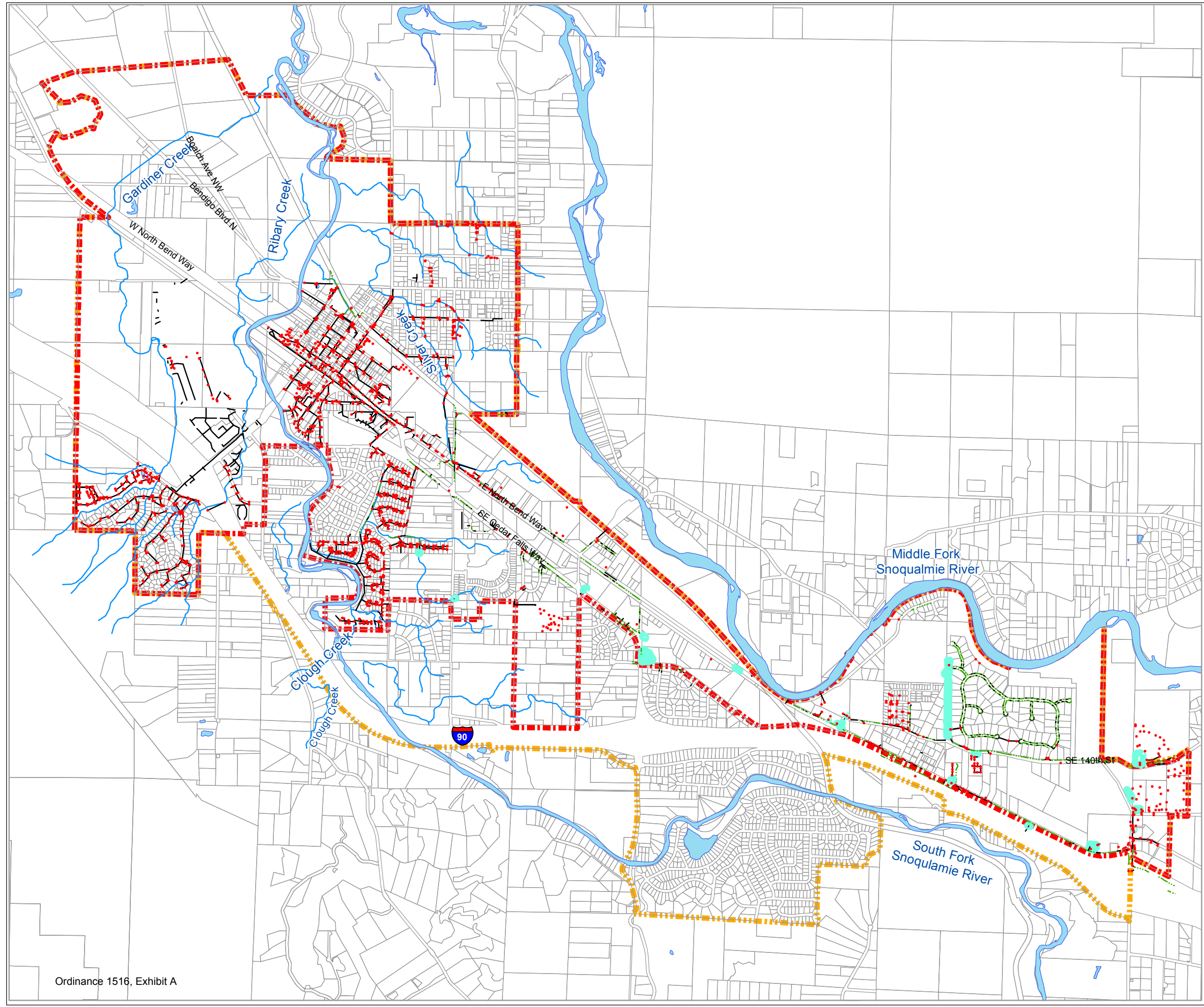
Hydrologic analysis addresses the movement of rainfall to the conveyance system. The purpose of a hydrologic model is to predict the flow of stormwater runoff into the conveyance system. The information generated in the continuous simulation hydrologic model is presented in the form of a flow frequency curve for a specific drainage basin. The flow frequency curve is illustrated with a plot of flow (cfs) versus cumulative probability (of exceedance). The continuous simulation models identify a flow rate matching a specific recurrence interval, as does a single event model. However, the recurrence interval in a continuous model is based on decades of rainfall data, and not a single theoretical storm event.

Hydrologic modeling methods require input parameters that describe physical drainage basin characteristics. Key parameters in any hydrologic model are the area of pervious and impervious surfaces, the interconnectivity of the impervious areas, topography, and infiltration characteristics of the soil. WWHM utilizes precipitation volume and duration, location multiplication factors, pan evaporation, soil data, vegetation data (land cover), and slope as input data. However, because Ecology has developed a simplified model, the user only needs to identify the project site's location (map selection), soil type (A/B or C), land cover/vegetation (acres of forest, pasture, lawn, and impervious surfaces), and general slope (flat, moderate, steep). Information about the existing stormwater conveyance system was obtained from the City's stormwater base map which was developed through the review of existing as-builts for the City, discussions with City staff and residents, and data collected during field visits.

The basic steps in the development of the hydrologic model include:

- Delineation of the drainage basins and subbasins.
- Identification of land use and estimation of the amount of pervious and impervious area.
- Identification of soil types.





**LEGEND:**

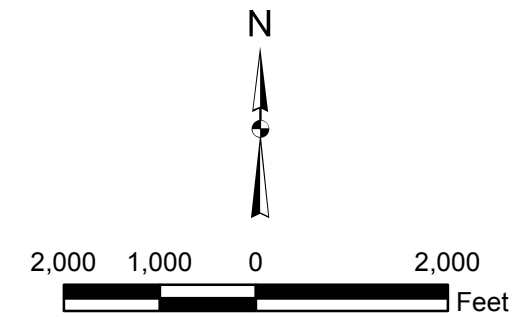
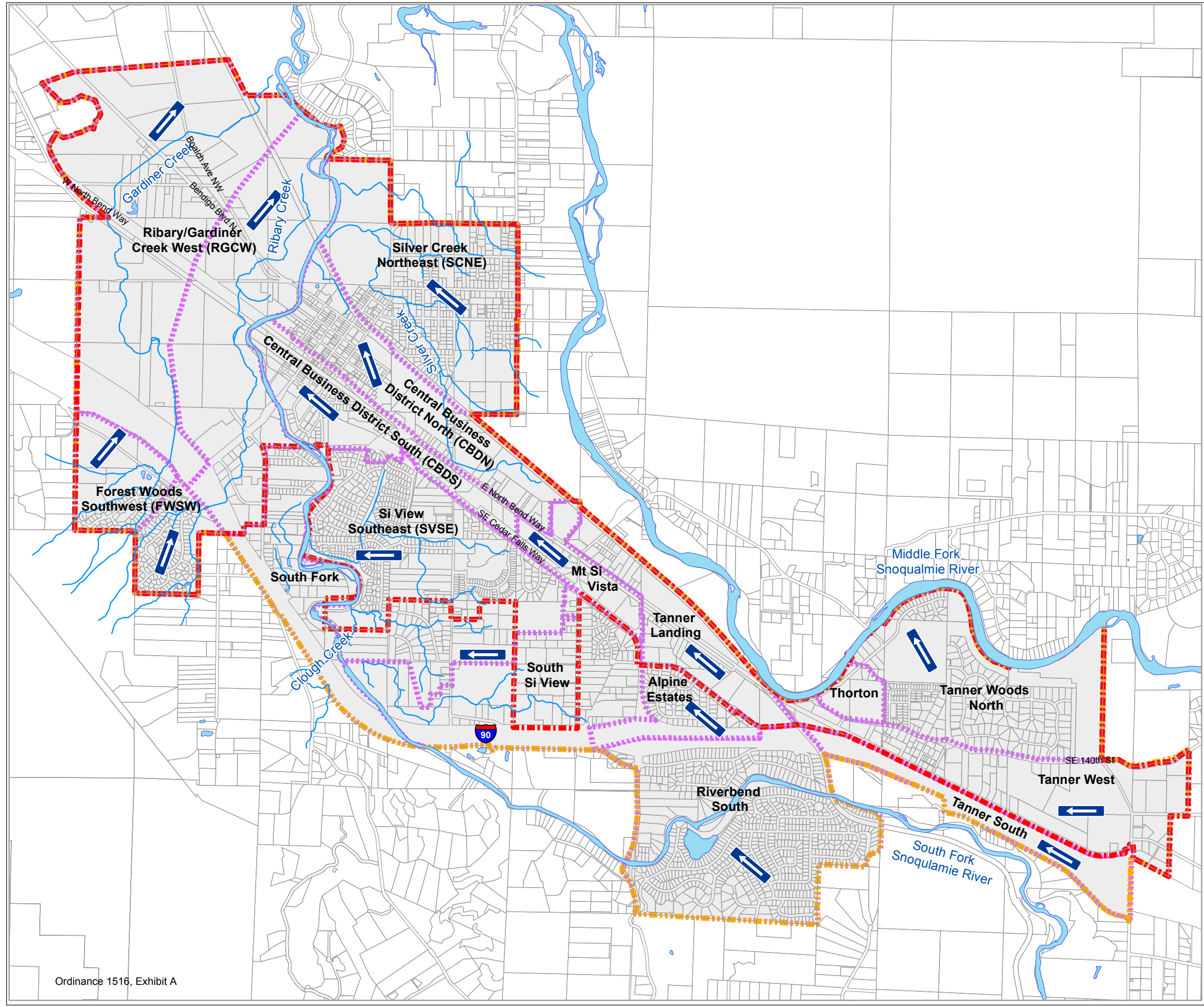
- CITY LIMITS
- UGA LIMITS
- STORM STRUCTURES
- DITCH
- PIPE
- POND
- RIVERS
- STREAMS
- PARCELS

**CITY OF NORTH BEND**

STORMWATER COMPREHENSIVE PLAN  
FIGURE 4-1  
STORM DRAINAGE FACILITIES







- LEGEND:**
- CITY LIMITS
  - UGA LIMITS
  - STORM DRAINAGE FLOW
  - DRAINAGE BASINS
  - RIVERS
  - STREAMS
  - PARCELS

**CITY OF NORTH BEND**

STORMWATER COMPREHENSIVE PLAN  
FIGURE 4-2  
DRAINAGE BASINS

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CONSULTING ENGINEERS

- Identification of topographic characteristics and estimation of flow parameters including average slope.

Once the model estimates the runoff from each sub-basin, the flow is inserted into the conveyance system, at each sub-basin's respective connection point. Hydraulic analysis is then used to assess the adequacy of the conveyance system. The water surface elevations are determined over time throughout the conveyance system for a given storm recurrence. Hydraulic analysis is based on the physical characteristics of the conveyance system, such as cross-sectional area, slope, and roughness.

It should be noted that missing information relating to the conveyance system was supplemented with assumptions including the estimation of pipe invert elevations at approximately 3 feet below the ground surface and a slope corresponding to the natural topography above the pipe. All recommended pipe sizes assume that the existing slope will be utilized in the future. However, the optimum slope should be analyzed in order to provide maximum capacity while also allowing sand and other sediment to transport through the pipe. Prior to the implementation of any recommended design projects, the slope should be evaluated to ensure that the maximum pipe capacity is attainable while allowing the minimum size pipe to be installed.

The City requested that modeling be performed only on newly annexed areas, which have completed significant infrastructure design and construction since the previous stormwater comprehensive plan. Newly annexed areas as well as areas with potential to be annexed in the future are shown in Figure 4-3.

## **DESIGN STORM**

All storm runoff models require the input of data describing rainfall volume, intensity, and duration over time. The WWHM computer program incorporates over 40 years of actual local rainfall data to input into the model for flow generation. The 25-year modeled peak flow was used to analyze/size the conveyance system.

## **MODELING RESULTS**

Only the newly annexed areas were addressed for hydrologic modeling. Due to the lack of development in the older part of the City since the last Stormwater Comprehensive Plan in 2001, these older areas were not analyzed for this update. The findings from the previous model still apply. The newly annexed areas have mostly open ditches and a small amount of pipes and structures. Taking this into consideration along with the City's report of no known problems areas, only existing conditions were modeled.

Figure 4-3 shows the areas that were modeled, including the newly annexed areas within the City limits, and the areas the City requested to be modeled. The shaded areas distinguish individual drainage basins. The peak runoff rates at the discharge for each modeled basin are provided in Table 4-1.

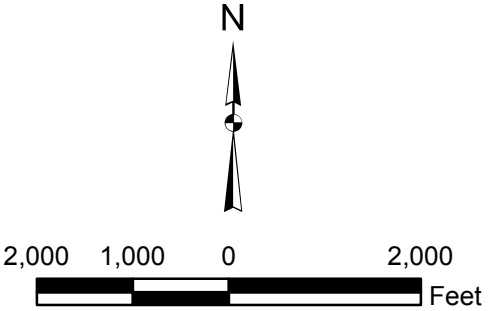
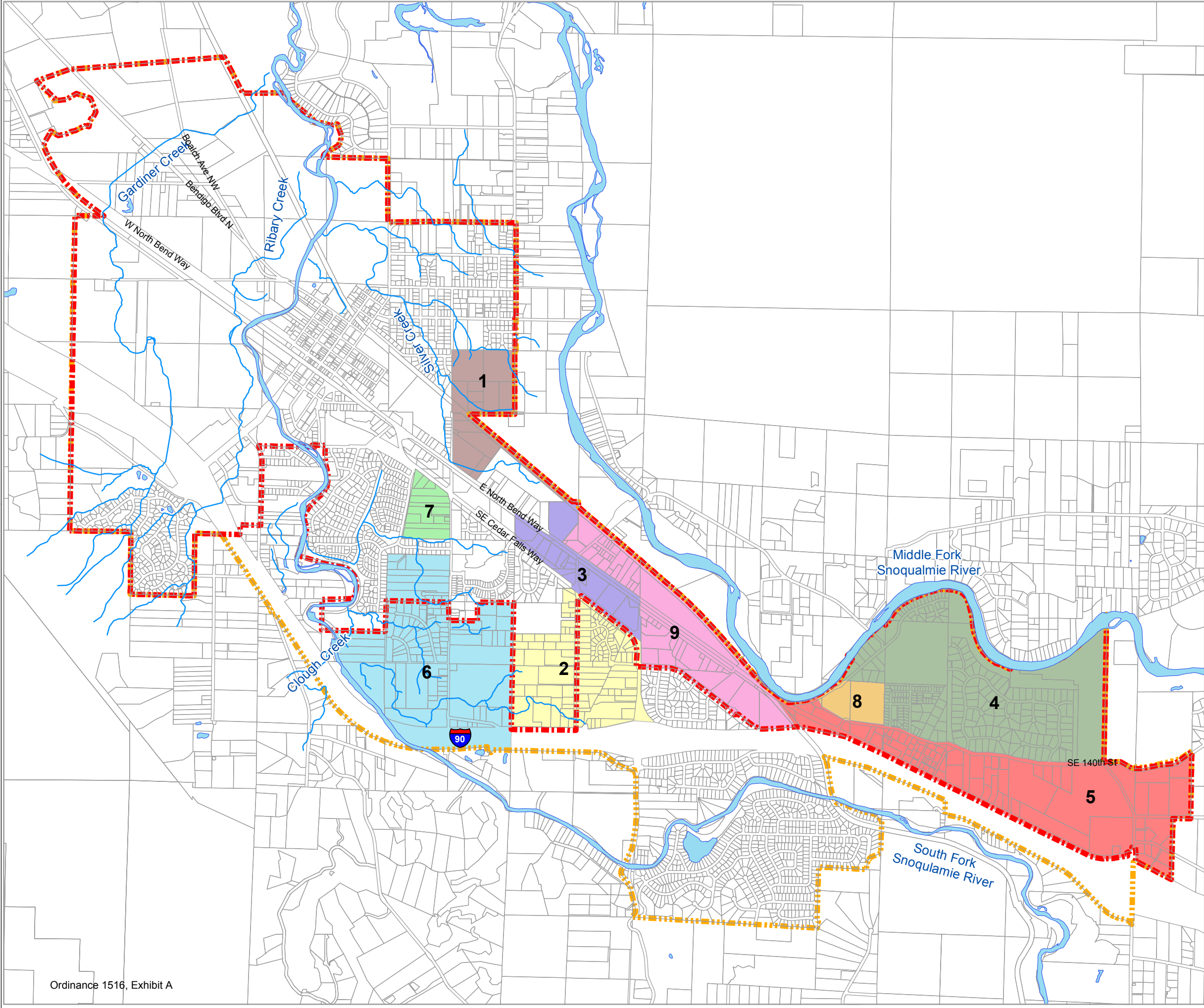
The soils within the City typically have moderate to high infiltration rates, with the majority of the drainage infrastructure being open ditches with no known existing problems. The modeling in these areas did not reveal any conveyance capacity problems.

**TABLE 4-1**

**Peak Flows from 25-Year Modeled Storm**

| <b>Basin</b> | <b>Peak Flow (cfs)</b> |
|--------------|------------------------|
| 1            | 27.85                  |
| 2            | 62.63                  |
| 3            | 29.74                  |
| 4            | 119.8                  |
| 5            | 125.83                 |
| 6            | 97.62                  |
| 7            | 10.14                  |
| 8            | 11.78                  |
| 9            | 58.18                  |





- LEGEND:**
- RIVERS
  - STREAMS
  - PARCELS
  - CITY LIMITS
  - UGA LIMITS
- BASINS:**
- 1
  - 2
  - 3
  - 4
  - 5
  - 6
  - 7
  - 8
  - 9

CITY OF NORTH BEND

STORMWATER COMPREHENSIVE PLAN  
FIGURE 4-3  
NEWLY ANNEXED AREA BASINS



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# **CHAPTER 5**

## **WATER QUALITY**

### **INTRODUCTION**

North Bend's surface water features (streams, rivers, and wetlands) play a big part in its natural beauty and rich heritage. Fish and wildlife habitat, clean water, and aesthetic appeal are benefits of the surface water resources, which must be managed wisely to protect their value. Without proper management, land development and the associated stormwater runoff may degrade these surface water resources.

Stormwater runoff can be defined as precipitation that does not percolate into the ground, but rather flows overland (and also directly beneath the surface as interflow) into a drainage system, eventually discharging into a surface water body such as a pond, lake, stream, river, or wetland. Runoff can flow over urban, rural, or natural areas, with the effects on surface water different for each case.

In North Bend, stormwater runoff flows predominantly over residential, commercial, and other urbanized areas. As rain falls and runs off of these areas, pollutants are entrained in the runoff and transported to downstream surface waters where they may cause damage to aquatic organisms, impact typical water uses, and reduce the aesthetic value of the water body. In addition, as natural vegetated areas are converted to rooftops, streets, parking lots, and urban landscaping, there is a significant increase in the volume and rate of runoff, causing erosion of the land surfaces and scouring of natural stream channels. The decreased water quality, sediment deposition (sedimentation), and general instability within urban stream channels can cause significant damage to aquatic organisms, including permanent habitat degradation.

### **HISTORICAL WATER QUALITY DATA**

Pollutants in stormwater are largely uncontrolled, due to the diverse characteristics of the land over which the water flows and the diffuse manner in which small amounts of pollution are entrained, transported, and later discharged into downstream water bodies. Research in Western Washington has shown that the concentrations of many pollutants found in stormwater from residential, commercial, and industrial areas exceed established State and Federal water quality criteria.

### **NATIONWIDE URBAN RUNOFF PROGRAM (NURP)**

The Nationwide Urban Runoff Program (EPA, 1983) included extensive field monitoring throughout the United States to characterize urban stormwater runoff flows and pollutant

concentrations. Listed below are the conclusions reached in the Nationwide Urban Runoff Program Study:

1. Heavy metals (especially copper, lead, and zinc) are the most prevalent priority pollutants. Urban runoff produces frequent exceedances of ambient water quality criteria for heavy metals. Copper, lead, and zinc pose a significant threat to aquatic life uses in some areas of the country. Copper is suggested to be the most significant of the three.
2. The organic priority pollutants were detected less frequently and at lower concentrations than the heavy metals. Organic priority pollutants typically are not a threat to freshwater aquatic life.
3. Coliform bacteria are typically present at high levels and may exceed EPA water quality criteria during and immediately after storm events in most rivers and streams.
4. Nutrients (i.e., phosphorous and nitrogen) are present, but typical concentrations are not high, and generally not a concern in rivers and streams.
5. Oxygen-demanding substances are present at concentrations approximating those in secondary wastewater treatment plant discharges. Urban runoff is typically well-oxygenated and adds water to stream flow, so dissolved oxygen problems due solely to runoff should not be widespread.
6. Total suspended solids concentrations are fairly high in comparison with wastewater treatment plant discharges.
7. Contaminated stream, lake, and wetland bottom materials (substrate) can be attributed wholly or in part to urban runoff.
8. Bank erosion and streambed scour can be significant causes of habitat disruption. Habitat changes associated with streambed scour and sedimentation produced by urban runoff may be more significant than pollutant concentrations.

## **NATIONAL WATER QUALITY INVENTORY**

Point source pollution (predominantly industrial and municipal wastewater discharges) has been highly regulated and controlled for years, even prior to the passage of the Clean Water Act. The National Water Quality Inventory, 1986 Report to Congress (EPA, 1986), concluded that diffuse sources of water pollution, including runoff from urban areas, are the leading cause of water quality impairment.

## **SNOQUALMIE RIVER BASIN TMDL**

The Department of Ecology is required to perform a total maximum daily load evaluation, and complete either, or in some cases both, a waste load allocation for point sources and a load allocation for nonpoint sources in water quality problem areas. The basic goal of the Total Maximum Daily Load (TMDL)/Waste Load Allocation (WLA) procedure is to bring water bodies back into standards compliance by limiting pollutant loading based on the characteristics of the water bodies, rather than by arbitrary pollutant limits resulting from the usual source treatment processes. The City of North Bend is included in the Water Resource Inventory Area (WRIA) No. 7, the Snohomish watershed. In general, water quality problems in this WRIA include summer high temperatures, low dissolved oxygen levels, and high fecal coliform counts in streams. In June 2011, Ecology published a Water Quality Improvement Report and Implementation Plan for the Snoqualmie River Basin TMDL related to temperature (available at <https://fortress.wa.gov/ecy/publications/publications/1110041.pdf>). It is noted in the TMDL that stormwater does not have a significant impact on temperature in small tributaries. Also, it is stated that the South Fork Snoqualmie River has a cooling effect on the main stem of the Snoqualmie River, where water temperature is a problem. Therefore, the role for the City is limited in regards to implementation of the plan, but the City will be required to meet waste load allocations with respect to future NPDES permits for the wastewater treatment plant.

## **CLEAN WATER ACT, SECTION 303D**

There is one section of the South Fork Snoqualmie River, near the northern City limits, that is a CWA 303(d) list Category 4A water for fecal coliform. Category 4A waters are defined as impaired, but a TMDL addressing impairment has been developed and approved by the US Environmental Protection Agency (EPA). The remaining waters within the WRIA listed on the CWA 303(d) list have no documented water quality violations within the City.

## **WATER QUALITY STANDARDS**

The following discussion focuses on the criteria used to evaluate water quality contaminants most common in runoff. General water quality problems in the North Bend area are identified later in this chapter. Appropriate strategies for addressing problem areas and reducing impacts are then summarized.

Stormwater runoff constitutes the primary transport mechanism for nonpoint pollution. Pollution problems associated with urban land use and development encompass typical pollutants such as sediment, metals, bacteria, pesticides, fertilizers, and petroleum products. A further problem stemming from residential, commercial, and industrial land uses is the higher volume of runoff because of the higher amount of impervious area. In developed areas, certain pollutants are more prevalent than in undeveloped areas.

Pollutants accumulate in surficial soils and on paved surfaces from vehicular emissions, atmospheric deposition, spills, leaks, improper waste storage/disposal practices, and fertilizer/pesticide application. They are then washed off the land surface during subsequent storm events and transported via stormwater runoff to nearby water bodies or infiltrated to shallow groundwater.

Although these specific pollutants can be attributed to an individual source (e.g., bacteria from pet waste and livestock), their intermittent, diffuse, and widespread nature makes them difficult to contain and control. Parameters of interest in nonpoint pollution are discussed below in terms of State standards and potential sources.

## **PARAMETERS OF CONCERN**

There are numerous classes of water quality parameters that are affected by stormwater runoff including suspended solids (sediment), nutrients, and metals; oxygen demanding and inert material; particulate and dissolved substances; chemical, biological, and physical characteristics; toxic and nontoxic substances; and organic and inorganic substances. Several pollutants may be incorporated into one classification if their effects on receiving waters are similar. Receiving waters can assimilate a limited quantity of many substances, but there are thresholds beyond which the substance becomes a pollutant and results in an undesirable impact. The following section provides a brief description of contaminants/characteristics, potential environmental effects, and likely sources.

### **Dissolved Oxygen**

Dissolved oxygen is necessary in water to maintain healthy aquatic life. Oxygen from water is consumed by fish, insects, and microorganism in the oxidation of organic matter by biological activities (i.e., feeding and decomposition). Low dissolved oxygen levels puts stress on aquatic organisms and can lead to fish kills and reduction in aesthetic values. Low dissolved oxygen results when the rate of oxygen consumption exceeds the rate of replenishment.

Oxygen in water is replenished by plant respiration and via gas exchange at the air-water interface. The amount of oxygen that can be dissolved into water depends mostly on water temperature – the colder the water, the greater the amount of dissolved oxygen. Dissolved oxygen levels are especially important during summer when low stream flows and high temperatures make oxygen less available to aquatic life. Concentrations of dissolved oxygen vary with season and location. These natural variations are caused by differences in such things as light intensity (as it affects photosynthesis), nutrient levels, and organic input. Natural variation can also be driven by groundwater or water draining bogs and marshes that typically have lower dissolved oxygen concentrations.

Dissolved oxygen concentrations may become critical when wastes (organic material) that require oxygen for decomposition enter the water. Common significant sources of



organic wastes include effluent from wastewater treatment plants (point source), leaking sewers and failed septic systems, poor livestock grazing and waste management practices, illicit connections, and poor management of garbage and waste areas for grocers, restaurants, and food processing facilities.

## **pH**

pH is a measure of the activity of hydrogen atoms in water, and provides a basis for measuring the relative acidity or alkalinity of water. Similar to dissolved oxygen, pH responds to natural environmental factors. Changes in pH affect the degree of dissociation of weak acids and bases, which affect the toxicity, reactivity, and solubility of many compounds. Diurnal variations in pH occur as a result of changes in plant production and respiration rates (photosynthesis), and different water sources such as groundwater or water draining wetlands. Generally speaking, rainwater is slightly acidic (low pH), due to the adsorption of carbon dioxide, and substances such as cement concrete are very basic (high pH), due to the presence of lime. Significant sources of high pH substances includes the pouring, finishing, and washing of cement concrete.

## **Temperature**

Water temperature extremes (higher than normal) affect stream productivity and eventually may result in loss of aquatic life. Temperature also affects a stream's chemical properties, specifically the solubility of oxygen, carbon dioxide, and metals, and varies diurnally and seasonally. Water temperatures are most affected by the removal of riparian vegetation that provides shade.

## **Turbidity**

Turbidity is not a measurement of mass or concentration, rather it is a water quality attribute pertaining to the amount of light that can penetrate the water column. It is therefore affected by the amount of suspended solids and dissolved substances. It cannot be used as a quantitative measure to calculate loadings, but is used qualitatively to compare against a standard. High turbidity can impact the available light to plants for photosynthesis. Turbidity responds to physical factors such as proximity to exposed erodible soils and stream flow.

## **Nutrients**

Nutrients are chemicals that are required for cell metabolism and growth of animals and plants, such as algae and water plants. The primary nutrients of concern in freshwater systems are nitrogen and phosphorous, with phosphorus often being the controlling nutrient for algae growth. Nitrogen can affect the trophic status of receiving waters. Nitrogen (in the form of nitrate) is also an important parameter for water used as drinking water supplies.

The typical nutrient concentrations in stormwater runoff are often more than sufficient to stimulate the growth of algae and other plant species. The increased algal activity will initially raise dissolved oxygen levels, through increased plant growth. However, such “algal blooms” only last until phosphorous levels drop, or sufficient light (intensity and daily amount) for photosynthesis begins to fade (as in the late summer or early fall). Once decomposition of the dead algae begins, surface algal scums form, dissolved oxygen levels rapidly drop, and water discoloration and odors may occur. If dissolved oxygen levels in receiving waters drop too much, die-off of fish and other aquatic life may occur.

Natural sources include organic decomposition byproducts and soil erosion. Typical anthropogenic sources include detergents, fertilizers, septic system effluent, and livestock manure.

### **Pathogens/Bacteria**

Pathogens and bacteria commonly refer to fecal coliform bacteria, which are found in the intestinal tracts of warm-blooded animals, including humans. Concentrations of fecal coliform bacteria in surface water have historically been used as an indicator of waterborne pathogenic bacteria or viruses. Therefore, fecal coliform bacteria concentrations are used as indicators of potential public health concerns. High levels in surface waters can indicate failing septic systems, poor livestock management practices, poor wastewater treatment facility performance, pet wastes, and leaking municipal sanitary sewers.

### **Oil and Grease**

High oil and grease concentrations are associated with stormwater runoff from roadways, parking lots, and industrial property. The presence of oils and grease can serve as indicators of a wide array of hydrocarbon compounds that can be toxic to aquatic life at low concentrations. Typically, oil and grease concentrations are low in receiving waters and are usually associated with recent runoff events.

### **Total Suspended Solids**

Total suspended solids (TSS) represents particulate material that is suspended in the water column due to velocity and turbulence. The higher the velocity of the water, the larger a particle can be suspended. High amounts of TSS can affect the oxygen exchange in the gills of aquatic organisms, and, as suspended solids settle out, gravels in the stream bed can be smothered, reducing their value as aquatic habitat.

Total suspended solids generally originate from soil erosion or scour within a stream. Also, materials that are washed off paved surfaces are transported by runoff and discharged to receiving waters. Land-clearing activities associated with urban development as well as poor livestock and crop management can accelerate soil erosion

and increase sediment transport to receiving waters. Timber harvest and the conversion of forestland to urban uses can result in sedimentation, increases in impervious surfaces, and accelerated stormwater runoff. As the total volume and peak rate of stormwater increases, scouring occurs in stream channels, thereby increasing the suspended solids loading in the stream.

### **Heavy Metals**

Most metals are adsorbed onto suspended solids present in the runoff and are probably not toxic to aquatic life. However, the accumulation of heavy metals in the substrate can pose a problem, should the pH in the water change, dissolving the metals into the water column and becoming available for ingestion by fish and insects. Metals commonly found in stormwater runoff typically originate from road surfaces and parking areas and include lead, zinc, copper, chromium, arsenic, cadmium, and nickel. Other potential sources of metals originate from commercial car washes, auto repair facilities, and industrial operations.

### **Toxic Organic Compounds**

Toxic organic compounds include a variety of contaminants such as pesticides, petroleum hydrocarbons, and volatile organic compounds. Compounds that are most frequently found in runoff include phosphates, polyaromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), and some pesticides. The availability of toxic organic compounds to aquatic life is difficult to determine because of their adsorption to particulate matter. Potential nonpoint sources of these contaminants include urban and agricultural runoff, hazardous substance spills, improper disposal of waste products, and industrial discharges.

### **Organic Material**

Organic material is an integral component of topsoil and detrital matter deposited by plants and animals. The organic content is primarily produced by microorganisms during the degradation of dead plant and animal material. The microbial degradation of organic matter in aerobic systems results in the consumption of oxygen. Waters high in organic matter may experience depressed oxygen concentrations. Manmade sources of organic matter include yard waste and materials deposited in surface waters from soil erosion and landslides.

## CRITERIA

Water quality standards for surface water in Washington State are established in Chapter 173-201A, Washington Administrative Code (WAC). Standard criteria allow for comparison of the water quality data to a safe or desired level. Management practices that violate or exceed established standards are subject to further investigation and ultimately appropriate corrective measures.

The State adopted new water quality standards for surface waters in 2006, with updates through 2011. The EPA has approved these revised standards. The standards assign specific designated uses to surface waters of the State, such as aquatic life uses, recreational uses, water supply uses, and miscellaneous uses. Each use then has categories that are ranked, generally speaking, from a higher quality to lower quality. Water quality standards have been assigned to each specific designated use category, for parameters such as fecal coliform, dissolved oxygen, temperature, pH, turbidity, and toxic, radioactive, and deleterious substances.

The Snohomish Water Resource Inventory Area (WRIA #7) includes the Middle Fork of the Snoqualmie River (and tributaries) and is identified under WAC 173-201A-602, with the following designated uses:

- Aquatic Life Uses – Core Summer Habitat, except where designated Char Spawning/Rearing. This is the highest quality category for Aquatic Life Uses.
- Recreation Uses – Extraordinary Primary Contact Recreation. This is the highest quality category.
- Water Supply Uses – Domestic, Industrial, Agricultural and Stock.
- Miscellaneous Uses – Wildlife Habitat, Harvesting, Commerce/Navigation, Boating and Aesthetics.

In addition to the water quality parameters listed in Table 5-1, concentrations of toxic substances, such as organic compounds and metals, must not exceed standards specified in WAC 173-201A-240. These standards are based on the EPA Quality Criteria for Water (1986), which are derived from federal water quality criteria based on aquatic toxicology. The WAC defines both acute and chronic criteria for toxic substances. Acute toxicity criteria are based on death percentages of test organisms within 24 hours. Chronic toxicity criteria are defined as the concentration that causes long-term adverse effects on an organism's functions. Standards also exist for radioactive and deleterious materials and aesthetics, as described in Table 5-1.

The criteria shown in Table 5-1 is only a brief summary of the full water quality criteria. Since there is wide variability in natural systems, and the level of tolerance is different

for each species of interest, there are exceptions and/or ranges of the criteria pertaining to specific species' acclimations, background conditions, or during specific time periods. A full reading of WAC 173-201A is encouraged to achieve a complete understanding of the criteria.

**TABLE 5-1****Water Quality Criteria for Fresh Surface Water (WAC 173-201A-200)**

| <b>Parameter</b>                                | <b>Criteria</b>                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature(1)                                  | The 7-day average of daily maximum temperatures (7-DADMax) shall not exceed 12 degrees C. When natural conditions exceed 12 degrees C, no temperature increases are allowed that raise the receiving water's 7-DADMax more than 0.3 degrees C.                                                                                                     |
| Dissolved Oxygen(1)                             | Dissolved oxygen equal or exceed 9.5 mg/L (lowest 1-day minimum). When natural conditions are lower than 9.5 mg/L, no decreases are allowed that lower the receiving water more than 0.2 mg/L.                                                                                                                                                     |
| Turbidity(1)                                    | Turbidity shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.                                                                                                                                |
| Total Dissolved Gas(1)                          | Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.                                                                                                                                                                                                                                                  |
| pH(1)                                           | pH shall be within the range of 6.5 to 8.5 with a human-caused variation within a range of less than 0.2 units.                                                                                                                                                                                                                                    |
| Fecal Coliform(2)                               | Fecal coliform organisms shall not exceed a geometric mean value of 50 colonies/100 ml, with not more than 10 percent of samples exceeding 100 colonies/100 ml.                                                                                                                                                                                    |
| Toxic, Radioactive, or Deleterious Materials(3) | Toxic, radioactive, or deleterious material concentrations must be below those which have the potential, either singularly or cumulatively, to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health (see WAC 173-201A-260(2)). |
| Aesthetic Values(3)                             | Aesthetic values shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste (see WAC 173-201A-260(2)).                                                                                                                                       |

(1) Aquatic Life Use Criteria for Char Spawning and Rearing

(2) Recreation Use Criteria for Extraordinary Primary Contact

(3) Criteria applies to Aquatic, Recreation, Water Supply and Miscellaneous Uses



## **SOURCES OF NONPOINT POLLUTANTS**

The significant sources of pollutants/water quality parameters found in urban stormwater runoff was discussed briefly under the description of each water quality parameter. The major types of nonpoint pollution sources in the North Bend area are generically related to urban development, including commercial and industrial activities; transportation-related facilities; and agricultural activities. Other important sources of nonpoint pollution may include illicit connections to the storm drain system and on-site sewage systems.

### **Urban Development**

The construction-related activities of land clearing and site preparation for developing properties are potential sources of stormwater pollution. Areas that have been cleared of vegetation are more prone to erosion and can significantly increase sediment loading to nearby water bodies. Sediment can be deposited in natural and constructed channels, thereby reducing the hydraulic capacity. The efficiency and capacity of associated stormwater control structures such as culverts, pipes, and detention facilities may also be affected by the deposition of sediment.

The amount of stormwater runoff usually increases during construction activities as vegetative cover is removed. Leaf interception and infiltration provide a natural detention benefit, while plant roots generally improve a soil's water holding capacity. When vegetation is removed from an area, the total runoff volume and peak runoff rate increase, which can accelerate channel scouring and erode stream banks. This in turn can damage property, destroy riparian habitat, and degrade water quality.

In addition to soil erosion and the transport of sediment, other pollutants can be generated by construction activities. Pesticides, fertilizers, petroleum products, cleaning solvents, paints, asphalt byproducts, acids, and salts as well as solid wastes are potential sources of stormwater pollution if improperly handled or stored on a construction site. The pouring and finishing of concrete can also adversely affect water quality by potentially increasing the pH of the water.

Stormwater problems caused by land development does not stop after construction. The volume of stormwater runoff and peak discharge rate increase as a direct result of the decrease in vegetation and increase in the amount of impervious area. Higher flow rates accelerate bank erosion and scour in the receiving systems, which result in an increase in sediment deposition further downstream. Higher flow rates can also cause localized flooding where the carrying capacity of natural streams and conveyance systems is exceeded. The removal of vegetation from riparian areas reduces habitat and can cause dramatic increases in water temperature, destabilize stream banks, and reduce the natural input of organic materials.

The pollutant load of stormwater in residential areas also increases as development increases. The potential pollutant sources in residential areas include fertilizers, pesticides and herbicides from landscaping activities, biological loads from pet wastes, waste oil disposal from vehicle maintenance activities, improper disposal of household and yard wastes and illegal connections of sanitary sewers to the storm sewer system.

Commercial development in the City includes many small- and medium-sized businesses such as professional offices, retail, restaurants, grocery stores and convenience stores, gas stations, car washes, tire shop, lumber yard, hardware store, hotels, and storage facilities. Schools and churches could also be included in this category. More intense types of commercial development are present with the truck stop, commercial storage yards, automobile and truck repair center, and various smaller paint, tool, and machine shops. Potential sources of pollution from these developments include oil and grease, suspended solids and metals from the parking lots; bacterial loads and garbage from improper waste storage and disposal practices at grocery stores and restaurants; and fertilizers, pesticides, and herbicides from landscaping activities.

Based on national studies, runoff from commercial development most likely contributes metals, such as cadmium (a catalyst used in tire manufacture) and lead, to stormwater runoff. These contaminants are produced by dryfall from vehicle emissions, vehicle wear and tear, and chemical products. Other contaminants that may be associated with the commercial establishments in the City include toxic organic compounds such as pesticides and PAHs. VOCs, such as solvents, may also be present in urban runoff and are typically associated with spills and improper waste disposal activities. Improper chemical storage and waste disposal practices are common sources of contaminants migrating off site from commercial and industrial establishments. The improper use of garbage dumpsters, such as exposing the contents to rain or depositing garbage on the ground rather than in the dumpster, are potential sources of stormwater pollution.

### **Highways and Roads**

Stormwater runoff from Interstate freeways as well as City collectors and residential streets can contain elevated concentrations of metals, suspended solids, and organic compounds such as petroleum hydrocarbons. Studies have shown that pollutant loading is directly related to the amount of vehicle traffic. Also, heavy trucks and equipment tend to be larger contributors than passenger vehicles and light trucks. Major highways with high vehicle use can be significant sources of nonpoint pollutant loading. Sanding in the winter further contributes material to the drainage system. Major thoroughfares in the City include Interstate 90, State Route 202 (Bendigo Boulevard) and East North Bend Way.

### **Agricultural Activities**

Agricultural activities are limited in North Bend, but may still contribute to stormwater pollution. Animal keeping activities are most likely the most significant source of

nonpoint source pollution from agricultural activities. Pasturing and boarding of animals generally contribute to nonpoint pollution source through poor waste management and grazing practices. Runoff from barnyard and pastureland may pollute water supplies, injuring aquatic life in streams, and generally degrade water quality. Nitrate, ammonia, organic carbon, and fecal coliform are commonly elevated in runoff from land used by livestock.

Overgrazing can lead to soil erosion. When livestock are allowed direct access to open water bodies they severely damage the banks, causing erosion and bank sloughing. The direct access of animals to streams, ponds, and wetlands also promotes direct contact with feces and urine wastes. The associated sediment, nutrients, organic loads, and pathogens are then introduced to the surface water system.

### **Domestic Activities**

Nonpoint pollution from domestic activities in the City consists primarily of pet waste and runoff from residential gardens and landscaping. Pet wastes are likely the most significant source of nonpoint pollution from residential activities. Runoff laden with animal wastes, fertilizers, pesticides, or herbicides can contribute to nonpoint pollution.

### **Additional Pollutant Sources**

In addition to the pollutant sources discussed above, the following activities may contribute to stormwater pollution:

- Inconsistent application of land development regulations;
- Inadequate maintenance of stormwater facilities;
- Pollutant wash-off from car and truck parking areas; and
- Dumping of used motor oil, anti-freeze, paint and solvents, yard waste, etc., into the City's storm drainage system or on the ground.
- The North Bend Wastewater Treatment Plant has an individual Stormwater Industrial NPDES permits from the Department of Ecology. The Stormwater Industrial permit includes requirements the permittee must follow to prevent stormwater pollution in runoff from the property.

## **CHAPTER 6**

### **STORMWATER CONTROL**

The following sections discuss general considerations for the control of stormwater pollution from the sources identified in Chapter 5 and present specific recommendations for the City of North Bend.

#### **GENERAL CONSIDERATIONS FOR URBAN STORMWATER**

Each issue discussed in the previous chapters represents a typical stormwater quantity or quality management problem. Stormwater management solutions to alleviate the problem areas can be found from a public education, land use, and/or engineering viewpoint. Timing is important. For example, adopting new land use policies that require more retained vegetation will certainly reduce the impacts of new development, but will not provide relief for existing problems. Existing problems must be addressed either through education, implementation and enforcement of best management practices, or engineered solutions.

As the consequences of uncontrolled urban runoff have become more widely recognized and better understood, and as the alternatives available for control have increased and improved, the complexity of stormwater management has grown. In addition, the strategy has also changed from “end-of-pipe” treatment to prevention. Several general considerations may be identified which provide a framework for discussion of issues that affect the method in which the City implements its stormwater management program. The considerations are briefly discussed in the following paragraphs.

#### **STRUCTURAL VERSUS NONSTRUCTURAL CONTROLS**

Control of stormwater pollution from industrial and municipal discharges typically relies on structural devices such as biofiltration, wet pool, oil/water separator, and filtration facilities to treat stormwater runoff and detention and infiltration facilities to provide flow control from developed areas. It is important that the facilities be designed, constructed, and maintained for long-term continued performance.

Nonstructural stormwater controls focus on preventing pollution and/or high flows. Nonstructural solutions include enhanced maintenance programs, land use controls and development regulations, public involvement, education, and other measures. Complete and consistent implementation of land use policies and regulations requires staff that are properly trained and qualified with respect to design review and construction inspection. The most effective stormwater control programs use an appropriate mix of structural and nonstructural controls.

## **STORMWATER QUALITY VERSUS QUANTITY CONTROL**

Stormwater management has traditionally been concerned with controlling runoff quantities for the purpose of preventing flooding and erosion. Accordingly, most regulations and engineering design practices address this concern. However, techniques for removing pollutants from stormwater runoff have lagged behind. Protection of the nation's waters (physical, chemical, and biological) is the main point behind the Clean Water Act and stormwater runoff quality has become a leading concern due to the recognition that water quality goals often cannot be met solely through control of point sources of pollution.

Efforts at "end-of-pipe" quantity and quality control must confront the same basic task: predict the amount and rate of runoff resulting under various conditions and provide sufficient storage capacity to achieve control objectives. In the case of quantity control, the objective is to detain and release storm runoff at a rate that does not exceed stream channel or manmade conveyance capacity (which may not be the same as matching predevelopment hydrologic conditions). For quality control, the objective is to provide sufficient holding time for the effective operation of gravity settling, filtration, or biochemical removal of pollutants. Because storage may benefit both quantity and quality, some of the same storage technologies can achieve, or partially achieve, both goals.

### **Water Quality Control: Source Control vs. Treatment**

Source controls are methods that prevent pollutants from coming into contact with stormwater. Implementation of source control best management practices (BMPs) prevents the generation or release of pollutants at the source. Source control BMPs are generally more effective and less expensive than treatment devices. Downstream treatment is generally located some distance from the source and designed to remove pollutants once they are in stormwater.

Source control measures (such as enclosing or covering a pollutant source) are usually applied at multiple locations, while a single downstream treatment facility (such as a constructed wetland) often receives runoff from an entire development. In some cases, a single regional downstream facility (such as a regional wet pond) can serve multiple properties covering a large area.

### **Water Quantity Control: Low Impact Development vs. Detention**

Low Impact Development (LID) is a method for controlling stormwater on a site. LID is an efficient method of decreasing the amount and rate of runoff associated with a developing site. The primary goal of LID methods is to mimic the predevelopment site hydrology by using site design techniques that store, infiltrate, evaporate, and detain runoff. Use of these techniques helps to reduce off-site runoff and ensure adequate groundwater recharge. Techniques are applied throughout the site, whereas,



detention/retention facilities are generally large facilities located at the downstream corner of a site, or even farther away as a regional facility collecting runoff from multiple sites.

## **CONSTRUCTION VERSUS LONG-TERM SITE OPERATION**

In general, water quality and quantity problems that occur during site construction differ from those that occur during the operation of a developed site. Therefore, these periods should be treated separately in stormwater management planning. At the same time, there should be awareness that some measures installed for the construction phase can be converted to permanent service. Proper implementation and enforcement of temporary erosion control measures and best management practices is essential to controlling runoff from construction sites.

## **CONTROL IN NEW VERSUS EXISTING DEVELOPMENT**

New developments offer greater opportunities to apply stormwater management techniques than do existing developments, due to new regulations requiring stormwater controls. Retrofitting structural measures in existing developments is generally difficult and expensive. It may be easier to implement nonstructural approaches, such as modified maintenance practices or public education for existing development; however, the benefits will fall short of the more comprehensive approach for new development.

## **CRITICAL AREAS**

Critical areas (and their buffers) that are sensitive to impacts from urban stormwater include stream corridors, lakes, floodplains, wetlands, steep slopes and other geologic hazards, and groundwater aquifers. Some special considerations in stormwater management apply to these areas, including additional studies, increased protection standards, and limitations on facility siting.

## **CONTROL OF ACUTE VERSUS CHRONIC IMPACTS**

An acute water quality impact is caused by a one-time occurrence or an intense occurrence of short duration. An example of an acute impact would be a fuel spill into a catch basin near a creek and a resultant fish kill. Conversely, a chronic impact is one that occurs over a long duration. A long-term discharge of stormwater runoff at velocities that cause erosion and sedimentation of a stream can result in a chronic impact to water quality and habitat in the stream. A stormwater management program should include strategies to reduce both acute and chronic impacts to water resources.

## **STRUCTURAL ALTERNATIVES**

Stormwater management alternatives for control of the quantity and quality of stormwater runoff need not be mutually exclusive. The outdated method of designing

stormwater conveyance systems that relied on curb and gutters to transport stormwater directly into pipes which discharged the stormwater directly into a stream, river, or lake provided little in the way of stormwater quantity control and nothing in the way of quality control. As citizens, municipalities, and designers are becoming more aware of the damaging effects of stormwater quantity and quality, the line between stormwater management alternatives which are strictly concerned with quantity issues and those concerned strictly with quality issues is becoming blurred. The remainder of this chapter discusses structural and non-structural stormwater management alternatives which will serve to limit the quantity and/or rate of stormwater runoff and improve the quality of the runoff, prior to discharge to receiving waters.

## **STRUCTURAL QUANTITY CONTROL**

The quantity (rate and amount) of runoff from developed areas can be controlled by low impact development techniques, flow control BMPs, infiltration, or by storage and regulated release (detention) facilities. A combination of all of these will result in the greatest control.

### **Low Impact Development**

Low Impact Development techniques can significantly reduce the amount of runoff generated from a site, as compared to a more traditional design of “pipes and ponds”. Not all sites are suitable for LID, and not all LID techniques are equally applicable amongst different sites. LID is a developing methodology and is not considered a traditional “end-of-pipe” structural solution, but does incorporate constructed items.

The Department of Ecology recommends that LID include the following:

- Maintain the predeveloped, undisturbed stormwater flows;
- Retain native vegetation and soils to intercept, evaporate, and transpire stormwater on the site, rather than using ponds and conveyances;
- Maintain and improve soil quality in order to improve infiltration and reduce runoff;
- Cluster development and roads on the site and retain natural features that promote infiltration; and
- Reduce impervious surface area and use permeable hard surfaces.

Management and design practices used in LID include minimizing clearing and grading, bioretention facilities (rain gardens), dry wells, filter/buffer strips, grass swales, soil amendments, pin pile foundations, and infiltration trenches. As with many practices,

maintenance of LID facilities is essential and should be reviewed and understood prior to implementation.

LID design guidance is available in the *Low Impact Development, Technical Guidance Manual for Puget Sound*, December 2012, Puget Sound Partnership and Washington State University Pierce County Extension.

### **Flow Control BMPs**

Flow control BMPs seek to control runoff at or near its source and often utilize pervious and undisturbed areas to disperse, infiltrate, and manage runoff. They are often required and used to supplement and reduce the size of larger “end-of-pipe” facilities. Many of the flow control BMPs are similar to LID techniques and include:

- Limited Infiltration
- Dispersion
- Rain Gardens
- Permeable Pavement
- Rainwater Harvesting
- Vegetated Roof
- Reduced Impervious Credit
- Native Growth Retention Credit

The credits are utilized to reduce the size of traditional facilities.

### **Infiltration**

Infiltration devices capture runoff and infiltrate it into the ground. The King County *Surface Water Design Manual* provides design and sizing guidance in Chapter 5 (Flow Control Design). Facilities can be open basins, ponds, and swales; or closed vaults, tanks, manholes, and trenches. Infiltration systems provide groundwater recharge, can be integrated into a site’s landscaped and open areas, and if designed properly, can serve larger developments. Infiltration devices should be used only in situations where the captured volume of water can infiltrate into the ground before the next storm (typically 24 hours) and where soils, slope, and cover will not promote sloughing and mass wasting (landslides).

The basic design behind all infiltration facilities is to collect and store the water in the facility for a period of time while it infiltrates into the ground. Designing an infiltration facility requires site-specific exploration and testing of the underlying soils and groundwater elevation to verify and calculate the soil’s capacity to infiltrate. In addition, in order to protect groundwater and the long-term performance of the facility, the runoff must be pre-treated prior to infiltration. Open designs can be incorporated into the landscape setting such as parks and sports fields. Regular inspection of infiltration

facilities is essential, as are legally binding maintenance agreements and education of private facility owners regarding the function and maintenance needs.

### **Storage and Regulated Release (Detention)**

Storage and regulated release facilities are currently installed in the newer developments in the City. In addition, detention may occur in the form of ponding in yards, vacant lots, and ditches. Storage and regulated release of stormwater requires the installation of detention systems to insure that the rate of stormwater runoff leaving the site for the design storm event during the post-development condition is regulated to mimic and be no greater than the pre-development rate for the same design storm event. This method of stormwater control minimizes downstream impact on the existing conveyance system, including reducing erosion and scour in streams and wetlands. Design, sizing, and maintenance criteria for detention facilities can be found in Chapter 5 (Flow Control Design) of the King County *Surface Water Design Manual*. Per Section 1.2.3, some areas of the City that discharge directly to the Middle or South Fork Snoqualmie River may be exempt from constructing flow control facilities.

Detention systems have been widely used for runoff quantity control since the late 1970s in Western Washington. Facilities designed solely as detention systems perform poorly as treatment devices for runoff. This is primarily due to short residence time and the fact that these basins do not remove dissolved pollutants. However, there is some removal of suspended solids in a typical detention facility. If combined with a wet pool, they can act as effective runoff quality control devices as well. Detention facilities can be designed for multiple uses such as sports courts, playfields, or parking lots.

An alternative to having many individual detention facilities is regional detention. Regional detention, if feasible, can provide additional benefits such as integration of open space, recreation opportunities and environmental protection with detention and water quality treatment, and potential cost savings in capital costs. Maintenance of a regional facility would become the responsibility of the City. Initial funding for the facility would also fall on the City's shoulders, with some type of cost recovery from future development projects. Providing regional detention however, requires adequate capacity of the existing conveyance system to the regional facility which may be cost prohibitive to replace/construct.

### **STRUCTURAL QUALITY CONTROL**

The quality of runoff can be controlled by biofiltration, wet pools, media filtration, and oil/water separation. Depending on the target pollutants and receiving water, utilizing a water quality facility in combination with another facility (two-train treatment system) may be required. Specific design criteria are provided in the Chapter 6 Water Quality Design in the King County *Surface Water Design Manual*. As mentioned regarding detention facilities, regional facilities can also be utilized for water quality treatment.

## **Biofiltration**

Bioswales and filter strips are among the oldest stormwater quality control measures, having been used alongside streets and highways as well as by farmers for many years. A bioswale is a shallow ditch with flatter side slopes (i.e., 3H:1V); thick vegetation such as grass for soil stabilization, stormwater treatment, and nutrient uptake; and contiguous areas of standing or flowing water following rainfall events. A filter strip is simply a strip of land across which stormwater from a street or parking lot sheet flows before entering adjacent conveyance systems or receiving waters.

For smaller storms, both bioswales and filter strips remove pollutants from stormwater by: (1) slowing the water and settling or filtering out solids as the water travels over the grassed area; and (2) allowing infiltration into the underlying soil. Heavy metals are typically trapped in the upper regions of the soil column. In addition, the vegetation tends to function as fixed media to support growth of microorganisms, which can break down dilute concentrations of organics such as oil residues.

Maintenance of these facilities is an important consideration both for aesthetics and hydraulic efficiency. In the case of the bioswale, care must be taken to ensure that flows during large storms are not impeded by overgrown vegetation, or cause erosion and scour. To prevent this, the vegetation planted in the channel should be suitable for mowing, and the channel designed so that mowing machines can be easily and efficiently operated along the swale.

## **Wet Pools**

A wet pool is a facility that maintains a permanent pool of water, and treats stormwater both by gravity settling and biological uptake of algae and microorganisms. Wet pools typically contains two cells and are designed to reduce turbulence so that previously captured pollutants are not disturbed and entrained into the water column and washed out of the facility. Several options are available such as a wet pond, combined wetpond/detention facility, wet vault/tank, or stormwater wetland. If properly designed and maintained, wet ponds can provide effective water quality protection and ancillary benefits such as enhanced aesthetics and wildlife habitat. Different design criteria target different pollutants. All wet pools remove suspended solids, but removal of metals for stream protection and phosphorus for lake protection require different variations to the basic design principles.

## **Media Filtration**

Stormwater filtration systems (i.e., sand filters) consist of either an open pond or closed vault wherein stormwater is allowed to flow through an engineered sand into a collection pipe and then discharged. Such facilities are subject to clogging, so pre-settling is required to remove larger solid particles before the water enters the facility. A level spreader is required to allow the water to evenly and gently spread across the filter.



Maintenance on large sand filters can be expensive, since the sand media must be removed and replaced. Proper design to assist in this effort is essential.

As an alternative to using a large vault or pond filled with sand as the filter media, several companies have developed filtration technologies that are more modular, so they come in various sizes and configurations. Depending on the application, a vault with canisters of a specific filter media can be designed for any number of canisters, to target several different pollutants. Maintenance is achieved by vactoring the vault and replacing the canisters (or the filter media in each).

### **Oil/Water Separators**

Oil water separators are devices, usually installed in parking lots or streets that remove oil from stormwater prior to discharge into the main conveyance system or treatment facility. They are required in all areas subject to high volumes of traffic, where vehicle fueling is exercised, or other industrial uses prone to fuel, oil, and hydraulic leaks. Catch basin inserts serve to capture oil right at the source, prior to entering the drainage system, whereas coalescing plate separators tend to collect runoff from several areas and passively remove oil prior to discharge from an industrial site. Proper operation of these devices requires regular maintenance.

## **NON-STRUCTURAL ALTERNATIVES**

Non-structural practices that provide the basis for a strong stormwater management program include:

- Public Education and Involvement. Since stormwater pollution is highly variable and widespread across the City, educating the general public on more friendly day-to-day activities and getting citizens involved in more active stewardship projects can reap significant benefits. In addition, an informed public is better able to understand the program's objectives and how it is funded.
- Program Administration. There are several aspects of program administration that can be implemented to decrease the effects of urbanization on the natural environment.
  - With accurate and complete maps of the drainage system, staff will be better able to response to citizen complaints and spills.
  - Although not yet required by state or federal regulations, any kind of water quality data will prove to be beneficial in the future for evaluating the programs' effectiveness.
  - Record keeping of all program activities (and their effectiveness) are key to understanding the best use of resources.

- Thorough and complete review of stormwater system design and the diligent inspection of erosion control measures and construction of the drainage infrastructure are essential.
- Regulations. Land use policies and regulations that promote site planning to reduce clearing and soil disturbance, protection of critical areas, and implementation of best management practices.
- Operation and Maintenance. Enhanced operation and maintenance practices can result in better performing stormwater facilities. Other activities, like vactoring the slurry from asphalt or cement concrete sawing can prevent the direct discharge of pollutants to the drainage system.

## **CHAPTER 7**

### **OPERATION AND MAINTENANCE**

The following sections summarize considerations for the control of stormwater pollution from the sources identified in Chapters 5 and 6 and present specific recommendations for the City of North Bend. A detailed water quality BMP operations and maintenance schedule can be found in Appendix B.

#### **FACILITY OPERATION AND MAINTENANCE PROGRAM**

The objective of a stormwater maintenance program is to assure the continued functioning of stormwater management facilities. A complete maintenance program includes more than the physical tasks of cleaning catch basins, pipes, and open ditches; maintenance of vegetation in biological treatment structures; and proper disposal of debris from the maintenance activities. Maintenance programs also involve management items such as completing and maintaining a facilities inventory, updating a base map, scheduling inspections and maintenance activities, assessing costs for contract maintenance versus staff maintenance, and record keeping.

In order to perform inspections and maintenance at the appropriate time, a budget, staff, and priority schedule needs to be established. Certain types of maintenance are more important than others. It is important that catch basins and conveyance facilities be inspected annually before the wet season to assure that debris has not blocked a channel or taken up capacity in a manhole. Street sweeping in the fall is important because leaves block catch basin grates, which could result in ponding or minor flooding on private property or roadways. Loss of vegetative cover in treatment swales and filter strips during summer drought conditions can result in reduced effectiveness.

Reports and record keeping are important feedback mechanisms that enable management to compare actual versus planned costs, production, and efficiency. Reports provide a database for improved budgeting and resource allocation. Records and reports should include personnel hours, equipment hours, materials used, and the unit of work completed.

Maintenance control establishes accountability for specific results within a specific time frame and budget. The maintenance program needs a control hierarchy to establish a chain of command to complete the work.

One item of critical importance is inspecting privately owned facilities to ensure that they are properly maintained. The proper operation and maintenance of stormwater facilities benefits the public as a whole; therefore, the City should utilize innovative solutions to accomplish the goals of stormwater management in those cases where a private entity cannot or will not maintain its facility. Through the development review process, it is

recommended that all private facilities be designed and constructed under the same standards as public systems. If the private system is ever turned over to the City for operation and maintenance, the transfer should be seamless and not require the City to further train employees or purchase new maintenance equipment. Also, private systems should be designed and located to allow easy inspection by City staff.

## **MAINTENANCE STANDARDS**

Appendix A of King County's Surface Water Drainage Manual (Manual) identifies maintenance requirements for flow control, conveyance, and water quality facilities that should be established by the City. Similar requirements are contained in the Ecology Stormwater Management Manual for Western Washington, Volume 5, Chapter 4.

The following is a brief description of the recommended maintenance procedures and the impact on stormwater pollution that could result from not maintaining a facility. Appendix B contains complete descriptions of maintenance activities the City may need to complete.

### **STREET SWEEPING**

Streets with concrete curb and gutter or thickened edges are part of the stormwater conveyance system. All streets accumulate particles, silt, leaves, debris, and other pollutants that could enter the stormwater conveyance system. Street sweeping (not washing) is an important maintenance item to reduce pollution from entering receiving waters and to reduce the potential for blocking of the conveyance system.

High-efficiency street sweepers are recommended due to the fact that they are able to pick up small particulates that accumulate pollutants along City streets. On average, the City sweeps one-half of the streets weekly, which means all streets are swept every 2 weeks. This is consistent with recommended maintenance.

### **CATCH BASIN CLEANING**

The City has mapped approximately 1,600 storm drainage catch basin and manhole structures, including types with and without sumps. Sumps are important features that allow deposition of particulate matter carried in the stormwater. When sumps become filled to 60 percent of their volume, the efficiency of silt removal diminishes significantly. Maintenance is recommended when the sediment exceeds this 60 percent threshold. The City has historically cleaned all catch basins once every year. Depending on the location, this frequency may be relaxed or increased, based on past maintenance records. Catch basins are normally cleaned with a vacuum truck that removes the sediment from the basin. This sediment must be disposed of properly at an appropriate disposal site.

## **PIPE CLEANING**

The City has mapped over 26 miles of stormwater pipe. Pipes in the City vary in size from 6-inch to 96-inch diameter. Pipe types include concrete, corrugated metal, and HDPE. Although there are no specific guidelines, a typical schedule for pipe cleaning is to clean storm drain pipes on a 3- to 5-year rotating basis. The City currently cleans pipes on an as-needed basis. The primary maintenance activity for stormwater pipes is removal of accumulated sediment once the accumulated sediment or debris exceeds 20 percent of the diameter of the pipe. Sediment can decrease conveyance capacity or can be washed out of the pipes during storm events causing downstream sediment and pollution problems. When jetting and flushing pipes, adequate downstream siltation control must be in place. This is usually accomplished by using a vector truck at the nearest downstream structure. Additionally, it is recommended that the City implement a television inspection program with a goal of inspecting pipes on a 10-year rotating basis.

## **OPEN DITCH MOWING AND CLEANING**

The City currently has mapped approximately 8.3 miles of open channels. Ditches and swales can provide biofiltration, if vegetation is allowed to remain within the channel and on the sides. The primary pollutant removal mechanism of a bioswale (or ditch) involves filtration by grass blades, which enhance sedimentation, as well as trapping and adhesion of pollutants to the grass and thatch. To be most effective, the vegetation within the ditch should be cut down to a height between 2 and 6 inches. Mowing is the first method that should be used to reduce capacity loss. If the ditch must be reshaped to promote drainage or remove excess materials, the work should be performed during dry weather. Two methods to clear obstructions or reshape the ditch include the following:

1. Swales can be cleaned with a backhoe, taking care not to remove more material than is necessary. Clean areas only where there is a flow restriction. Small amounts of sediment should be removed by hand.
2. Under the close supervision of City staff, yearly maintenance may be performed by a qualified contractor. A contractor can utilize an auger attachment mounted on a dump truck. The auger removes sediment from the swale/ditch and places the material directly into the truck.

## **DETENTION SYSTEM CLEANING**

Very few public detention facilities are located within City limits. Upon installation of a detention system, the City should obtain a manual regarding specific maintenance requirements for facilities such as detention ponds. At a minimum, when detention systems are installed, they should be monitored annually for sediment accumulation. Removal of accumulated sediment is anticipated to be required once every 5 years, or when accumulated sediment takes up more than 10 percent of the pond depth.

## BIOFILTRATION SWALES

The grass in the bioswale should be mowed periodically to keep it at the proper height. If the grass is damaged, for example by drought or storms, it should be replaced. Leaves, grass clippings, and other debris should be removed.

## CULVERTS

Culverts should be inspected annually and after every significant runoff event to check for blockages, excessive scour, and deposition of new sediment and debris. Especially in the wet season, any potential blockage or loss of capacity should be immediately removed. This type of maintenance activity will require a Hydraulic Project Approval (HPA) from the Washington Department of Fish & Wildlife. The HPA is usually valid for 5 years. In emergency situations, immediate work is allowed, with an HPA issued after-the-fact.

## RECOMMENDED MAINTENANCE PROGRAM

The City's current stormwater maintenance program consists of routine ditch mowing, swale mowing, right-of-way (shoulder) mowing, catch basin cleaning, and as required, pipe cleaning. The stormwater facilities the City must maintain are shown in Table 7-1.

**TABLE 7-1**

### **Inventory of Stormwater Facilities**

| <b>Facility</b>           | <b>Quantity</b> |
|---------------------------|-----------------|
| Catch Basins              | 1,600           |
| Storm Pipe                | 140,000 LF      |
| Ditches                   | 44,000 LF       |
| Detention Facilities*     | 21 (est.)       |
| Water Quality Facilities* | 6 (est.)        |
| River Outfalls            | 36              |

\*Most stormwater facilities in City limits are privately owned.

In addition to the maintenance of the facilities listed in Table 7-1 the City will continue the practice of street sweeping to remove sediment and debris, before it enters the system.

The stormwater maintenance activities anticipated by City staff and the corresponding production units, estimated personnel hours, and estimated labor costs are shown in Table 7-2. This information is used to estimate the cost of the stormwater maintenance program and estimate the staff required to implement the program. It has been assumed that all maintenance activities will be completed by City staff and that the cost to the City per man-hour is an average of \$45.



**TABLE 7-2****Annual Maintenance Expenses**

| <b>Activity</b>                                      | <b>Production Unit</b> | <b>Number of Units</b> | <b>Manpower Requirement</b> | <b>Recommended Schedule</b> | <b>Staff Hours</b> | <b>Est. Annual Cost</b> |
|------------------------------------------------------|------------------------|------------------------|-----------------------------|-----------------------------|--------------------|-------------------------|
| Clean Catch Basins*                                  | 30 CBs/day             | 1,600                  | 2-man crew                  | One half per Year           | 432                | \$41,472*               |
| Detention Ponds and Other                            | N/A                    | N/A                    | N/A                         | N/A                         | N/A                | N/A                     |
| Street Sweeping                                      | 27.5 miles/day         | 55 miles               | 1-man crew                  | Once every 2 weeks          | 416                | \$18,720                |
| Ditch/Swale Mowing                                   | 4,400 LF/day           | 44,000 LF              | 1-man crew                  | 3 times per year            | 240                | \$10,800                |
| Ditch Maintenance (sediment removal and maintenance) | 500 LF/day             | 27,300 LF              | 2-man crew                  | 1,000 LF/year               | 32                 | \$1,440                 |
| Storm Pipe Cleaning*                                 | 1,200 LF/day           | 26.5miles              | 2-man crew                  | As needed                   | 160                | \$15,360*               |
| Pipe Inspection (TV)@                                | 1,200 LF/day           | 106,100 LF             | 2-man crew                  | One tenth per year          | 144                | \$11,880@               |
| Miscellaneous Repairs & Inspection                   | Varies                 | Varies                 | 40 hrs/month                | As needed                   | 480                | \$21,600                |
| <b>Total</b>                                         |                        |                        |                             |                             | <b>1,904</b>       | <b>\$121,272</b>        |

\*Labor plus vector truck costs \$192/hour with 2-man crew

@ Labor plus TV equipment costs \$165 per hour with 2-man crew

Assume basic labor total cost at \$45/hour/employee

## STAFF REQUIREMENTS

The total City staff hours required for the maintenance activities identified in Table 7-2 is approximately 1,904 hours.

## EQUIPMENT NEEDS

The Public Works Department has expressed a need for a new street sweeper and two new mowers. This equipment is required to efficiently and effectively complete the maintenance activities identified in Table 7-2. The stormwater utility will fund 50 percent of the cost of street sweeper, with the transportation budget covering the other half. The estimated cost in 2011 of the new equipment is shown in Table 7-3.

**TABLE 7-3**

### **Stormwater Maintenance Equipment Needs**

| <b>Equipment</b> | <b>Estimated Cost</b> | <b>Stormwater<br/>Utility Cost</b> |
|------------------|-----------------------|------------------------------------|
| Street Sweeper   | \$200,000             | \$100,000                          |
| Mower (two)      | \$10,000              | \$10,000                           |
| <b>Total</b>     | <b>\$210,000</b>      | <b>\$110,000</b>                   |

## INSPECTION

The City should inspect all private and City-owned stormwater treatment and flow control facilities annually, unless there are maintenance records to support a different frequency. Reducing the inspection frequency should be based on records of double the length of time needed for maintenance.

Spot checks must be performed to detect potentially damaged permanent treatment and flow control facilities (other than catch basins) after a major (greater than 24-hour, 10 year) storm event. If spot checks indicate widespread damage/maintenance needs, the City should inspect all stormwater treatment and flow control facilities that may be affected. Repair or appropriate maintenance action should be performed in accordance with established maintenance standards.

All catch basins and inlets should be inspected at least once per year and cleaned if the inspections indicate a need to do so. The decant water generated from catch basin and pipe cleaning must be disposed of properly.

## **STAFF TRAINING**

As discussed previously in this chapter, the City must develop and implement an ongoing training program for City employees whose construction and O&M job functions may impact stormwater quality. This program should address the importance of protecting water quality, O&M standards, inspection procedures, BMP selection, preventing impact to water quality, and procedures for reporting water quality concerns.

The City should ensure that the staff is well trained on techniques and procedures to inspect and maintain best management stormwater practices as outlined in Appendix A, of the 2009 King County Surface Water Design Manual (King County Manual). At a minimum, staff should be educated on how to maintain catch basins, detention ponds and control structures, bioswales/ditches, and any other best management practices implemented within the City. Staff should also be knowledgeable in identifying pollutant sources and in understanding pollutant control measures, spill response procedures, and environmentally acceptable material handling practices. Ecology's "Stormwater Pollution Prevention Planning for Industrial Facilities" (WQ-R-93-015, 9/93) may be used as a training reference. The City Engineer should be designated as responsible for setting up training for new employees regarding these issues. Renewal training for all employees on a biannual basis is recommended as well.

Personnel should also be well trained on erosion and sediment control issues so they can properly investigate and advise contractors regarding problem areas during construction. Appropriate staff members should be certified through the "Construction Site Erosion and Sediment Control Certification Course" offered by the Associated General Contractors of Washington Education Foundation or an approved equivalent. Equivalent certificates include:

- WSDOT certification in Construction Site Erosion and Sediment Control, and
- Certified Professional in Erosion and Sediment Control (CPESC) offered by the International Erosion Control Association (IECA).

Erosion and sediment control certification for staff members should be renewed every 3 years.

## **ENFORCEMENT**

Staffing levels must be sufficient to respond to stormwater complaints, and provide periodic inspection of private stormwater treatment facilities such as oil/water separators and detention facilities. City staff should document the hours spent onsite inspections, together with the frequency of inspection. From these records and the records of time spent responding to complaints, an understanding of the adequacy of the current staffing level can be gained.

## **PUBLIC EDUCATION AND OUTREACH**

An important element of a stormwater management plan is public education and outreach. The involvement of the public is necessary to insure the overall success of the stormwater management program. For the public to be motivated to participate in stormwater management, it must first be aware of existing stormwater and surface water problems, the public's role in creating these problems, and actions to avoid and correct them.

The public must also be aware of how their normal activities affect stormwater quality and quantity. Most citizens believe that stormwater management is someone else's problem. In order to educate the public, issues with local relevance must be identified and programs must be designed to address them. The following is the outline of a public education and outreach program.

### **BEST MANAGEMENT PRACTICES (BMPs)**

In most communities, a major source of stormwater contamination comes from sources that are lumped together and called nonpoint pollution. Nonpoint pollution sources can generally be defined as "pollution that does not have a single point of discharge." Nonpoint pollution discharges can be divided into commercial and residential categories.

The treatment of stormwater runoff prior to discharge to surface water or prevention of nonpoint pollution in stormwater should be accomplished by using BMPs. BMPs are defined as physical, structural, and/or managerial practices, which when used singly or in combination, prevent or reduce pollution of water.

The King County Surface Water Design Manual contains BMPs for urban land uses. Best Management Practices can be placed into two general groups: source control BMPs, and runoff treatment BMPs. The former group includes those BMPs that keep pollutants from coming in contact with stormwater; the latter group consists of methods for treating stormwater, once it is polluted. Source control BMPs are preferred as they are generally less expensive and frequently are more effective.

BMPs and general strategies for their use are listed below in order of preference:

1. **Alter the Activity:** The preferred option is to alter any practice that may contaminate surface water or groundwater by either not producing the pollutant to begin with or by controlling it in such a way as to keep it out of the environment. An example would be recycling used oil rather than dumping it down a storm drain.
2. **Enclose the Activity:** If the practice cannot be altered, it should be enclosed in a building. Enclosure accomplishes two things. It keeps rain

from coming into contact with the activity and since drains inside a building must discharge to sanitary or process wastewater sewers or a dead-end sump, any contamination of runoff is avoided.

3. **Cover the Activity:** Placing the activity inside a building may be infeasible or prohibitively expensive. A less expensive structure with only a roof may be effective although it may not keep out all precipitation. Internal drains must be connected to the sanitary sewer to collect water used to wash down the area as well as any rain that may enter along the perimeter.
4. **Segregate the Activity:** Segregating an activity that generates more pollutants than other activities may lower the cost of enclosure or covering to a reasonable level.

If the segregated activity cannot be covered, it may be possible in certain situations to connect the area to the public sanitary sewer, subject to approval. Drains may also be connected to a businesses' own process wastewater system if the business operates independently of the local authority.

5. **Discharge Stormwater to the Process Wastewater Treatment System:** Many industries have their own process wastewater treatment system with final disposal directly to the receiving water. In these cases, stormwater from areas of significant pollution sources can be plumbed to the process treatment system as long as its capacity is not exceeded.
6. **Discharge Small, High-Frequency Storms to Public Sanitary Sewer:** This BMP would be limited to those few outside activities that contribute unusually high concentrations of pollutants and/or pollutants of unusual concern. Limited entry of these few special cases may not overtax the public sanitary sewer.

The entry of stormwater to the sanitary or combined sewer can be limited to the small high-frequency storms that carry off the majority of pollutants over time. Storm flows in excess of the hydraulic capacity of the sanitary or combined sewer would be discharged to the storm drain.

7. **Discharge Small, High-Frequency Storms to a Dead-End Sump:** This BMP would be limited to those few activities that contribute unusually high concentrations of pollutants and/or pollutants of unusual concern. This option would be used when discharge into a sanitary sewer or process wastewater treatment is not available or feasible. This option requires the capacity to pump out the sump regularly and to dispose of the waste in an appropriate manner.

8. **Treat the Stormwater with a Stormwater Treatment BMP:** The treatment of stormwater is the least-preferred option for several reasons. Source control BMPs keep the pollutants completely away from stormwater. In contrast, stormwater treatment devices are not 100 percent effective. In fact, a highly effective BMP is considered successful if 80 percent of the pollutants are removed. Even after treatment, freshwater criteria may not be met for some areas.

Given the above strategies for use of BMPs, the King County Manual provides a menu of BMPs for many types of pollutant sources. There is also a specific King County Stormwater Pollution Prevention Manual with descriptions of various source control measures such as car wash pads and coverage of storage piles. Certain projects may trigger “Special Requirement #4” (Source Control) which would require the applicant to implement various source control measures on the project. These may include structural and non-structural BMPs.

The Manual also contains “Special Requirement #5” (Oil Control) which provides oil control measures for “high use sites.” These areas include:

- An area of a commercial or industrial site subject to an expected average daily traffic count equal to or greater than 100 vehicles per 1,000 square feet of gross building area,
- An area of a commercial or industrial site subject to petroleum storage or transfer in excess of 1,500 gallons per year, not including delivered heating oil,
- An area of a commercial or industrial site subject to use, storage, or maintenance of 25 or more diesel vehicles that are over 10 tons net weight,
- A road intersection with a measured average daily traffic count of 25,000 vehicles or more on the main roadway and 15,000 vehicles or more on any intersecting roadway, excluding projects proposing primarily pedestrian or bicycle use improvements.

Providing treatment under the high use menu is just one of five treatment menus that the Manual provides. The other four include a basic, enhanced, sensitive lake protection and a sphagnum bog protection menu. However, as noted earlier, source control BMPs are preferred over treatment BMPs, if feasible.

Detailed water quality BMP operations and maintenance procedures can be found in Appendix B.



## **CHAPTER 8**

### **CAPITAL IMPROVEMENT PLAN**

#### **INTRODUCTION**

The City of North Bend's Stormwater Capital Improvement Plan is presented in this section. The recommended projects include structural and nonstructural elements to control both the quantity and quality of stormwater runoff.

The Capital Improvement Plan (CIP) was developed based on input from several sources. Sources included City staff, who identified storm drainage problems, and the City's 2001 Comprehensive Stormwater Management Plan which was reviewed for projects completed and projects outstanding.

Whenever an inadequately sized culvert, pipe, or channel is replaced or reconstructed, the improvement may transfer the problem downstream. It is therefore strongly recommended that all improvements include analysis of downstream conditions. As a general rule, projects should proceed from the downstream end of the system towards the upstream end of the system.

#### **CAPITAL IMPROVEMENT PROJECTS**

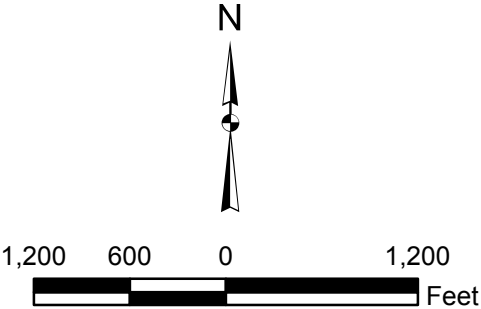
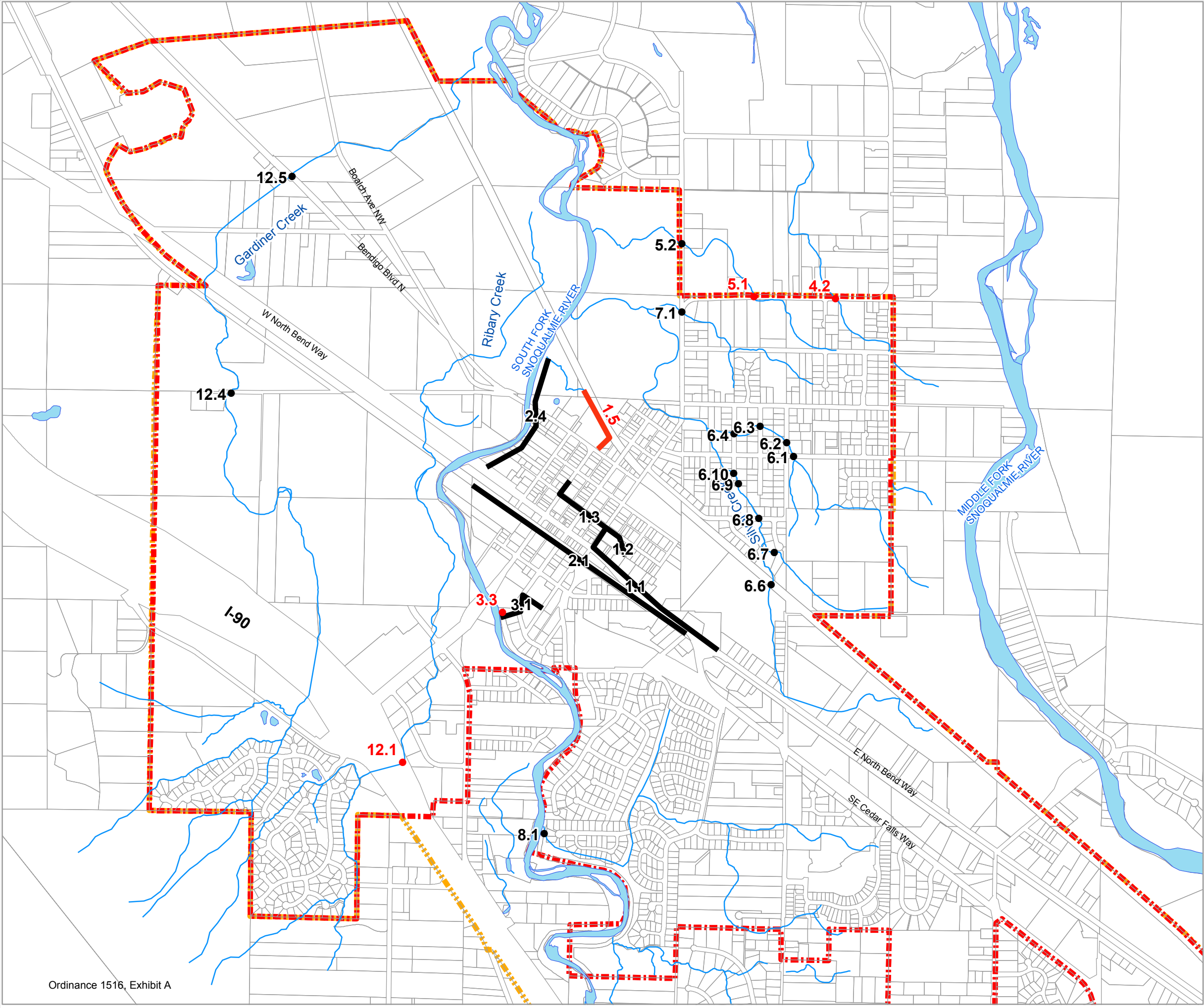
This Comprehensive Stormwater Management Plan Update reviewed the outstanding projects from the 2001 Comprehensive Stormwater Management Plan (2001 Comp Plan). Further evaluation and modeling did not reveal any new projects. In the 2001 Comp Plan, there were 33 capital improvement projects (CIPs) identified. Of those 33 CIPs, eight have been completed as of October 2013. Table 8-1 shows project number (from the 2001 Comp Plan), description, and project status. Figure 8-1 shows the locations of the outstanding projects.

For the newly annexed areas of the City, a field reconnaissance was performed with City staff. There were also copies of as-built drawings obtained from the City for the developments in this area. Per City staff, there are no known problems existing in the newly annexed areas or additional problems in the old City limits. During the field reconnaissance there were no flooding, erosion, or other drainage problems observed, therefore there are no new CIPs identified.

Although no new CIPs were determined, the newly annexed areas will generally increase the maintenance required for storm water facilities.

**TABLE 8-1****2001 Comprehensive Stormwater Management Plan CIP Status**

| <b>Project No.</b> | <b>Project Location</b>                                                                               | <b>Project Description</b>                                                                                                                                                               | <b>Project Status</b>                             |
|--------------------|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| 1.1                | North side of North Bend Way to intersection of Ballarat Avenue North and East 2 <sup>nd</sup> Street | Replace existing gravity trunk line (12- and 18-inch RCP,) with 2,175 LF of 30-inch CPEP                                                                                                 | Not Completed                                     |
| 1.2                | Janet Avenue culvert to East 2 <sup>nd</sup> Street to Ballarat Avenue                                | Replace existing gravity trunk line (24-inch CMP) with 500 LF of 30-inch CPEP                                                                                                            | Not Completed                                     |
| 1.3                | East 2 <sup>nd</sup> Street from Ballarat Avenue North to Bendigo Avenue South                        | Replace existing gravity trunk line (36-inch RCP) with 825 LF concrete box, 4-feet wide by 3.5-feet deep                                                                                 | Not Completed                                     |
| 1.4                | <i>Culvert under East 4<sup>th</sup> Street from ex. concrete box to ditch</i>                        | <i>Replace culvert with 85 LF concrete box, 4-feet by 3.5-feet deep. Tie to improved ditch system</i>                                                                                    | <i>Completed 2006</i>                             |
| 1.5                | Drainage swale from East 4 <sup>th</sup> Street culvert to Pond 1                                     | Widen and regrade the existing ditch to 5-foot bottom width, 3.5-feet deep, with 2:1 side slope                                                                                          | Design complete, waiting on funding               |
| 2.1                | Storm drain along BNRR from SE Orchard Drive to Outfall                                               | Replace existing gravity trunk line (12- and 24-inch RCP) with 1,400 LF of 54-inch CPEP, 1,150 LF of 48-inch CPP and 520 LF of 30-inch CPEP. Replace outfall with 48-inch CPEP/flap gate | Not Completed                                     |
| 2.4                | East bank of South Fork from Pond 2 to Pond 1                                                         | Reroute Pond 2 outfall north to Pond 1 outfall in an open channel/culvert system                                                                                                         | Park and Ride will address WQ and capacity issues |
| 3.1                | Southwest of Cedar Avenue South and East Park Street along Main Avenue South                          | Replace existing gravity trunk line (8-inch PVC) and 24-inch CMP outfall with 750 LF of 24-inch CPEP                                                                                     | Not Completed                                     |
| 3.3                | <i>Pump Station</i>                                                                                   | <i>Replace with new 5-cfs pump station and wet well. Create a 0.5-acre-foot surface storage pond with intertie to wet well</i>                                                           | <i>Portable Pump Purchased in 2013.</i>           |



- LEGEND:**
- 6 YEAR CAPITAL IMPROVEMENT PROJECTS (CIP)
  - 20 YEAR CAPITAL IMPROVEMENT PROJECTS (CIP)
  - 6 YEAR CIP LINE
  - 20 YEAR CIP LINE
  - RIVERS/STREAMS
  - PARCELS
  - - - CITY LIMITS
  - ... UGA LIMITS

CITY OF NORTH BEND

STORMWATER COMPREHENSIVE PLAN  
FIGURE 8-1  
CIP LOCATIONS



TABLE 8-1 – (continued)

## 2001 Comprehensive Stormwater Management Plan CIP Status

| Project No. | Project Location                            | Project Description                                                              | Project Status |
|-------------|---------------------------------------------|----------------------------------------------------------------------------------|----------------|
| 4.1         | Pickett Avenue NE                           | Replace 70 LF 12-inch culvert with two 36-inch culverts                          | Completed 2006 |
| 4.2         | NE 12 <sup>th</sup> Street                  | Install 65 LF 48-inch culvert parallel to existing 36-inch RCP culvert           | Not Completed  |
| 5.1         | NE 12 <sup>th</sup> Street                  | Replace two 18-inch RCP culverts (50 LF) with a 48-inch culvert                  | Not Completed  |
| 5.2         | Ballarat Avenue NE<br>(Outside City Limits) | Replace 50 LF 24-inch CMP culvert with two 42-inch culverts                      | Not Completed  |
| 6.1         | NE 6 <sup>th</sup> Street                   | Replace two 24-inch culverts (50 LF) with 48-inch culverts                       | Not Completed  |
| 6.2         | Thrasher Avenue                             | Replace 65 LF 12-inch and 24-inch RCP culverts with 6-foot by 5-foot box culvert | Not Completed  |
| 6.3         | Merritt Avenue NE                           | Replace two 45 LF 18-inch RCP culverts with an 8-foot by 4-foot box culvert      | Not Completed  |
| 6.4         | Orchard Avenue NE                           | Replace 45 LF 15-inch and 18-inch RCP culverts with 8-foot by 4-foot box culvert | Not Completed  |
| 6.5         | Ballarat Avenue NE                          | Replace two 24-inch culverts (50 LF) with two 9-foot by 4-foot box culverts.     | Completed 2004 |
| 6.6         | Snoqualmie Valley Trail                     | Replace 65 LF 36-inch RCP culvert with two 60-inch culverts                      | Not Completed  |
| 6.7         | Private Drive End of Merrit Place NE        | Replace 55 LF 36-inch CMP culvert with 60-inch culvert                           | Not Completed  |
| 6.8         | NE 4 <sup>th</sup> Street                   | Replace two 42-inch CMP culverts (90 LF) with two 72-inch culverts               | Not Completed  |
| 6.9         | Private Drive U/S Ogle Avenue NE            | Replace 25 LF 42-inch CMP culvert with 10-foot by 4-foot box culvert             | Not Completed  |
| 6.10        | Ogle Avenue NE                              | Replace 60 LF 24-inch RCP culvert with 10-foot by 4-foot box culvert             | Not Completed  |
| 6.11        | NE 6 <sup>th</sup> Street                   | Replace two 24-inch (60 LF) culverts with 10-foot by 4-foot box culvert          | Completed 2006 |

TABLE 8-1 – (continued)

## 2001 Comprehensive Stormwater Management Plan CIP Status

| <b>Project No.</b> | <b>Project Location</b>                     | <b>Project Description</b>                                                                                                   | <b>Project Status</b>           |
|--------------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 7.1                | Ballarat Avenue NE                          | Replace 50 LF 18-inch RCP culvert with 4-foot by 4-foot box culvert and work on drainage at Ballarat and 12 <sup>th</sup> St | Not Completed                   |
| 8.1                | Si View Outfall                             | Install man-way access through bar rack for maintenance                                                                      | Not Completed                   |
| 10.1/11.1          | <i>Ribary Creek and Gardiner Creek</i>      | <i>Channel bank stabilization at selected problem area locations</i>                                                         | <i>Completed 2007</i>           |
| 12.1               | Ribary Creek Downstream of I-90             | Enlarge and restore 540 LF channel I-90 to Mt Si Road                                                                        | Not Completed                   |
| 12.2               | <i>Gardiner Creek Upstream of I-90</i>      | <i>Construct sedimentation control basin downstream of I-90</i>                                                              | <i>Completed 2008</i>           |
| 12.3               | <i>Gardiner Creek Downstream of I-90</i>    | <i>Enlarge and restore 550 LF channel adjacent to Outlet Mall</i>                                                            | <i>Completed 2008</i>           |
| 12.4               | Gardiner Creek at NW 8 <sup>th</sup> Street | Replace 40 LF 48-inch culvert with two 6-foot by 4-foot box culverts                                                         | Developer to eventually upgrade |
| 12.5               | Gardiner Creek at Bendigo Avenue South      | Replace two 36-inch culverts (60 LF) with two 5-foot by 5-foot box culverts. Fish passage issue currently with outfall       | Not Completed                   |

Table 8-2 summarizes the new list of 6-Year Capital Improvement Projects. Cost estimates are provided in Appendix D.

These projects are ranked based on the severity of the problem and City input. Other drainage problems will arise in the future and will need to be addressed at that time. The Stormwater Management Plan will need to be updated as development and regulatory requirements change.

**TABLE 8-2**

**Capital Improvements Expenditures and Funding: 2014 to 2019**

| <b>Project No.</b> | <b>Project Description</b>                                | <b>2013 Cost</b> | <b>Year Planned</b> | <b>Work Done By</b> | <b>Priority</b> | <b>Funding</b>           |
|--------------------|-----------------------------------------------------------|------------------|---------------------|---------------------|-----------------|--------------------------|
| 3.3                | Purchase Portable Pump                                    | \$90,000         | 2013                | City                | 1               | City Funds               |
| 12.1               | Ribary Creek D/S I-90                                     | \$209,000        | 2014                | Contractor          | 2               | K.C. FCZD/<br>City Funds |
| 5.1                | NE 12 <sup>th</sup> Street Culvert Replacement            | \$130,000        | 2015 <sup>(1)</sup> | Contractor          | 3               | City Funds               |
| 4.2                | NE 12 <sup>th</sup> Street Culvert Addition               | \$147,000        | 2015 <sup>(1)</sup> | Contractor          | 3               | City Funds               |
| 1.5                | Drainage swale from East 4 <sup>th</sup> Street to Pond 1 | \$310,000        | 2018 <sup>(2)</sup> | Contractor          | 4               | City Funds               |
| 7.1                | Ballarat Avenue NE Culvert                                | \$190,000        | 2019                | Contractor          | 3               | City Funds               |

(1) Projects 5.1 and 4.2 will be constructed as part of the street rehabilitation efforts along NE 12<sup>th</sup> Street.

(2) Project 1.5 opened bids in 2012 at \$310,000.



## **CHAPTER 9**

### **FINANCIAL REVIEW**

As discussed in Chapter 7, the City projects expenditures of \$110,000 for major equipment and Chapter 8 shows a range from approximately \$90,000 to \$342,000 per year in the 6-year plan for capital project expenditures. In addition, the estimated annual expenditures, not including capital projects, for the storm water system is approximately \$506,000 in 2013. The City's stormwater-related revenues are found to be adequate to support the planned operational expenses and capital improvements over the proposed 6 year planning period. However, there are significant funding deficiencies for the 20-year period.

The financial resources available to the City to fund the operation and maintenance and capital improvements, other than general revenue from property taxes, include service charges, general facilities charge (GFCs), grants and loans.

If additional funds are needed, this chapter provides a summary of potential funding sources. The City has formed a stormwater utility to fund ongoing operation and maintenance, and capital improvements. A 6-year and 20-year budget forecast and rate recommendation required to fund the planned stormwater program are provided.

### **STORMWATER UTILITY**

RCW Chapter 35.67 allows the City to form a stormwater management utility to provide for the planning, development, management, operation, maintenance, use, and improvement of the storm drainage system. A utility is an enterprise that is operated or regulated by a government entity. The enterprise funds are predominantly self-sustaining and account for the acquisition, operation, and maintenance of governmental facilities.

The City of North Bend stormwater utility formation and rate structure is codified in North Bend Municipal Code Chapter 13.44.050. The current stormwater service charge is set at \$9.86 per month per equivalent service unit (ESU) or single-family residence (SFR) and the flood management rate is \$2.50 per ESU or SFR. One ESU corresponds to 2,920 square feet of impervious surface area for non-single-family properties per Drainage Ordinance No. 1117. Therefore, for non-single-family residential parcels, the stormwater service charge would be \$9.86 for every 2,920 square feet of impervious surface area per parcel. Also, per NBMC Chapter 13.44.110, the City charges a Capital Facilities Base Charge (CFC) of \$872.22 per new ESU, indexed to the Seattle Engineering News Record Construction Cost Index.

The monthly service charge is a fee levied by the City upon all developed property within the City's boundary. The stormwater service charge fee pays for improvements and maintenance to address drainage and flooding problems within the City. It was adopted

to protect the environment and comply with new regulations protecting drainage systems. The flood management fee is used to develop long-term solutions related to floodplain management, such as elevation of service, Community Rating Service, levy relocation and acquisition of property for flood storage.

The total number of ESUs in the City will be used to determine the monthly service charge required to support the O&M program and planned capital improvements. Table 9-1 shows the number of residential and commercial ESUs in the City, for the year 2013.

**TABLE 9-1**

**ESU Summary**

| <b>Land Use</b>                                                              | <b>2001 ESUs<sup>(1)</sup></b> | <b>Newly annexed ESUs<sup>(2)</sup></b> | <b>Total ESUs</b> |
|------------------------------------------------------------------------------|--------------------------------|-----------------------------------------|-------------------|
| Residential (Single-Family)                                                  | 1,143                          | 303                                     | 1,446             |
| Multi-Family                                                                 | 212                            |                                         | 212               |
| Commercial/Industrial                                                        | 1,050                          | 1,518                                   | 2,568             |
| Other (Retirement Homes, Mobile Homes, Schools, Post Office, Churches, etc.) | 1,248                          | 117                                     | 1,365             |
| <b>Total ESUs</b>                                                            | <b>3,653</b>                   | <b>1,938</b>                            | <b>5,591</b>      |

(1) 2001 numbers are based on the 2001 Stormwater Comprehensive Management Plan.

(2) Newly annexed areas are based on GIS information for zoning and parcel areas and aerial information to determine impervious areas.

## **CAPITAL IMPROVEMENT PLAN**

The recommended capital improvements for the stormwater utility are detailed in Chapter 8. The list of projects, recommended schedule for implementation of the 6-year CIP and their costs are shown in Table 9-2.

**TABLE 9-2****Planned Capital Improvements 2014-2019<sup>(1)</sup>**

| <b>Capital Expense</b>                                                                                                                                                                | <b>2013</b> | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>2017</b> | <b>2018</b> | <b>2019</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>CIP 3.3</b> – Pump Station. Purchase new trailer-mounted portable pump.                                                                                                            | \$90,000    |             |             |             |             |             |             |
| <b>CIP 12.1</b> - Ribary Creek D/S I-90. Enlarge and restore 540 LF channel I-90 to Mt Si Road.                                                                                       |             | \$213,180   |             |             |             |             |             |
| <b>CIP 5.1</b> – NE 12 <sup>th</sup> Street. Replace two 18-inch RCP culverts (50 LF) with a 48-inch culvert                                                                          |             |             | \$135,252   |             |             |             |             |
| <b>CIP 4.2</b> – NE 12 <sup>th</sup> Street. Install 65 LF 48-inch culvert parallel to existing 36-inch RCP culvert                                                                   |             |             | \$152,939   |             |             |             |             |
| <b>CIP 1.5</b> – Drainage swale from East 4 <sup>th</sup> Street culvert to Pond 1. Widen and regrade the existing ditch to 5-foot bottom width, 3.5-feet deep, with 2:1 side slopes. |             |             |             |             |             | \$341,925   |             |
| <b>CIP 7.1</b> – Ballarat Avenue NE Culvert                                                                                                                                           |             |             |             |             |             |             | \$213,971   |

(1) Project costs reflect estimated cost for the year in which the project is scheduled for construction.

## OPERATIONS AND MAINTENANCE AND EQUIPMENT PURCHASE

The annual stormwater operating expenses and equipment purchase list is shown below. In Chapter 7, the annual stormwater maintenance cost was determined to be \$121,272. Table 9-3 shows 2013 operating and maintenance expenses and Table 9-4 shows the City's 2013 proposed equipment purchases.

**TABLE 9-3**

### 2013 Operating Expenses

| <b>Expenditures</b>              | <b>2013</b>      |
|----------------------------------|------------------|
| Salaries and Wages               | \$189,700        |
| Benefits                         | \$82,000         |
| Supplies                         | \$3,100          |
| Supplies Office                  | \$600            |
| Professional Services            | \$4,350          |
| Communications                   | \$1,300          |
| Education and Training           | \$100            |
| Priority 1 Projects Loan Payment | \$118,000        |
| Repair and Maintenance           | \$4,000          |
| External Taxes                   | \$12,000         |
| Miscellaneous                    | \$46,957         |
| Public Works Shop Debt           | \$44,344         |
| <b>Total</b>                     | <b>\$506,451</b> |

**TABLE 9-4**

### 2013 Planned Equipment Purchases

| <b>Equipment</b> | <b>Cost of Equipment</b> | <b>Cost to Stormwater Utility</b> |
|------------------|--------------------------|-----------------------------------|
| Street Sweeper   | \$200,000                | \$100,000                         |
| Mower (2)        | \$10,000                 | \$10,000                          |

## SERVICE CHARGE DETERMINATION

The 6-year analysis assumes the capital improvement projects from Table 9-2 are funded from monthly service rates and capital facility charges. As an alternative, low interest loans from the PWTF program may be used when necessary. Use of low interest loans may be financially favorable to self-financing as long as the interest costs of the loans are less than the interest that can be earned from reserve funds.

The budget forecast assumptions are included in Table 9-5. The stormwater utility expenses are taken from the 2013 budget. An increase of 0.5 percent is assumed for ESUs, and a 2.0 percent increase in project and O&M costs is assumed as a conservative measure in assessing the budget.

**TABLE 9-5****Budget Forecast Assumptions and Baseline Operating Costs**

| <b>Item</b>                                  | <b>Assumption</b> |
|----------------------------------------------|-------------------|
| <b>Number of ESUs in 2013</b>                |                   |
| Multi-family, Commercial and Industrial ERUs | 212               |
| Residential ESUs                             | 1,446             |
| Other ESUs                                   | 3,933             |
| Total ESUs for Rate Analysis                 | 5,591             |
| <b>Escalation Factors</b>                    |                   |
| Growth (Single-Family and Non-Single Family) | 0.5%              |
| Inflation (Yearly O&M Expenses)              | 2.0%              |
| Construction Cost Inflation                  | 2.0%              |
| Investment Interest                          | 0.0%              |
| Revenue Bond                                 | 0.0%              |
| <b>Taxes</b>                                 |                   |
| State Excise Tax                             | 1.8%              |

**PRELIMINARY RATE ANALYSIS**

Table 9-6 presents a simple, cash-based rate analysis based on the recommended project financing. The preliminary rate analysis is based on the following assumptions.

1. The rate of growth (ESUs), O&M costs, and project costs assumed at a 0.5, 2.0, and 2.0 percent annual increase, respectively.
2. The utility has a balance of \$309,345 at the start of 2013 (from City's revenue and expenditure reports).

Based on these assumed project completion dates in Table 9-2, it appears the stormwater service charge does not need to increase to accommodate the proposed 6-year CIP. However, it is recommended that the stormwater service charge be increased annually per a cost-of living or consumer price index factor.

**TABLE 9-6****Rate Analysis**

| <b>Year</b>                  | <b>2013</b>      | <b>2014</b>      | <b>2015</b>      | <b>2016</b>      | <b>2017</b>      | <b>2018</b>      | <b>2019</b>      |
|------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Beginning Fund Balance       | \$309,345        | \$374,421        | \$337,613        | \$222,723        | \$392,845        | \$559,676        | \$381,180        |
| ESUs                         | 5,591            | 5,619            | 5,647            | 5,675            | 5,704            | 5,732            | 5,761            |
| Monthly Storm Service Rate   | \$9.86           | \$9.86           | \$9.86           | \$9.86           | \$9.86           | \$9.86           | \$9.86           |
| Rate Revenue                 | \$661,527        | \$664,835        | \$668,159        | \$671,500        | \$674,857        | \$678,232        | \$681,623        |
| CFC Revenue                  | \$0.00           | \$24,871         | \$25,495         | \$26,135         | \$26,791         | \$27,463         | \$28,153         |
| Total Revenue                | \$661,527        | \$689,705        | \$693,654        | \$697,635        | \$701,648        | \$706,695        | \$709,775        |
| Yearly O&M Costs             | \$506,451        | \$513,333        | \$520,353        | \$527,513        | \$534,816        | \$542,266        | \$549,864        |
| Capital Reserve              | \$464,421        | \$550,793        | \$510,914        | \$392,845        | \$559,676        | \$723,105        | \$541,091        |
| <b>CIP Projects</b>          |                  |                  |                  |                  |                  |                  |                  |
| CIP 3.3                      | \$90,000         |                  |                  |                  |                  |                  |                  |
| CIP 12.1                     |                  | \$213,180        |                  |                  |                  |                  |                  |
| CIP 5.1                      |                  |                  | \$135,252        |                  |                  |                  |                  |
| CIP 4.2                      |                  |                  | \$152,939        |                  |                  |                  |                  |
| CIP 1.5                      |                  |                  |                  |                  |                  | \$341,925        |                  |
| CIP 7.1                      |                  |                  |                  |                  |                  |                  | \$213,971        |
| CIP Total                    | \$90,000         | \$213,180        | \$288,191        | \$0              | \$0              | \$341,925        | \$213,971        |
| <b>Year End Fund Balance</b> | <b>\$374,421</b> | <b>\$337,613</b> | <b>\$222,723</b> | <b>\$392,845</b> | <b>\$559,676</b> | <b>\$381,180</b> | <b>\$327,120</b> |

## **GRANT AND LOAN PROGRAMS**

Grants and loans can be used to fund capital improvement projects, but cannot be used to fund operation and maintenance. Within the State of Washington, there are several grant and loan funds available for capital improvements. Among these are the Public Works Trust Fund (PWTF), Centennial Clean Water Fund (CCWF), the State Revolving Fund (SRF), and Flexline. The various grant and loan programs are briefly described below for reference.

### **PUBLIC WORKS TRUST FUND**

This program is a revolving fund loan designed to help local governments finance needed public works projects through low-interest loans and technical assistance. It was established by the Washington State Legislature in 1985 and is administered by the Public Works Board. The 2009 Washington State Legislature transferred \$368 million from the Public Works Trust Fund to the state general fund operating budget to help make up a \$9 billion revenue shortfall. The Legislature cancelled the 2010 to 2012 biennium funding cycle. Although loan repayments and tax revenue streams that fund the program will continue to be deposited in the fund, it is uncertain what level of funding may be available through the program in the near future.

### **DEPARTMENT OF ECOLOGY INTEGRATED FUNDING PROGRAM**

The Department of Ecology administers several loan and grant programs that can be used to fund the following:

- Stormwater capital improvements including stormwater system retrofits;
- Low-impact development projects;
- Inventories of stormwater sources;
- Public education and communication;
- Review and preparation of stormwater regulations;
- Mapping;
- Source control activities; and
- Establishing and refining stormwater utilities.

The funding programs include the Centennial Clean Water Grant and Loan program (state funds), the Clean Water Act Section 319 Nonpoint Source Fund (federal funds), the Stormwater Retrofit and Low-Impact Development Grant Program (state funds) and the Washington State Water Pollution Control Revolving Fund (federal and state funds). A common application is available for funding from the Ecology-administered programs. The programs are competitive and the majority of the funding available is in the form of low-interest loans.



## **DEBT FINANCING**

Two forms of debt financing are available for capital improvements including general obligation (G.O.) bonds and revenue bonds. G.O. bonds are backed by the “full faith and credit of the City” and are paid for through property tax levies. These bonds require voter approval before they can be implemented. A less common means of financing capital improvements associated with stormwater projects is through the use of revenue bonds. The City, like other municipalities, is capable of issuing tax-exempt bonds. The principal and interest of such bonds are repaid from revenue generated from a utility, such as a water, sewer, or stormwater utility. This type of funding may be offered without voter approval. However, in order to qualify to sell revenue bonds, the City must establish that its net operating income is equal to or greater than its debt coverage factor, typically 1.4, multiplied by the annual principal and interest due for all outstanding bonded indebtedness. Utility rates have to be set high enough to ensure revenue bond repayment.

## **20-YEAR CAPITAL IMPROVEMENT PLAN**

The total cost, in 2013 dollars, of the 2014-2019 CIP is approximately \$1.08 million. The stormwater utility revenues are adequate to support the planned operational and capital expenses over the 6-year planning period, without any service rate increases. A closer look at revenues versus expenditures indicates that the amount of funds available for capital projects over the next 20 years is approximately \$4.3 million, assuming no increase in rates, and also assuming the debt for the Public Works shop building (\$44,344 per year) and the Priority 1 projects (\$118,000 per year) will be retired in 2021 and 2026, respectfully. Further, the amount of funds available for capital projects will decrease due to increasing O&M costs. However, the total cost of the projects scheduled for years 7 through 20 is over \$8.3 million (2013 dollars), for which there would be a significant revenue shortfall, were rates to remain unchanged.

**APPENDIX A**

**SOIL DESCRIPTION**

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 13—Barneston gravelly sandy loam, 0 to 8 percent slopes

#### Map Unit Setting

*Elevation:* 250 to 1,400 feet

*Mean annual precipitation:* 50 to 75 inches

*Mean annual air temperature:* 46 to 50 degrees F

*Frost-free period:* 180 to 220 days

#### Map Unit Composition

*Barneston and similar soils:* 85 percent

*Minor components:* 2 percent

#### Description of Barneston

##### Setting

*Landform:* Terraces

*Parent material:* Volcanic ash and glacial outwash

##### Properties and qualities

*Slope:* 0 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Somewhat excessively drained

*Capacity of the most limiting layer to transmit water (Ksat):* High (1.98 to 5.95 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Low (about 4.4 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 3s

##### Typical profile

*0 to 9 inches:* Gravelly sandy loam

*9 to 17 inches:* Very gravelly sandy loam

*17 to 60 inches:* Extremely gravelly sand

#### Minor Components

##### Norma

*Percent of map unit:* 2 percent

*Landform:* Depressions

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 14—Barneston gravelly sandy loam, 8 to 30 percent slopes

#### Map Unit Setting

*Elevation:* 250 to 1,400 feet

*Mean annual precipitation:* 50 to 75 inches

*Mean annual air temperature:* 46 to 50 degrees F

*Frost-free period:* 180 to 220 days

#### Map Unit Composition

*Barneston and similar soils:* 100 percent

#### Description of Barneston

##### Setting

*Landform:* Terraces, escarpments

*Parent material:* Volcanic ash and glacial outwash

##### Properties and qualities

*Slope:* 8 to 30 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Somewhat excessively drained

*Capacity of the most limiting layer to transmit water (Ksat):* High (1.98 to 5.95 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Low (about 4.4 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 4e

##### Typical profile

*0 to 9 inches:* Gravelly sandy loam

*9 to 17 inches:* Very gravelly sandy loam

*17 to 60 inches:* Extremely gravelly sand

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 16—Barneston gravelly sandy loam, windswept, 6 to 30 percent slopes

#### Map Unit Setting

*Elevation:* 250 to 1,400 feet

*Mean annual precipitation:* 50 to 75 inches

*Mean annual air temperature:* 46 to 50 degrees F

*Frost-free period:* 180 to 220 days

#### Map Unit Composition

*Barneston and similar soils:* 85 percent

*Minor components:* 2 percent

#### Description of Barneston

##### Setting

*Landform:* Terraces

*Parent material:* Volcanic ash and glacial outwash

##### Properties and qualities

*Slope:* 6 to 30 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Somewhat excessively drained

*Capacity of the most limiting layer to transmit water (Ksat):* High (1.98 to 5.95 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Low (about 4.4 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 4e

##### Typical profile

*0 to 9 inches:* Gravelly sandy loam

*9 to 17 inches:* Very gravelly sandy loam

*17 to 60 inches:* Extremely gravelly sand

#### Minor Components

##### Norma

*Percent of map unit:* 2 percent

*Landform:* Depressions

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 53—Edgewick silt loam, 0 to 3 percent slopes

#### Map Unit Setting

*Elevation:* 50 to 500 feet

*Mean annual precipitation:* 55 to 70 inches

*Mean annual air temperature:* 48 to 50 degrees F

*Frost-free period:* 130 to 160 days

#### Map Unit Composition

*Edgewick and similar soils:* 85 percent

*Minor components:* 5 percent

#### Description of Edgewick

##### Setting

*Landform:* Terraces

*Parent material:* Alluvium

##### Properties and qualities

*Slope:* 0 to 3 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 1.98 in/hr)

*Depth to water table:* About 36 to 48 inches

*Frequency of flooding:* Occasional

*Frequency of ponding:* None

*Available water capacity:* Moderate (about 6.0 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 3w

##### Typical profile

*0 to 8 inches:* Silt loam

*8 to 20 inches:* Silt loam

*20 to 46 inches:* Loamy sand

*46 to 60 inches:* Very gravelly sand

#### Minor Components

##### Oridia

*Percent of map unit:* 5 percent

*Landform:* Flood plains

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 106—Klabe r silt loam, 0 to 8 percent slopes

#### Map Unit Setting

*Mean annual precipitation:* 40 to 70 inches

*Mean annual air temperature:* 50 degrees F

*Frost-free period:* 125 to 200 days

#### Map Unit Composition

*Klabe r and similar soils:* 100 percent

#### Description of Klabe r

##### Setting

*Landform:* Terraces

*Parent material:* Lacustrine deposits

##### Properties and qualities

*Slope:* 0 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Poorly drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)

*Depth to water table:* About 0 inches

*Frequency of flooding:* None

*Frequency of ponding:* Frequent

*Available water capacity:* High (about 9.3 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 6w

##### Typical profile

*0 to 6 inches:* Silt loam

*6 to 22 inches:* Silt loam

*22 to 60 inches:* Silty clay

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009



## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 111—Klaus sandy loam, 0 to 8 percent slopes

#### Map Unit Setting

*Elevation:* 700 to 1,400 feet

*Mean annual precipitation:* 80 to 100 inches

*Mean annual air temperature:* 48 to 52 degrees F

*Frost-free period:* 140 to 170 days

#### Map Unit Composition

*Klaus and similar soils:* 85 percent

*Minor components:* 1 percent

#### Description of Klaus

##### Setting

*Landform:* Terraces

*Parent material:* Volcanic ash and alluvium over glacial outwash

##### Properties and qualities

*Slope:* 0 to 8 percent

*Depth to restrictive feature:* 20 to 40 inches to ortstein

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately low to moderately high (0.06 to 0.57 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Low (about 3.4 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 4s

##### Typical profile

*0 to 7 inches:* Sandy loam

*7 to 16 inches:* Gravelly sandy loam

*16 to 28 inches:* Very gravelly sand

*28 to 60 inches:* Extremely gravelly sand

#### Minor Components

##### Norma

*Percent of map unit:* 1 percent

*Landform:* Depressions

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 112—Klaus sandy loam, 8 to 15 percent slopes

#### Map Unit Setting

*Elevation:* 700 to 1,400 feet

*Mean annual precipitation:* 80 to 100 inches

*Mean annual air temperature:* 48 to 52 degrees F

*Frost-free period:* 140 to 170 days

#### Map Unit Composition

*Klaus and similar soils:* 85 percent

*Minor components:* 1 percent

#### Description of Klaus

##### Setting

*Landform:* Terraces

*Parent material:* Volcanic ash and alluvium over glacial outwash

##### Properties and qualities

*Slope:* 8 to 15 percent

*Depth to restrictive feature:* 20 to 40 inches to ortstein

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately low to moderately high (0.06 to 0.57 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Low (about 3.4 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 4s

##### Typical profile

*0 to 7 inches:* Sandy loam

*7 to 16 inches:* Gravelly sandy loam

*16 to 28 inches:* Very gravelly sand

*28 to 60 inches:* Very gravelly sand

#### Minor Components

##### Norma

*Percent of map unit:* 1 percent

*Landform:* Depressions

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 146—Nargar fine sandy loam, 0 to 15 percent slopes

#### Map Unit Setting

*Elevation:* 50 to 1,200 feet

*Mean annual precipitation:* 50 to 75 inches

*Mean annual air temperature:* 46 to 50 degrees F

*Frost-free period:* 120 to 200 days

#### Map Unit Composition

*Nargar and similar soils:* 100 percent

#### Description of Nargar

##### Setting

*Landform:* Terraces

*Parent material:* Volcanic ash and sandy alluvium

##### Properties and qualities

*Slope:* 0 to 15 percent

*Depth to restrictive feature:* 20 to 40 inches to strongly contrasting textural stratification

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.57 to 1.98 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Low (about 4.9 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 3e

##### Typical profile

*0 to 2 inches:* Fine sandy loam

*2 to 24 inches:* Fine sandy loam

*24 to 60 inches:* Sand

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 147—Nargar fine sandy loam, 15 to 30 percent slopes

#### Map Unit Setting

*Elevation:* 50 to 1,200 feet

*Mean annual precipitation:* 50 to 75 inches

*Mean annual air temperature:* 46 to 50 degrees F

*Frost-free period:* 120 to 200 days

#### Map Unit Composition

*Nargar and similar soils:* 100 percent

#### Description of Nargar

##### Setting

*Landform:* Terraces

*Parent material:* Volcanic ash and sandy alluvium

##### Properties and qualities

*Slope:* 15 to 30 percent

*Depth to restrictive feature:* 20 to 40 inches to strongly contrasting textural stratification

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.57 to 1.98 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Low (about 4.9 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 4e

##### Typical profile

*0 to 2 inches:* Fine sandy loam

*2 to 24 inches:* Fine sandy loam

*24 to 60 inches:* Sand

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 150—Neilton gravelly loamy sand, 2 to 15 percent slopes

#### Map Unit Setting

*Mean annual precipitation:* 30 to 55 inches

*Mean annual air temperature:* 50 degrees F

*Frost-free period:* 145 to 210 days

#### Map Unit Composition

*Neilton and similar soils:* 85 percent

*Minor components:* 2 percent

#### Description of Neilton

##### Setting

*Landform:* Terraces

*Parent material:* Glacial outwash

##### Properties and qualities

*Slope:* 2 to 15 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Excessively drained

*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Very low (about 2.3 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 4s

##### Typical profile

*0 to 16 inches:* Gravelly loamy sand

*16 to 21 inches:* Extremely gravelly sand

*21 to 60 inches:* Very gravelly sand

#### Minor Components

##### Norma

*Percent of map unit:* 2 percent

*Landform:* Depressions

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009

## **Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)**

### **151—Nimue loamy sand, 6 to 30 percent slopes**

#### **Map Unit Setting**

*Elevation:* 3,100 to 5,500 feet  
*Mean annual precipitation:* 70 to 120 inches  
*Mean annual air temperature:* 39 to 41 degrees F  
*Frost-free period:* 110 to 130 days

#### **Map Unit Composition**

*Nimue and similar soils:* 100 percent

#### **Description of Nimue**

##### **Setting**

*Landform:* Mountain slopes, ridges  
*Landform position (two-dimensional):* Backslope  
*Parent material:* Volcanic ash and pumice over colluvium derived  
from extrusive igneous rock

##### **Properties and qualities**

*Slope:* 6 to 30 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Well drained  
*Capacity of the most limiting layer to transmit water  
(Ksat):* Moderately high to high (0.57 to 1.98 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water capacity:* Low (about 5.7 inches)

##### **Interpretive groups**

*Land capability (nonirrigated):* 6e

##### **Typical profile**

*0 to 5 inches:* Loamy sand  
*5 to 10 inches:* Sandy loam  
*10 to 24 inches:* Very gravelly loam  
*24 to 60 inches:* Extremely gravelly silt loam

#### **Minor Components**

##### **Cryohemists**

*Percent of map unit:*

*Landform:* Alluvial cones

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce  
Counties)

Survey Area Data: Version 7, Sep 22, 2009





## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 157—Nooksack silt loam, 0 to 2 percent slopes

#### Map Unit Setting

*Elevation:* 0 to 500 feet

*Mean annual precipitation:* 35 to 55 inches

*Mean annual air temperature:* 48 to 52 degrees F

*Frost-free period:* 180 to 200 days

#### Map Unit Composition

*Nooksack and similar soils:* 85 percent

*Minor components:* 6 percent

#### Description of Nooksack

##### Setting

*Landform:* Flood plains, terraces

*Parent material:* Alluvium

##### Properties and qualities

*Slope:* 0 to 2 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Moderately well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.57 to 1.98 in/hr)

*Depth to water table:* About 36 to 48 inches

*Frequency of flooding:* Occasional

*Frequency of ponding:* None

*Available water capacity:* High (about 11.7 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 3w

##### Typical profile

*0 to 11 inches:* Silt loam

*11 to 29 inches:* Silt loam

*29 to 60 inches:* Silt loam

#### Minor Components

##### Oridia

*Percent of map unit:* 3 percent

*Landform:* Flood plains

##### Puget

*Percent of map unit:* 3 percent

*Landform:* Flood plains

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce  
Counties)

Survey Area Data: Version 7, Sep 22, 2009



## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 163—Ogarty gravelly loam, 30 to 65 percent slopes

#### Map Unit Setting

*Elevation:* 200 to 1,200 feet

*Mean annual precipitation:* 50 to 70 inches

*Mean annual air temperature:* 45 to 48 degrees F

*Frost-free period:* 140 to 200 days

#### Map Unit Composition

*Ogarty and similar soils:* 100 percent

#### Description of Ogarty

##### Setting

*Landform:* Hillslopes

*Landform position (two-dimensional):* Backslope

*Parent material:* Volcanic ash and colluvium and residuum derived from andesite and tuff breccia

##### Properties and qualities

*Slope:* 30 to 65 percent

*Depth to restrictive feature:* 20 to 40 inches to lithic bedrock

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.57 to 1.98 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Low (about 4.7 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 7e

##### Typical profile

*0 to 4 inches:* Gravelly loam

*4 to 37 inches:* Extremely gravelly fine sandy loam

*37 to 47 inches:* Unweathered bedrock

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 162—Ogarty gravelly loam, 8 to 30 percent slopes

#### Map Unit Setting

*Elevation:* 200 to 1,200 feet

*Mean annual precipitation:* 50 to 70 inches

*Mean annual air temperature:* 45 to 48 degrees F

*Frost-free period:* 140 to 200 days

#### Map Unit Composition

*Ogarty and similar soils:* 100 percent

#### Description of Ogarty

##### Setting

*Landform:* Hillslopes

*Landform position (two-dimensional):* Backslope

*Parent material:* Volcanic ash and colluvium and residuum derived from andesite and tuff breccia

##### Properties and qualities

*Slope:* 8 to 30 percent

*Depth to restrictive feature:* 20 to 40 inches to lithic bedrock

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.57 to 1.98 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Low (about 4.7 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 4e

##### Typical profile

*0 to 4 inches:* Gravelly loam

*4 to 37 inches:* Extremely gravelly fine sandy loam

*37 to 47 inches:* Unweathered bedrock

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009

## **Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)**

### **164—Ogarty-Rock outcrop complex, 45 to 90 percent slopes**

#### **Map Unit Setting**

*Elevation:* 200 to 1,200 feet

*Mean annual precipitation:* 50 to 70 inches

*Mean annual air temperature:* 45 to 48 degrees F

*Frost-free period:* 140 to 200 days

#### **Map Unit Composition**

*Ogarty and similar soils:* 50 percent

*Rock outcrop:* 40 percent

#### **Description of Ogarty**

##### **Setting**

*Landform:* Hillslopes, ridges

*Landform position (two-dimensional):* Backslope

*Parent material:* Volcanic ash and colluvium and residuum derived from andesite and tuff breccia

##### **Properties and qualities**

*Slope:* 45 to 90 percent

*Depth to restrictive feature:* 20 to 40 inches to lithic bedrock

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.57 to 1.98 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Low (about 4.7 inches)

##### **Interpretive groups**

*Land capability (nonirrigated):* 7e

##### **Typical profile**

*0 to 4 inches:* Gravelly loam

*4 to 37 inches:* Extremely gravelly fine sandy loam

*37 to 47 inches:* Unweathered bedrock

#### **Description of Rock Outcrop**

##### **Properties and qualities**

*Slope:* 45 to 90 percent

*Depth to restrictive feature:* 0 inches to lithic bedrock

**Interpretive groups**

*Land capability (nonirrigated): 8s*

**Data Source Information**

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce  
Counties)

Survey Area Data: Version 7, Sep 22, 2009



## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 187—Pilchuck loamy fine sand, 0 to 3 percent slopes

#### Map Unit Setting

*Mean annual precipitation:* 35 to 60 inches

*Mean annual air temperature:* 48 to 52 degrees F

*Frost-free period:* 160 to 210 days

#### Map Unit Composition

*Pilchuck and similar soils:* 85 percent

*Minor components:* 2 percent

#### Description of Pilchuck

##### Setting

*Landform:* Flood plains

*Parent material:* Alluvium

##### Properties and qualities

*Slope:* 0 to 3 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Somewhat excessively drained

*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr)

*Depth to water table:* About 24 to 48 inches

*Frequency of flooding:* Occasional

*Frequency of ponding:* None

*Available water capacity:* Low (about 4.0 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 4s

##### Typical profile

*0 to 9 inches:* Loamy fine sand

*9 to 55 inches:* Loamy fine sand

*55 to 60 inches:* Very gravelly sand

#### Minor Components

##### Riverwash

*Percent of map unit:* 2 percent

*Landform:* Flood plains

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009



## **Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)**

### **202—Puget silty clay loam, 0 to 2 percent slopes**

#### **Map Unit Setting**

*Elevation:* 10 to 650 feet

*Mean annual precipitation:* 35 to 55 inches

*Mean annual air temperature:* 48 to 50 degrees F

*Frost-free period:* 160 to 180 days

#### **Map Unit Composition**

*Puget and similar soils:* 85 percent

*Minor components:* 6 percent

#### **Description of Puget**

##### **Setting**

*Landform:* Flood plains

*Parent material:* Alluvium

##### **Properties and qualities**

*Slope:* 0 to 2 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Poorly drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)

*Depth to water table:* About 12 to 36 inches

*Frequency of flooding:* Occasional

*Frequency of ponding:* None

*Available water capacity:* High (about 11.5 inches)

##### **Interpretive groups**

*Land capability classification (irrigated):* 4w

*Land capability (nonirrigated):* 4w

##### **Typical profile**

*0 to 7 inches:* Silty clay loam

*7 to 45 inches:* Silty clay loam

*45 to 60 inches:* Silty clay

#### **Minor Components**

##### **Puget, undrained**

*Percent of map unit:* 3 percent

*Landform:* Flood plains

##### **Shalcar**

*Percent of map unit:* 3 percent

*Landform:* Depressions

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce  
Counties)

Survey Area Data: Version 7, Sep 22, 2009



## **Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)**

### **205—Ragnar-Lynnwood complex, 2 to 15 percent slopes**

#### **Map Unit Setting**

*Elevation:* 50 to 1,000 feet

*Mean annual precipitation:* 35 to 65 inches

*Mean annual air temperature:* 48 to 54 degrees F

*Frost-free period:* 150 to 210 days

#### **Map Unit Composition**

*Lynnwood and similar soils:* 45 percent

*Ragnar and similar soils:* 45 percent

*Minor components:* 2 percent

#### **Description of Ragnar**

##### **Setting**

*Landform:* Outwash terraces

*Parent material:* Glacial outwash

##### **Properties and qualities**

*Slope:* 2 to 15 percent

*Depth to restrictive feature:* 20 to 40 inches to strongly contrasting textural stratification

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water (Ksat):* High (1.98 to 5.95 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Low (about 5.4 inches)

##### **Interpretive groups**

*Land capability (nonirrigated):* 3e

##### **Typical profile**

*0 to 13 inches:* Loam

*13 to 24 inches:* Sandy loam

*24 to 60 inches:* Loamy sand

#### **Description of Lynnwood**

##### **Setting**

*Landform:* Outwash terraces

*Parent material:* Glacial outwash

##### **Properties and qualities**

*Slope:* 2 to 15 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Somewhat excessively drained

*Capacity of the most limiting layer to transmit water (Ksat):* High (1.98 to 5.95 in/hr)

*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water capacity:* Low (about 4.8 inches)

**Interpretive groups**

*Land capability (nonirrigated):* 3e

**Typical profile**

*0 to 6 inches:* Loamy fine sand  
*6 to 26 inches:* Loamy fine sand  
*26 to 60 inches:* Fine sand

**Minor Components**

**Norma**

*Percent of map unit:* 2 percent  
*Landform:* Depressions

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)  
Survey Area Data: Version 7, Sep 22, 2009

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 215—Riverwash

#### Map Unit Composition

*Riverwash*: 100 percent

#### Description of Riverwash

##### Setting

*Landform*: Flood plains

*Parent material*: Alluvium

##### Properties and qualities

*Slope*: 0 to 2 percent

*Depth to water table*: About 0 to 24 inches

*Frequency of flooding*: Frequent

##### Interpretive groups

*Land capability (nonirrigated)*: 8

##### Typical profile

*0 to 60 inches*: Error

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 226—Salal silt loam, 0 to 2 percent slopes

#### Map Unit Setting

*Elevation:* 400 to 500 feet

*Mean annual precipitation:* 70 to 80 inches

*Mean annual air temperature:* 48 to 52 degrees F

*Frost-free period:* 140 to 180 days

#### Map Unit Composition

*Salal and similar soils:* 100 percent

#### Description of Salal

##### Setting

*Landform:* Terraces, flood plains

*Parent material:* Alluvium

##### Properties and qualities

*Slope:* 0 to 2 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Moderately well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.57 to 1.98 in/hr)

*Depth to water table:* About 36 to 48 inches

*Frequency of flooding:* Occasional

*Frequency of ponding:* None

*Available water capacity:* High (about 12.0 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 3w

##### Typical profile

*0 to 11 inches:* Silt loam

*11 to 50 inches:* Silt loam

*50 to 60 inches:* Silt loam

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 227—Sauk silt loam, 0 to 8 percent slopes

#### Map Unit Setting

*Mean annual precipitation:* 65 to 90 inches

*Mean annual air temperature:* 46 to 50 degrees F

*Frost-free period:* 160 to 200 days

#### Map Unit Composition

*Sauk and similar soils:* 85 percent

*Minor components:* 3 percent

#### Description of Sauk

##### Setting

*Landform:* Terraces

*Parent material:* Volcanic ash and alluvium

##### Properties and qualities

*Slope:* 0 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.57 to 1.98 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* High (about 9.9 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 2e

##### Typical profile

*0 to 6 inches:* Silt loam

*6 to 22 inches:* Silt loam

*22 to 42 inches:* Fine sandy loam

*42 to 60 inches:* Very gravelly loamy sand

#### Minor Components

##### Shalcar

*Percent of map unit:* 3 percent

*Landform:* Depressions

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 231—Seattle muck, 0 to 1 percent slopes

#### Map Unit Setting

*Elevation:* 0 to 1,000 feet

*Mean annual precipitation:* 25 to 50 inches

*Mean annual air temperature:* 48 to 52 degrees F

*Frost-free period:* 150 to 250 days

#### Map Unit Composition

*Seattle and similar soils:* 85 percent

*Minor components:* 6 percent

#### Description of Seattle

##### Setting

*Landform:* Depressions, till plains, valleys

*Parent material:* Herbaceous organic material and woody organic material

##### Properties and qualities

*Slope:* 0 to 1 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Very poorly drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.57 to 1.98 in/hr)

*Depth to water table:* About 0 inches

*Frequency of flooding:* None

*Frequency of ponding:* Frequent

*Available water capacity:* Very high (about 26.9 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 5w

##### Typical profile

*0 to 8 inches:* Muck

*8 to 60 inches:* Stratified mucky peat to muck

#### Minor Components

##### Puget

*Percent of map unit:* 2 percent

*Landform:* Flood plains

##### Shalcar

*Percent of map unit:* 2 percent

*Landform:* Depressions

##### Seattle, drained

*Percent of map unit:* 2 percent



*Landform:* Depressions

## **Data Source Information**

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce  
Counties)

Survey Area Data: Version 7, Sep 22, 2009



## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 236—Si silt loam, 0 to 2 percent slopes

#### Map Unit Setting

*Mean annual precipitation:* 70 to 80 inches

*Mean annual air temperature:* 50 degrees F

*Frost-free period:* 150 days

#### Map Unit Composition

*Si and similar soils:* 100 percent

#### Description of Si

##### Setting

*Landform:* Terraces

*Parent material:* Alluvium

##### Properties and qualities

*Slope:* 0 to 2 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Moderately well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.57 to 1.98 in/hr)

*Depth to water table:* About 24 to 48 inches

*Frequency of flooding:* Occasional

*Frequency of ponding:* None

*Available water capacity:* High (about 10.8 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 3w

##### Typical profile

*0 to 11 inches:* Silt loam

*11 to 22 inches:* Silt loam

*22 to 60 inches:* Stratified fine sandy loam to silt loam

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce  
Counties)

Survey Area Data: Version 7, Sep 22, 2009

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 241—Snoqualmie loamy fine sand, 0 to 8 percent slopes

#### Map Unit Setting

*Elevation:* 40 to 1,700 feet

*Mean annual precipitation:* 50 to 90 inches

*Mean annual air temperature:* 46 to 50 degrees F

*Frost-free period:* 130 to 180 days

#### Map Unit Composition

*Snoqualmie and similar soils:* 85 percent

*Minor components:* 2 percent

#### Description of Snoqualmie

##### Setting

*Landform:* Terraces

*Parent material:* Gravelly alluvium

##### Properties and qualities

*Slope:* 0 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Somewhat excessively drained

*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr)

*Depth to water table:* About 36 to 60 inches

*Frequency of flooding:* Occasional

*Frequency of ponding:* None

*Available water capacity:* Very low (about 2.2 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 4s

##### Typical profile

*0 to 8 inches:* Loamy fine sand

*8 to 36 inches:* Extremely gravelly coarse sand

*36 to 60 inches:* Extremely cobbly coarse sand

#### Minor Components

##### Riverwash

*Percent of map unit:* 2 percent

*Landform:* Flood plains

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 255—Tokul gravelly loam, 6 to 15 percent slopes

#### Map Unit Setting

*Mean annual precipitation:* 45 to 70 inches

*Mean annual air temperature:* 48 degrees F

*Frost-free period:* 140 to 200 days

#### Map Unit Composition

*Tokul and similar soils:* 85 percent

*Minor components:* 3 percent

#### Description of Tokul

##### Setting

*Landform:* Hillslopes, till plains

*Landform position (two-dimensional):* Footslope

*Parent material:* Volcanic ash over basal till

##### Properties and qualities

*Slope:* 6 to 15 percent

*Depth to restrictive feature:* 20 to 40 inches to ortstein

*Drainage class:* Moderately well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately low to moderately high (0.06 to 0.57 in/hr)

*Depth to water table:* About 18 to 36 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Moderate (about 7.1 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 3e

##### Typical profile

*0 to 3 inches:* Gravelly loam

*3 to 31 inches:* Gravelly loam

*31 to 37 inches:* Gravelly fine sandy loam

*37 to 60 inches:* Very gravelly sandy loam

#### Minor Components

##### Norma

*Percent of map unit:* 3 percent

*Landform:* Depressions

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce  
Counties)

Survey Area Data: Version 7, Sep 22, 2009

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 258—Tokul-Pastik complex, 45 to 90 percent slopes

#### Map Unit Setting

*Elevation:* 200 to 800 feet

*Mean annual precipitation:* 45 to 70 inches

*Mean annual air temperature:* 45 to 48 degrees F

*Frost-free period:* 140 to 200 days

#### Map Unit Composition

*Tokul and similar soils:* 50 percent

*Pastik and similar soils:* 25 percent

#### Description of Tokul

##### Setting

*Landform:* Escarpments, hillslopes

*Landform position (two-dimensional):* Footslope

*Parent material:* Volcanic ash over basal till

##### Properties and qualities

*Slope:* 45 to 90 percent

*Depth to restrictive feature:* 20 to 40 inches to ortstein

*Drainage class:* Moderately well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately low to moderately high (0.06 to 0.57 in/hr)

*Depth to water table:* About 18 to 36 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Moderate (about 7.1 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 7e

##### Typical profile

*0 to 3 inches:* Gravelly loam

*3 to 31 inches:* Gravelly loam

*31 to 37 inches:* Gravelly fine sandy loam

*37 to 60 inches:* Very gravelly sandy loam

#### Description of Pastik

##### Setting

*Landform:* Terraces

*Parent material:* Volcanic ash and lacustrine deposits

##### Properties and qualities

*Slope:* 45 to 90 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Moderately well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)

*Depth to water table:* About 18 to 30 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Very high (about 14.5 inches)

**Interpretive groups**

*Land capability (nonirrigated):* 7e

**Typical profile**

*0 to 6 inches:* Silt loam

*6 to 31 inches:* Very fine sandy loam

*31 to 60 inches:* Silt loam

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

Survey Area Data: Version 7, Sep 22, 2009

## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 261—Tukwila muck, 0 to 1 percent slopes

#### Map Unit Setting

*Elevation:* 30 to 750 feet

*Mean annual precipitation:* 35 to 80 inches

*Mean annual air temperature:* 48 to 52 degrees F

*Frost-free period:* 150 to 200 days

#### Map Unit Composition

*Tukwila and similar soils:* 85 percent

*Minor components:* 6 percent

#### Description of Tukwila

##### Setting

*Landform:* Depressions, stream terraces

*Parent material:* Herbaceous organic and woody organic material  
with stratified alluvium

##### Properties and qualities

*Slope:* 0 to 1 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Very poorly drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.57 to 1.98 in/hr)

*Depth to water table:* About 0 inches

*Frequency of flooding:* None

*Frequency of ponding:* Frequent

*Available water capacity:* Very high (about 26.9 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 5w

##### Typical profile

*0 to 41 inches:* Muck

*41 to 60 inches:* Stratified diatomaceous earth to muck

#### Minor Components

##### Norma

*Percent of map unit:* 2 percent

*Landform:* Depressions

##### Woodinville

*Percent of map unit:* 2 percent

*Landform:* Flood plains

##### Tukwila, drained

*Percent of map unit:* 2 percent

*Landform:* Depressions

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce  
Counties)

Survey Area Data: Version 7, Sep 22, 2009





## Snoqualmie Pass Area, Washington (Parts of King and Pierce Counties)

### 280—Winston loam, windswept, 0 to 30 percent slopes

#### Map Unit Setting

*Elevation:* 150 to 1,900 feet

*Mean annual precipitation:* 40 to 80 inches

*Mean annual air temperature:* 46 to 50 degrees F

*Frost-free period:* 140 to 200 days

#### Map Unit Composition

*Winston and similar soils:* 85 percent

*Minor components:* 2 percent

#### Description of Winston

##### Setting

*Landform:* Outwash plains, terraces, terraces

*Parent material:* Volcanic ash and glacial outwash

##### Properties and qualities

*Slope:* 0 to 30 percent

*Depth to restrictive feature:* 20 to 40 inches to strongly contrasting textural stratification

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high to high (0.57 to 1.98 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Moderate (about 8.7 inches)

##### Interpretive groups

*Land capability (nonirrigated):* 4e

##### Typical profile

*0 to 11 inches:* Loam

*11 to 21 inches:* Gravelly loam

*21 to 34 inches:* Gravelly fine sandy loam

*34 to 60 inches:* Extremely gravelly sand

#### Minor Components

##### Shalcar

*Percent of map unit:* 2 percent

*Landform:* Depressions

## Data Source Information

Soil Survey Area: Snoqualmie Pass Area, Washington (Parts of King and Pierce  
Counties)

Survey Area Data: Version 7, Sep 22, 2009



**APPENDIX B**

**WATER QUALITY BMP  
OPERATIONS & MAINTENANCE**

# **APPENDIX A**

## **MAINTENANCE REQUIREMENTS FOR FLOW CONTROL, CONVEYANCE, AND WQ FACILITIES**

This appendix contains the maintenance requirements for the following typical stormwater control facilities and components:

- No. 1 – Detention Ponds (p. A-2)
- No. 2 – Infiltration Facilities (p. A-3)
- No. 3 – Detention Tanks and Vaults (p. A-5)
- No. 4 – Control Structure/Flow Restrictor (p. A-7)
- No. 5 – Catch Basins and Manholes (p. A-9)
- No. 6 – Conveyance Pipes and Ditches (p. A-11)
- No. 7 – Debris Barriers (e.g., Trash Racks) (p. A-12)
- No. 8 – Energy Dissipaters (p. A- 13)
- No. 9 – Fencing (p. A-14)
- No. 10 – Gates/Bollards/Access Barriers (p. A-15)
- No. 11 – Grounds (Landscaping) (p. A-16)
- No. 12 – Access Roads (p. A-17)
- No. 13 – Basic Biofiltration Swale (grass) (p. A-18)
- No. 14 – Wet Biofiltration Swale (p. A-19)
- No. 15 – Filter Strip (p. A-20)
- No. 16 – Wetpond (p. A-21)
- No. 17 – Wetvault (p. A-23)
- No. 18 – Stormwater Wetland (p. A-24)
- No. 19 – Sand Filter Pond (p. A-26)
- No. 20 – Sand Filter Vault (p. A-28)
- No. 21 – Stormfilter (Cartridge Type) (p. A-30)
- No. 22 – Baffle Oil/Water Separator (p. A-32)
- No. 23 – Coalescing Plate Oil/Water Separator (p. A-33)
- No. 24 – Catch Basin Insert (p. A-35)

| <b>NO. 1 – DETENTION PONDS</b>                |                               |                                                                                                                                                                                                                                             |                                                                                                                                                                                       |
|-----------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maintenance Component</b>                  | <b>Defect or Problem</b>      | <b>Conditions When Maintenance Is Needed</b>                                                                                                                                                                                                | <b>Results Expected When Maintenance Is Performed</b>                                                                                                                                 |
| Site                                          | Trash and debris              | Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping. | Trash and debris cleared from site.                                                                                                                                                   |
|                                               | Noxious weeds                 | Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.                                                                                                                                         | Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.                  |
|                                               | Contaminants and pollution    | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                                                                                                                                | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.         |
|                                               | Grass/groundcover             | Grass or groundcover exceeds 18 inches in height.                                                                                                                                                                                           | Grass or groundcover mowed to a height no greater than 6 inches.                                                                                                                      |
| Top or Side Slopes of Dam, Berm or Embankment | Rodent holes                  | Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.                                                                                                  | Rodents removed or destroyed and dam or berm repaired.                                                                                                                                |
|                                               | Tree growth                   | Tree growth threatens integrity of slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat or not interfering with access or maintenance, they do not need to be removed.             | Trees do not hinder facility performance or maintenance activities.                                                                                                                   |
|                                               | Erosion                       | Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.                                                                       | Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion. |
|                                               | Settlement                    | Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation.                                                                                                                                            | Top or side slope restored to design dimensions. If settlement is significant, a licensed civil engineer should be consulted to determine the cause of the settlement.                |
| Storage Area                                  | Sediment accumulation         | Accumulated sediment that exceeds 10% of the designed pond depth.                                                                                                                                                                           | Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.                                                                                 |
|                                               | Liner damaged (If Applicable) | Liner is visible or pond does not hold water as designed.                                                                                                                                                                                   | Liner repaired or replaced.                                                                                                                                                           |
| Inlet/Outlet Pipe.                            | Sediment accumulation         | Sediment filling 20% or more of the pipe.                                                                                                                                                                                                   | Inlet/outlet pipes clear of sediment.                                                                                                                                                 |
|                                               | Trash and debris              | Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).                                                                                                                                                | No trash or debris in pipes.                                                                                                                                                          |
|                                               | Damaged                       | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.                                                                                                   | No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.                                                                                                                |
| Emergency Overflow/Spillway                   | Tree growth                   | Tree growth impedes flow or threatens stability of spillway.                                                                                                                                                                                | Trees removed.                                                                                                                                                                        |
|                                               | Rock missing                  | Only one layer of rock exists above native soil in area five square feet or larger or any exposure of native soil on the spillway.                                                                                                          | Spillway restored to design standards.                                                                                                                                                |

**NO. 2 – INFILTRATION FACILITIES**

| <b>Maintenance Component</b>                                        | <b>Defect or Problem</b>                                         | <b>Conditions When Maintenance Is Needed</b>                                                                                                                                                                                                                                         | <b>Results Expected When Maintenance Is Performed</b>                                                                                                                                 |
|---------------------------------------------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Site                                                                | Trash and debris                                                 | Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.                                          | Trash and debris cleared from site.                                                                                                                                                   |
|                                                                     | Noxious weeds                                                    | Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.                                                                                                                                                                                  | Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.                  |
|                                                                     | Contaminants and pollution                                       | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                                                                                                                                                                         | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.         |
|                                                                     | Grass/groundcover                                                | Grass or groundcover exceeds 18 inches in height.                                                                                                                                                                                                                                    | Grass or groundcover mowed to a height no greater than 6 inches.                                                                                                                      |
| Infiltration Pond, Top or Side Slopes of Dam, Berm or Embankment    | Rodent holes                                                     | Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.                                                                                                                                           | Rodents removed or destroyed and dam or berm repaired.                                                                                                                                |
|                                                                     | Tree growth                                                      | Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat to dam, berm, or embankment integrity or not interfering with access or maintenance, they do not need to be removed. | Trees do not hinder facility performance or maintenance activities.                                                                                                                   |
|                                                                     | Erosion                                                          | Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.                                                                                                                | Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion. |
|                                                                     | Settlement                                                       | Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation.                                                                                                                                                                                     | Top or side slope restored to design dimensions. If settlement is significant, a licensed civil engineer should be consulted to determine the cause of the settlement.                |
| Infiltration Pond, Tank, Vault, Trench, or Small Basin Storage Area | Sediment accumulation                                            | If two inches or more sediment is present or a percolation test indicates facility is working at or less than 90% of design.                                                                                                                                                         | Facility infiltrates as designed.                                                                                                                                                     |
|                                                                     | Liner damaged (If Applicable)                                    | Liner is visible or pond does not hold water as designed.                                                                                                                                                                                                                            | Liner repaired or replaced.                                                                                                                                                           |
| Infiltration Tank Structure                                         | Plugged air vent                                                 | Any blockage of the vent.                                                                                                                                                                                                                                                            | Tank or vault freely vents.                                                                                                                                                           |
|                                                                     | Tank bent out of shape                                           | Any part of tank/pipe is bent out of shape more than 10% of its design shape.                                                                                                                                                                                                        | Tank repaired or replaced to design.                                                                                                                                                  |
|                                                                     | Gaps between sections, damaged joints or cracks or tears in wall | A gap wider than ½-inch at the joint of any tank sections or any evidence of soil particles entering the tank at a joint or through a wall.                                                                                                                                          | No water or soil entering tank through joints or walls.                                                                                                                               |
| Infiltration Vault Structure                                        | Damage to wall, frame, bottom, and/or top slab                   | Cracks wider than ½-inch, any evidence of soil entering the structure through cracks or qualified inspection personnel determines that the vault is not structurally sound.                                                                                                          | Vault is sealed and structurally sound.                                                                                                                                               |

**NO. 2 – INFILTRATION FACILITIES**

| <b>Maintenance Component</b>                                                         | <b>Defect or Problem</b>       | <b>Conditions When Maintenance Is Needed</b>                                                                                                                                                               | <b>Results Expected When Maintenance Is Performed</b>                      |
|--------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Inlet/Outlet Pipes                                                                   | Sediment accumulation          | Sediment filling 20% or more of the pipe.                                                                                                                                                                  | Inlet/outlet pipes clear of sediment.                                      |
|                                                                                      | Trash and debris               | Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).                                                                                                               | No trash or debris in pipes.                                               |
|                                                                                      | Damaged                        | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.                                                                  | No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.     |
| Access Manhole                                                                       | Cover/lid not in place         | Cover/lid is missing or only partially in place.<br><b>Any open manhole requires immediate maintenance.</b>                                                                                                | Manhole access covered.                                                    |
|                                                                                      | Locking mechanism not working  | Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.                                                                      | Mechanism opens with proper tools.                                         |
|                                                                                      | Cover/lid difficult to remove  | One maintenance person cannot remove cover/lid after applying 80 lbs of lift.                                                                                                                              | Cover/lid can be removed and reinstalled by one maintenance person.        |
|                                                                                      | Ladder rungs unsafe            | Missing rungs, misalignment, rust, or cracks.                                                                                                                                                              | Ladder meets design standards. Allows maintenance person safe access.      |
| Large access doors/plate                                                             | Damaged or difficult to open   | Large access doors or plates cannot be opened/removed using normal equipment.                                                                                                                              | Replace or repair access door so it can be opened as designed.             |
|                                                                                      | Gaps, doesn't cover completely | Large access doors not flat and/or access opening not completely covered.                                                                                                                                  | Doors close flat and covers access opening completely.                     |
|                                                                                      | Lifting Rings missing, rusted  | Lifting rings not capable of lifting weight of door or plate.                                                                                                                                              | Lifting rings sufficient to lift or remove door or plate.                  |
| Infiltration Pond, Tank, Vault, Trench, or Small Basin Filter Bags                   | Plugged                        | Filter bag more than ½ full.                                                                                                                                                                               | Replace filter bag or redesign system.                                     |
| Infiltration Pond, Tank, Vault, Trench, or Small Basin Pre-settling Ponds and Vaults | Sediment accumulation          | 6" or more of sediment has accumulated.                                                                                                                                                                    | Pre-settling occurs as designed                                            |
| Infiltration Pond, Rock Filter                                                       | Plugged                        | High water level on upstream side of filter remains for extended period of time or little or no water flows through filter during heavy rain storms.                                                       | Rock filter replaced evaluate need for filter and remove if not necessary. |
| Infiltration Pond Emergency Overflow Spillway                                        | Rock missing                   | Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. Rip-rap on inside slopes need not be replaced. | Spillway restored to design standards.                                     |
|                                                                                      | Tree growth                    | Tree growth impedes flow or threatens stability of spillway.                                                                                                                                               | Trees removed.                                                             |

**NO. 3 – DETENTION TANKS AND VAULTS**

| <b>Maintenance Component</b> | <b>Defect or Problem</b>                                         | <b>Conditions When Maintenance is Needed</b>                                                                                                                                                                                                                                      | <b>Results Expected When Maintenance is Performed</b>                                                                                                                         |
|------------------------------|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Site                         | Trash and debris                                                 | Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.                                       | Trash and debris cleared from site.                                                                                                                                           |
|                              | Noxious weeds                                                    | Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.                                                                                                                                                                               | Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.          |
|                              | Contaminants and pollution                                       | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                                                                                                                                                                      | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film. |
|                              | Grass/groundcover                                                | Grass or groundcover exceeds 18 inches in height.                                                                                                                                                                                                                                 | Grass or groundcover mowed to a height no greater than 6 inches.                                                                                                              |
| Tank or Vault Storage Area   | Trash and debris                                                 | Any trash and debris accumulated in vault or tank (includes floatables and non-floatables).                                                                                                                                                                                       | No trash or debris in vault.                                                                                                                                                  |
|                              | Sediment accumulation                                            | Accumulated sediment depth exceeds 10% of the diameter of the storage area for ½ length of storage vault or any point depth exceeds 15% of diameter. Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than ½ length of tank. | All sediment removed from storage area.                                                                                                                                       |
| Tank Structure               | Plugged air vent                                                 | Any blockage of the vent.                                                                                                                                                                                                                                                         | Tank or vault freely vents.                                                                                                                                                   |
|                              | Tank bent out of shape                                           | Any part of tank/pipe is bent out of shape more than 10% of its design shape.                                                                                                                                                                                                     | Tank repaired or replaced to design.                                                                                                                                          |
|                              | Gaps between sections, damaged joints or cracks or tears in wall | A gap wider than ½-inch at the joint of any tank sections or any evidence of soil particles entering the tank at a joint or through a wall.                                                                                                                                       | No water or soil entering tank through joints or walls.                                                                                                                       |
| Vault Structure              | Damage to wall, frame, bottom, and/or top slab                   | Cracks wider than ½-inch, any evidence of soil entering the structure through cracks or qualified inspection personnel determines that the vault is not structurally sound.                                                                                                       | Vault is sealed and structurally sound.                                                                                                                                       |
| Inlet/Outlet Pipes           | Sediment accumulation                                            | Sediment filling 20% or more of the pipe.                                                                                                                                                                                                                                         | Inlet/outlet pipes clear of sediment.                                                                                                                                         |
|                              | Trash and debris                                                 | Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).                                                                                                                                                                                      | No trash or debris in pipes.                                                                                                                                                  |
|                              | Damaged                                                          | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.                                                                                                                                         | No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.                                                                                                        |



**NO. 3 – DETENTION TANKS AND VAULTS**

| <b>Maintenance Component</b> | <b>Defect or Problem</b>       | <b>Conditions When Maintenance is Needed</b>                                                                                          | <b>Results Expected When Maintenance is Performed</b>                 |
|------------------------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Access Manhole               | Cover/lid not in place         | Cover/lid is missing or only partially in place. <b>Any open manhole requires immediate maintenance.</b>                              | Manhole access covered.                                               |
|                              | Locking mechanism not working  | Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work. | Mechanism opens with proper tools.                                    |
|                              | Cover/lid difficult to remove  | One maintenance person cannot remove cover/lid after applying 80 lbs of lift.                                                         | Cover/lid can be removed and reinstalled by one maintenance person.   |
|                              | Ladder rungs unsafe            | Missing rungs, misalignment, rust, or cracks.                                                                                         | Ladder meets design standards. Allows maintenance person safe access. |
| Large access doors/plate     | Damaged or difficult to open   | Large access doors or plates cannot be opened/removed using normal equipment.                                                         | Replace or repair access door so it can opened as designed.           |
|                              | Gaps, doesn't cover completely | Large access doors not flat and/or access opening not completely covered.                                                             | Doors close flat and covers access opening completely.                |
|                              | Lifting Rings missing, rusted  | Lifting rings not capable of lifting weight of door or plate.                                                                         | Lifting rings sufficient to lift or remove door or plate.             |

| <b>NO. 4 – CONTROL STRUCTURE/FLOW RESTRICTOR</b> |                                 |                                                                                                                                                                                                                                                                                               |                                                                                                                                                                               |
|--------------------------------------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maintenance Component</b>                     | <b>Defect or Problem</b>        | <b>Condition When Maintenance is Needed</b>                                                                                                                                                                                                                                                   | <b>Results Expected When Maintenance is Performed</b>                                                                                                                         |
| Structure                                        | Trash and debris                | Trash or debris of more than ½ cubic foot which is located immediately in front of the structure opening or is blocking capacity of the structure by more than 10%.                                                                                                                           | No Trash or debris blocking or potentially blocking entrance to structure.                                                                                                    |
|                                                  |                                 | Trash or debris in the structure that exceeds 1/3 the depth from the bottom of basin to invert the lowest pipe into or out of the basin.                                                                                                                                                      | No trash or debris in the structure.                                                                                                                                          |
|                                                  |                                 | Deposits of garbage exceeding 1 cubic foot in volume.                                                                                                                                                                                                                                         | No condition present which would attract or support the breeding of insects or rodents.                                                                                       |
|                                                  | Sediment                        | Sediment exceeds 60% of the depth from the bottom of the structure to the invert of the lowest pipe into or out of the structure or the bottom of the FROP-T section or is within 6 inches of the invert of the lowest pipe into or out of the structure or the bottom of the FROP-T section. | Sump of structure contains no sediment.                                                                                                                                       |
|                                                  | Damage to frame and/or top slab | Corner of frame extends more than ¾ inch past curb face into the street (If applicable).                                                                                                                                                                                                      | Frame is even with curb.                                                                                                                                                      |
|                                                  |                                 | Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.                                                                                                                                                                                                                   | Top slab is free of holes and cracks.                                                                                                                                         |
|                                                  |                                 | Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.                                                                                                                                                                                     | Frame is sitting flush on top slab.                                                                                                                                           |
|                                                  | Cracks in walls or bottom       | Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering structure through cracks, or maintenance person judges that structure is unsound.                                                                                                                    | Structure is sealed and structurally sound.                                                                                                                                   |
|                                                  |                                 | Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering structure through cracks.                                                                                                                                    | No cracks more than 1/4 inch wide at the joint of inlet/outlet pipe.                                                                                                          |
|                                                  | Settlement/ misalignment        | Structure has settled more than 1 inch or has rotated more than 2 inches out of alignment.                                                                                                                                                                                                    | Basin replaced or repaired to design standards.                                                                                                                               |
|                                                  | Damaged pipe joints             | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the structure at the joint of the inlet/outlet pipes.                                                                                                                                        | No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.                                                                                                           |
|                                                  | Contaminants and pollution      | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                                                                                                                                                                                  | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film. |
|                                                  | Ladder rungs missing or unsafe  | Ladder is unsafe due to missing rungs, misalignment, rust, cracks, or sharp edges.                                                                                                                                                                                                            | Ladder meets design standards and allows maintenance person safe access.                                                                                                      |
| FROP-T Section                                   | Damage                          | T section is not securely attached to structure wall and outlet pipe structure should support at least 1,000 lbs of up or down pressure.                                                                                                                                                      | T section securely attached to wall and outlet pipe.                                                                                                                          |
|                                                  |                                 | Structure is not in upright position (allow up to 10% from plumb).                                                                                                                                                                                                                            | Structure in correct position.                                                                                                                                                |
|                                                  |                                 | Connections to outlet pipe are not watertight or show signs of deteriorated grout.                                                                                                                                                                                                            | Connections to outlet pipe are water tight; structure repaired or replaced and works as designed.                                                                             |
|                                                  |                                 | Any holes—other than designed holes—in the structure.                                                                                                                                                                                                                                         | Structure has no holes other than designed holes.                                                                                                                             |
| Cleanout Gate                                    | Damaged or missing              | Cleanout gate is missing.                                                                                                                                                                                                                                                                     | Replace cleanout gate.                                                                                                                                                        |

| NO. 4 – CONTROL STRUCTURE/FLOW RESTRICTOR |                               |                                                                                                                                           |                                                                         |
|-------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Maintenance Component                     | Defect or Problem             | Condition When Maintenance is Needed                                                                                                      | Results Expected When Maintenance is Performed                          |
|                                           |                               | Cleanout gate is not watertight.                                                                                                          | Gate is watertight and works as designed.                               |
|                                           |                               | Gate cannot be moved up and down by one maintenance person.                                                                               | Gate moves up and down easily and is watertight.                        |
|                                           |                               | Chain/rod leading to gate is missing or damaged.                                                                                          | Chain is in place and works as designed.                                |
| Orifice Plate                             | Damaged or missing            | Control device is not working properly due to missing, out of place, or bent orifice plate.                                               | Plate is in place and works as designed.                                |
|                                           | Obstructions                  | Any trash, debris, sediment, or vegetation blocking the plate.                                                                            | Plate is free of all obstructions and works as designed.                |
| Overflow Pipe                             | Obstructions                  | Any trash or debris blocking (or having the potential of blocking) the overflow pipe.                                                     | Pipe is free of all obstructions and works as designed.                 |
|                                           | Deformed or damaged lip       | Lip of overflow pipe is bent or deformed.                                                                                                 | Overflow pipe does not allow overflow at an elevation lower than design |
| Inlet/Outlet Pipe                         | Sediment accumulation         | Sediment filling 20% or more of the pipe.                                                                                                 | Inlet/outlet pipes clear of sediment.                                   |
|                                           | Trash and debris              | Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).                                              | No trash or debris in pipes.                                            |
|                                           | Damaged                       | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes. | No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.  |
| Metal Grates (If Applicable)              | Unsafe grate opening          | Grate with opening wider than 7/8 inch.                                                                                                   | Grate opening meets design standards.                                   |
|                                           | Trash and debris              | Trash and debris that is blocking more than 20% of grate surface.                                                                         | Grate free of trash and debris. footnote to guidelines for disposal     |
|                                           | Damaged or missing            | Grate missing or broken member(s) of the grate.                                                                                           | Grate is in place and meets design standards.                           |
| Manhole Cover/Lid                         | Cover/lid not in place        | Cover/lid is missing or only partially in place. <b>Any open structure requires urgent maintenance.</b>                                   | Cover/lid protects opening to structure.                                |
|                                           | Locking mechanism Not Working | Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.     | Mechanism opens with proper tools.                                      |
|                                           | Cover/lid difficult to Remove | One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.                                                            | Cover/lid can be removed and reinstalled by one maintenance person.     |

**NO. 5 – CATCH BASINS AND MANHOLES**

| <b>Maintenance Component</b> | <b>Defect or Problem</b>        | <b>Condition When Maintenance is Needed</b>                                                                                                                                                                                 | <b>Results Expected When Maintenance is Performed</b>                                                                                                                         |
|------------------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Structure                    | Sediment                        | Sediment exceeds 60% of the depth from the bottom of the catch basin to the invert of the lowest pipe into or out of the catch basin or is within 6 inches of the invert of the lowest pipe into or out of the catch basin. | Sump of catch basin contains no sediment.                                                                                                                                     |
|                              | Trash and debris                | Trash or debris of more than ½ cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of the catch basin by more than 10%.                                                     | No Trash or debris blocking or potentially blocking entrance to catch basin.                                                                                                  |
|                              |                                 | Trash or debris in the catch basin that exceeds ⅓ the depth from the bottom of basin to invert the lowest pipe into or out of the basin.                                                                                    | No trash or debris in the catch basin.                                                                                                                                        |
|                              |                                 | Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).                                                                                                        | No dead animals or vegetation present within catch basin.                                                                                                                     |
|                              |                                 | Deposits of garbage exceeding 1 cubic foot in volume.                                                                                                                                                                       | No condition present which would attract or support the breeding of insects or rodents.                                                                                       |
|                              | Damage to frame and/or top slab | Corner of frame extends more than ¾ inch past curb face into the street (If applicable).                                                                                                                                    | Frame is even with curb.                                                                                                                                                      |
|                              |                                 | Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.                                                                                                                                                 | Top slab is free of holes and cracks.                                                                                                                                         |
|                              |                                 | Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.                                                                                                                   | Frame is sitting flush on top slab.                                                                                                                                           |
|                              | Cracks in walls or bottom       | Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks, or maintenance person judges that catch basin is unsound.                                              | Catch basin is sealed and structurally sound.                                                                                                                                 |
|                              |                                 | Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.                                                                | No cracks more than ¼ inch wide at the joint of inlet/outlet pipe.                                                                                                            |
|                              | Settlement/ misalignment        | Catch basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.                                                                                                                                | Basin replaced or repaired to design standards.                                                                                                                               |
|                              | Damaged pipe joints             | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the catch basin at the joint of the inlet/outlet pipes.                                                                    | No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.                                                                                                           |
|                              | Contaminants and pollution      | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                                                                                                                | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film. |
| Inlet/Outlet Pipe            | Sediment accumulation           | Sediment filling 20% or more of the pipe.                                                                                                                                                                                   | Inlet/outlet pipes clear of sediment.                                                                                                                                         |
|                              | Trash and debris                | Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).                                                                                                                                | No trash or debris in pipes.                                                                                                                                                  |
|                              | Damaged                         | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.                                                                                   | No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.                                                                                                        |

**NO. 5 – CATCH BASINS AND MANHOLES**

| <b>Maintenance Component</b>   | <b>Defect or Problem</b>      | <b>Condition When Maintenance is Needed</b>                                                                                           | <b>Results Expected When Maintenance is Performed</b>               |
|--------------------------------|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| Metal Grates<br>(Catch Basins) | Unsafe grate opening          | Grate with opening wider than $\frac{7}{8}$ inch.                                                                                     | Grate opening meets design standards.                               |
|                                | Trash and debris              | Trash and debris that is blocking more than 20% of grate surface.                                                                     | Grate free of trash and debris. footnote to guidelines for disposal |
|                                | Damaged or missing            | Grate missing or broken member(s) of the grate.<br><b>Any open structure requires urgent maintenance.</b>                             | Grate is in place and meets design standards.                       |
| Manhole Cover/Lid              | Cover/lid not in place        | Cover/lid is missing or only partially in place.<br><b>Any open structure requires urgent maintenance.</b>                            | Cover/lid protects opening to structure.                            |
|                                | Locking mechanism Not Working | Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work. | Mechanism opens with proper tools.                                  |
|                                | Cover/lid difficult to Remove | One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.                                                        | Cover/lid can be removed and reinstalled by one maintenance person. |

**NO. 6 – CONVEYANCE PIPES AND DITCHES**

| <b>Maintenance Component</b> | <b>Defect or Problem</b>                            | <b>Conditions When Maintenance is Needed</b>                                                                                                | <b>Results Expected When Maintenance is Performed</b>                                                                                                                         |
|------------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pipes                        | Sediment & debris accumulation                      | Accumulated sediment or debris that exceeds 20% of the diameter of the pipe.                                                                | Water flows freely through pipes.                                                                                                                                             |
|                              | Vegetation/roots                                    | Vegetation/roots that reduce free movement of water through pipes.                                                                          | Water flows freely through pipes.                                                                                                                                             |
|                              | Contaminants and pollution                          | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                                | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film. |
|                              | Damage to protective coating or corrosion           | Protective coating is damaged; rust or corrosion is weakening the structural integrity of any part of pipe.                                 | Pipe repaired or replaced.                                                                                                                                                    |
|                              | Damaged                                             | Any dent that decreases the cross section area of pipe by more than 20% or is determined to have weakened structural integrity of the pipe. | Pipe repaired or replaced.                                                                                                                                                    |
| Ditches                      | Trash and debris                                    | Trash and debris exceeds 1 cubic foot per 1,000 square feet of ditch and slopes.                                                            | Trash and debris cleared from ditches.                                                                                                                                        |
|                              | Sediment accumulation                               | Accumulated sediment that exceeds 20% of the design depth.                                                                                  | Ditch cleaned/flushed of all sediment and debris so that it matches design.                                                                                                   |
|                              | Noxious weeds                                       | Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.                                         | Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.          |
|                              | Contaminants and pollution                          | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                                | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film. |
|                              | Vegetation                                          | Vegetation that reduces free movement of water through ditches.                                                                             | Water flows freely through ditches.                                                                                                                                           |
|                              | Erosion damage to slopes                            | Any erosion observed on a ditch slope.                                                                                                      | Slopes are not eroding.                                                                                                                                                       |
|                              | Rock lining out of place or missing (If Applicable) | One layer or less of rock exists above native soil area 5 square feet or more, any exposed native soil.                                     | Replace rocks to design standards.                                                                                                                                            |

| <b>NO. 7 – DEBRIS BARRIERS (E.G., TRASH RACKS)</b> |                          |                                                                                                                           |                                                           |
|----------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| <b>Maintenance Component</b>                       | <b>Defect or Problem</b> | <b>Condition When Maintenance is Needed</b>                                                                               | <b>Results Expected When Maintenance is Performed.</b>    |
| Site                                               | Trash and debris         | Trash or debris plugging more than 20% of the area of the barrier.                                                        | Barrier clear to receive capacity flow.                   |
|                                                    | Sediment accumulation    | Sediment accumulation of greater than 20% of the area of the barrier                                                      | Barrier clear to receive capacity flow.                   |
| Structure                                          | Cracked broken or loose  | Structure which bars attached to is damaged - pipe is loose or cracked or concrete structure is cracked, broken or loose. | Structure barrier attached to is sound.                   |
| Bars                                               | Bar spacing              | Bar spacing exceeds 6 inches.                                                                                             | Bars have at most 6 inch spacing.                         |
|                                                    | Damaged or missing bars  | Bars are bent out of shape more than 3 inches.                                                                            | Bars in place with no bends more than $\frac{3}{4}$ inch. |
|                                                    |                          | Bars are missing or entire barrier missing.                                                                               | Bars in place according to design.                        |
|                                                    |                          | Bars are loose and rust is causing 50% deterioration to any part of barrier.                                              | Repair or replace barrier to design standards.            |

**NO. 8 – ENERGY DISSIPATERS**

| <b>Maintenance Component</b> | <b>Defect or Problem</b>                          | <b>Conditions When Maintenance is Needed</b>                                                                                                                                         | <b>Results Expected When Maintenance is Performed.</b>                                                                                                                        |
|------------------------------|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Site                         | Trash and debris                                  | Trash and/or debris accumulation.                                                                                                                                                    | Dissipater clear of trash and/or debris.                                                                                                                                      |
|                              | Contaminants and pollution                        | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                                                                         | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film. |
| Rock Pad                     | Missing or moved Rock                             | Only one layer of rock exists above native soil in area five square feet or larger or any exposure of native soil.                                                                   | Rock pad prevents erosion.                                                                                                                                                    |
| Dispersion Trench            | Pipe plugged with sediment                        | Accumulated sediment that exceeds 20% of the design depth.                                                                                                                           | Pipe cleaned/flushed so that it matches design.                                                                                                                               |
|                              | Not discharging water properly                    | Visual evidence of water discharging at concentrated points along trench (normal condition is a "sheet flow" of water along trench).                                                 | Water discharges from feature by sheet flow.                                                                                                                                  |
|                              | Perforations plugged.                             | Over 1/4 of perforations in pipe are plugged with debris or sediment.                                                                                                                | Perforations freely discharge flow.                                                                                                                                           |
|                              | Water flows out top of "distributor" catch basin. | Water flows out of distributor catch basin during any storm less than the design storm.                                                                                              | No flow discharges from distributor catch basin.                                                                                                                              |
|                              | Receiving area over-saturated                     | Water in receiving area is causing or has potential of causing landslide problems.                                                                                                   | No danger of landslides.                                                                                                                                                      |
| Gabions                      | Damaged mesh                                      | Mesh of gabion broken, twisted or deformed so structure is weakened or rock may fall out.                                                                                            | Mesh is intact, no rock missing.                                                                                                                                              |
|                              | Corrosion                                         | Gabion mesh shows corrosion through more than ¼ of its gage.                                                                                                                         | All gabion mesh capable of containing rock and retaining designed form.                                                                                                       |
|                              | Collapsed or deformed baskets                     | Gabion basket shape deformed due to any cause.                                                                                                                                       | All gabion baskets intact, structure stands as designed.                                                                                                                      |
|                              | Missing rock                                      | Any rock missing that could cause gabion to loose structural integrity.                                                                                                              | No rock missing.                                                                                                                                                              |
| Manhole/Chamber              | Worn or damaged post, baffles or side of chamber  | Structure dissipating flow deteriorates to ½ or original size or any concentrated worn spot exceeding one square foot which would make structure unsound.                            | Structure is in no danger of failing.                                                                                                                                         |
|                              | Damage to wall, frame, bottom, and/or top slab    | Cracks wider than ½-inch or any evidence of soil entering the structure through cracks, or maintenance inspection personnel determines that the structure is not structurally sound. | Manhole/chamber is sealed and structurally sound.                                                                                                                             |
|                              | Damaged pipe joints                               | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the structure at the joint of the inlet/outlet pipes.                               | No soil or water enters and no water discharges at the joint of inlet/outlet pipes.                                                                                           |



| <b>NO. 9 – FENCING</b>               |                                          |                                                                                                                    |                                                                                                        |
|--------------------------------------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| <b>Maintenance Component</b>         | <b>Defect or Problem</b>                 | <b>Conditions When Maintenance is Needed</b>                                                                       | <b>Results Expected When Maintenance is Performed</b>                                                  |
| Site                                 | Erosion or holes under fence             | Erosion or holes more than 4 inches high and 12-18 inches wide permitting access through an opening under a fence. | No access under the fence.                                                                             |
| Wood Posts, Boards and Cross Members | Missing or damaged parts                 | Missing or broken boards, post out of plumb by more than 6 inches or cross members broken                          | No gaps on fence due to missing or broken boards, post plumb to within 1½ inches, cross members sound. |
|                                      | Weakened by rotting or insects           | Any part showing structural deterioration due to rotting or insect damage                                          | All parts of fence are structurally sound.                                                             |
|                                      | Damaged or failed post foundation        | Concrete or metal attachments deteriorated or unable to support posts.                                             | Post foundation capable of supporting posts even in strong wind.                                       |
| Metal Posts, Rails and Fabric        | Damaged parts                            | Post out of plumb more than 6 inches.                                                                              | Post plumb to within 1½ inches.                                                                        |
|                                      |                                          | Top rails bent more than 6 inches.                                                                                 | Top rail free of bends greater than 1 inch.                                                            |
|                                      |                                          | Any part of fence (including post, top rails, and fabric) more than 1 foot out of design alignment.                | Fence is aligned and meets design standards.                                                           |
|                                      |                                          | Missing or loose tension wire.                                                                                     | Tension wire in place and holding fabric.                                                              |
|                                      | Deteriorated paint or protective coating | Part or parts that have a rusting or scaling condition that has affected structural adequacy.                      | Structurally adequate posts or parts with a uniform protective coating.                                |
|                                      | Openings in fabric                       | Openings in fabric are such that an 8-inch diameter ball could fit through.                                        | Fabric mesh openings within 50% of grid size.                                                          |

**NO. 10 – GATES/BOLLARDS/ACCESS BARRIERS**

| <b>Maintenance Component</b> | <b>Defect or Problem</b>             | <b>Conditions When Maintenance is Needed</b>                                                                | <b>Results Expected When Maintenance is Performed</b>               |
|------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| Chain Link Fencing Gate      | Damaged or missing members           | Missing gate.                                                                                               | Gates in place.                                                     |
|                              |                                      | Broken or missing hinges such that gate cannot be easily opened and closed by a maintenance person.         | Hinges intact and lubed. Gate is working freely.                    |
|                              |                                      | Gate is out of plumb more than 6 inches and more than 1 foot out of design alignment.                       | Gate is aligned and vertical.                                       |
|                              |                                      | Missing stretcher bar, stretcher bands, and ties.                                                           | Stretcher bar, bands, and ties in place.                            |
|                              | Locking mechanism does not lock gate | Locking device missing, no-functioning or does not link to all parts.                                       | Locking mechanism prevents opening of gate.                         |
|                              | Openings in fabric                   | Openings in fabric are such that an 8-inch diameter ball could fit through.                                 | Fabric mesh openings within 50% of grid size.                       |
| Bar Gate                     | Damaged or missing cross bar         | Cross bar does not swing open or closed, is missing or is bent to where it does not prevent vehicle access. | Cross bar swings fully open and closed and prevents vehicle access. |
|                              | Locking mechanism does not lock gate | Locking device missing, no-functioning or does not link to all parts.                                       | Locking mechanism prevents opening of gate.                         |
|                              | Support post damaged                 | Support post does not hold cross bar up.                                                                    | Cross bar held up preventing vehicle access into facility.          |
| Bollards                     | Damaged or missing                   | Bollard broken, missing, does not fit into support hole or hinge broken or missing.                         | No access for motorized vehicles to get into facility.              |
|                              | Does not lock                        | Locking assembly or lock missing or cannot be attached to lock bollard in place.                            | No access for motorized vehicles to get into facility.              |
| Boulders                     | Dislodged                            | Boulders not located to prevent motorized vehicle access.                                                   | No access for motorized vehicles to get into facility.              |
|                              | Circumvented                         | Motorized vehicles going around or between boulders.                                                        | No access for motorized vehicles to get into facility.              |

| <b>NO. 11 – GROUNDS (LANDSCAPING)</b> |                            |                                                                                                                                                                                                                                             |                                                                                                                                                                               |
|---------------------------------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maintenance Component</b>          | <b>Defect or Problem</b>   | <b>Conditions When Maintenance is Needed</b>                                                                                                                                                                                                | <b>Results Expected When Maintenance is Performed</b>                                                                                                                         |
| Site                                  | Trash or litter            | Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping. | Trash and debris cleared from site.                                                                                                                                           |
|                                       | Noxious weeds              | Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.                                                                                                                                         | Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.          |
|                                       | Contaminants and pollution | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                                                                                                                                | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film. |
|                                       | Grass/groundcover          | Grass or groundcover exceeds 18 inches in height.                                                                                                                                                                                           | Grass or groundcover mowed to a height no greater than 6 inches.                                                                                                              |
| Trees and Shrubs                      | Hazard                     | Any tree or limb of a tree identified as having a potential to fall and cause property damage or threaten human life. <b>A hazard tree identified by a qualified arborist must be removed as soon as possible.</b>                          | No hazard trees in facility.                                                                                                                                                  |
|                                       | Damaged                    | Limbs or parts of trees or shrubs that are split or broken which affect more than 25% of the total foliage of the tree or shrub.                                                                                                            | Trees and shrubs with less than 5% of total foliage with split or broken limbs.                                                                                               |
|                                       |                            | Trees or shrubs that have been blown down or knocked over.                                                                                                                                                                                  | No blown down vegetation or knocked over vegetation. Trees or shrubs free of injury.                                                                                          |
|                                       |                            | Trees or shrubs which are not adequately supported or are leaning over, causing exposure of the roots.                                                                                                                                      | Tree or shrub in place and adequately supported; dead or diseased trees removed.                                                                                              |

| <b>NO. 12 – ACCESS ROADS</b> |                                                 |                                                                                                                                                                    |                                                                                                                                                                               |
|------------------------------|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maintenance Component</b> | <b>Defect or Problem</b>                        | <b>Condition When Maintenance is Needed</b>                                                                                                                        | <b>Results Expected When Maintenance is Performed</b>                                                                                                                         |
| Site                         | Trash and debris                                | Trash and debris exceeds 1 cubic foot per 1,000 square feet (i.e., trash and debris would fill up one standards size garbage can).                                 | Roadway drivable by maintenance vehicles.                                                                                                                                     |
|                              |                                                 | Debris which could damage vehicle tires or prohibit use of road.                                                                                                   | Roadway drivable by maintenance vehicles.                                                                                                                                     |
|                              | Contaminants and pollution                      | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                                                       | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film. |
|                              | Blocked roadway                                 | Any obstruction which reduces clearance above road surface to less than 14 feet.                                                                                   | Roadway overhead clear to 14 feet high.                                                                                                                                       |
|                              |                                                 | Any obstruction restricting the access to a 10- to 12 foot width for a distance of more than 12 feet or any point restricting access to less than a 10 foot width. | At least 12-foot of width on access road.                                                                                                                                     |
| Road Surface                 | Erosion, settlement, potholes, soft spots, ruts | Any surface defect which hinders or prevents maintenance access.                                                                                                   | Road drivable by maintenance vehicles.                                                                                                                                        |
|                              | Vegetation on road surface                      | Trees or other vegetation prevent access to facility by maintenance vehicles.                                                                                      | Maintenance vehicles can access facility.                                                                                                                                     |
| Shoulders and Ditches        | Erosion                                         | Erosion within 1 foot of the roadway more than 8 inches wide and 6 inches deep.                                                                                    | Shoulder free of erosion and matching the surrounding road.                                                                                                                   |
|                              | Weeds and brush                                 | Weeds and brush exceed 18 inches in height or hinder maintenance access.                                                                                           | Weeds and brush cut to 2 inches in height or cleared in such a way as to allow maintenance access.                                                                            |
| Modular Grid Pavement        | Contaminants and pollution                      | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                                                       | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film. |
|                              | Damaged or missing                              | Access surface compacted because of broken or missing modular block.                                                                                               | Access road surface restored so road infiltrates.                                                                                                                             |

| <b>NO. 13 – BASIC BIOFILTRATION SWALE (GRASS)</b> |                            |                                                                                                                                           |                                                                                                                                                                               |
|---------------------------------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maintenance Component</b>                      | <b>Defect or Problem</b>   | <b>Condition When Maintenance is Needed</b>                                                                                               | <b>Results Expected When Maintenance is Performed</b>                                                                                                                         |
| Site                                              | Trash and debris           | Any trash and/or debris accumulated on the bioswale site.                                                                                 | No trash or debris on the bioswale site.                                                                                                                                      |
|                                                   | Contaminants and pollution | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                              | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film. |
| Swale Section                                     | Sediment accumulation      | Sediment depth exceeds 2 inches in 10% of the swale treatment area.                                                                       | No sediment deposits in grass treatment area of the bioswale.                                                                                                                 |
|                                                   |                            | Sediment inhibits grass growth over 10% of swale length.                                                                                  | Grass growth not inhibited by sediment.                                                                                                                                       |
|                                                   |                            | Sediment inhibits even spreading of flow.                                                                                                 | Flow spreads evenly through swale                                                                                                                                             |
|                                                   | Erosion/scouring           | Eroded or scoured swale bottom due to channelization or high flows.                                                                       | No eroded or scoured areas in bioswale. Cause of erosion or scour addressed.                                                                                                  |
|                                                   | Poor vegetation coverage   | Grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom.                                                     | Swale has no bare spots and grass is thick and healthy.                                                                                                                       |
|                                                   | Grass too tall             | Grass excessively tall (greater than 10 inches), grass is thin or nuisance weeds and other vegetation has taken over.                     | Grass is between 3 and 4 inches tall, thick and healthy. No clippings left in swale. No nuisance vegetation present.                                                          |
|                                                   | Excessive shade            | Grass growth is poor because sunlight does not reach swale.                                                                               | Health grass growth or swale converted to a wet bioswale.                                                                                                                     |
|                                                   | Constant baseflow          | Continuous flow through the swale, even when it has been dry for weeks or an eroded, muddy channel has formed in the swale bottom.        | Baseflow removed from swale by a low-flow pea-gravel drain or bypassed around the swale.                                                                                      |
|                                                   | Standing water             | Water pools in the swale between storms or does not drain freely.                                                                         | Swale freely drains and there is no standing water in swale between storms.                                                                                                   |
|                                                   | Channelization             | Flow concentrates and erodes channel through swale.                                                                                       | No flow channels in swale.                                                                                                                                                    |
| Flow Spreader                                     | Concentrated flow          | Flow from spreader not uniformly distributed across entire swale width.                                                                   | Flows are spread evenly over entire swale width.                                                                                                                              |
| Inlet/Outlet Pipe                                 | Sediment accumulation      | Sediment filling 20% or more of the pipe.                                                                                                 | Inlet/outlet pipes clear of sediment.                                                                                                                                         |
|                                                   | Trash and debris           | Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).                                              | No trash or debris in pipes.                                                                                                                                                  |
|                                                   | Damaged                    | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes. | No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.                                                                                                        |

| <b>NO. 14 – WET BIOFILTRATION SWALE</b> |                            |                                                                                                                                           |                                                                                                                                                                               |
|-----------------------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maintenance Component</b>            | <b>Defect or Problem</b>   | <b>Condition When Maintenance is Needed</b>                                                                                               | <b>Results Expected When Maintenance Is Performed</b>                                                                                                                         |
| Site                                    | Trash and debris           | Any trash and/or debris accumulated at the site.                                                                                          | No trash or debris at the site.                                                                                                                                               |
|                                         | Contaminants and pollution | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                              | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film. |
| Swale Section                           | Sediment accumulation      | Sediment depth exceeds 2 inches in 10% of the swale treatment area.                                                                       | No sediment deposits in treatment area.                                                                                                                                       |
|                                         | Erosion/scouring           | Eroded or scoured swale bottom due to channelization or high flows.                                                                       | No eroded or scoured areas in bioswale. Cause of erosion or scour addressed.                                                                                                  |
|                                         | Water depth                | Water not retained to a depth of about 4 inches during the wet season.                                                                    | Water depth of 4 inches through out swale for most of wet season.                                                                                                             |
|                                         | Vegetation ineffective     | Vegetation sparse, does not provide adequate filtration or crowded out by very dense clumps of cattail or nuisance vegetation.            | Wetland vegetation fully covers bottom of swale and no cattails or nuisance vegetation present.                                                                               |
|                                         | Insufficient water         | Wetland vegetation dies due to lack of water.                                                                                             | Wetland vegetation remains healthy (may require converting to grass lined bioswale)                                                                                           |
| Flow Spreader                           | Concentrated flow          | Flow from spreader not uniformly distributed across entire swale width.                                                                   | Flows are spread evenly over entire swale width.                                                                                                                              |
| Inlet/Outlet Pipe                       | Sediment accumulation      | Sediment filling 20% or more of the pipe.                                                                                                 | Inlet/outlet pipes clear of sediment.                                                                                                                                         |
|                                         | Trash and debris           | Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).                                              | No trash or debris in pipes.                                                                                                                                                  |
|                                         | Damaged                    | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes. | No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.                                                                                                        |

| <b>NO. 15 – FILTER STRIP</b> |                            |                                                                                                                                           |                                                                                                                                                                               |
|------------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maintenance Component</b> | <b>Defect or Problem</b>   | <b>Condition When Maintenance is Needed</b>                                                                                               | <b>Results Expected When Maintenance Is Performed</b>                                                                                                                         |
| Site                         | Trash and debris           | Any trash and debris accumulated on the filter strip site.                                                                                | Filter strip site free of any trash or debris                                                                                                                                 |
|                              | Contaminants and pollution | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                              | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film. |
| Grass Strip                  | Sediment accumulation      | Sediment accumulation on grass exceeds 2 inches depth.                                                                                    | No sediment deposits in treatment area.                                                                                                                                       |
|                              | Erosion/scouring           | Eroded or scoured swale bottom due to channelization or high flows.                                                                       | No eroded or scoured areas in bioswale. Cause of erosion or scour addressed.                                                                                                  |
|                              | Grass too tall             | Grass excessively tall (greater than 10 inches), grass is thin or nuisance weeds and other vegetation has taken over.                     | Grass is between 3 and 4 inches tall, thick and healthy. No clippings left in swale. No nuisance vegetation present.                                                          |
|                              | Vegetation ineffective     | Grass has died out, become excessively tall (greater than 10 inches) or nuisance vegetation is taking over.                               | Grass is healthy, less than 9 inches high and no nuisance vegetation present.                                                                                                 |
| Flow Spreader                | Concentrated flow          | Flow from spreader not uniformly distributed across entire swale width.                                                                   | Flows are spread evenly over entire swale width.                                                                                                                              |
| Inlet/Outlet Pipe            | Sediment accumulation      | Sediment filling 20% or more of the pipe.                                                                                                 | Inlet/outlet pipes clear of sediment.                                                                                                                                         |
|                              | Trash and debris           | Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).                                              | No trash or debris in pipes.                                                                                                                                                  |
|                              | Damaged                    | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes. | No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.                                                                                                        |

| <b>NO. 16 – WETPOND</b>                                      |                                                   |                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                       |
|--------------------------------------------------------------|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maintenance Component</b>                                 | <b>Defect or Problem</b>                          | <b>Condition When Maintenance is Needed</b>                                                                                                                                                                                                                                                                                    | <b>Results Expected When Maintenance Is Performed</b>                                                                                                                                 |
| Site                                                         | Trash and debris                                  | Any trash and debris accumulated on the wetpond site.                                                                                                                                                                                                                                                                          | Wetpond site free of any trash or debris.                                                                                                                                             |
|                                                              | Noxious weeds                                     | Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.                                                                                                                                                                                                                            | Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.                  |
|                                                              | Contaminants and pollution                        | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                                                                                                                                                                                                                   | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.         |
|                                                              | Grass/groundcover                                 | Grass or groundcover exceeds 18 inches in height.                                                                                                                                                                                                                                                                              | Grass or groundcover mowed to a height no greater than 6 inches.                                                                                                                      |
| Side Slopes of Dam, Berm, internal berm or Embankment        | Rodent holes                                      | Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.                                                                                                                                                                                     | Rodents removed or destroyed and dam or berm repaired.                                                                                                                                |
|                                                              | Tree growth                                       | Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat to dam, berm or embankment integrity, are not interfering with access or maintenance or leaves do not cause a plugging problem they do not need to be removed. | Trees do not hinder facility performance or maintenance activities.                                                                                                                   |
|                                                              | Erosion                                           | Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.                                                                                                                                                          | Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion. |
| Top or Side Slopes of Dam, Berm, internal berm or Embankment | Settlement                                        | Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation.                                                                                                                                                                                                                               | Top or side slope restored to design dimensions. If settlement is significant, a licensed civil engineer should be consulted to determine the cause of the settlement.                |
|                                                              | Irregular surface on internal berm                | Top of berm not uniform and level.                                                                                                                                                                                                                                                                                             | Top of berm graded to design elevation.                                                                                                                                               |
| Pond Areas                                                   | Sediment accumulation (except first wetpool cell) | Accumulated sediment that exceeds 10% of the designed pond depth.                                                                                                                                                                                                                                                              | Sediment cleaned out to designed pond shape and depth.                                                                                                                                |
|                                                              | Sediment accumulation (first wetpool cell)        | Sediment accumulations in pond bottom that exceeds the depth of sediment storage (1 foot) plus 6 inches.                                                                                                                                                                                                                       | Sediment storage contains no sediment.                                                                                                                                                |
|                                                              | Liner damaged (If Applicable)                     | Liner is visible or pond does not hold water as designed.                                                                                                                                                                                                                                                                      | Liner repaired or replaced.                                                                                                                                                           |
|                                                              | Water level (first wetpool cell)                  | First cell empty, doesn't hold water.                                                                                                                                                                                                                                                                                          | Water retained in first cell for most of the year.                                                                                                                                    |
|                                                              | Algae mats (first wetpool cell)                   | Algae mats develop over more than 10% of the water surface should be removed.                                                                                                                                                                                                                                                  | Algae mats removed (usually in the late summer before Fall rains, especially in Sensitive Lake Protection Areas.)                                                                     |
| Gravity Drain                                                | Inoperable valve                                  | Valve will not open and close.                                                                                                                                                                                                                                                                                                 | Valve opens and closes normally.                                                                                                                                                      |
|                                                              | Valve won't seal                                  | Valve does not seal completely.                                                                                                                                                                                                                                                                                                | Valve completely seals closed.                                                                                                                                                        |
| Emergency Overflow Spillway                                  | Tree growth                                       | Tree growth impedes flow or threatens stability of spillway.                                                                                                                                                                                                                                                                   | Trees removed.                                                                                                                                                                        |



| <b>NO. 16 – WETPOND</b>      |                          |                                                                                                                                                                                                            |                                                                        |
|------------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| <b>Maintenance Component</b> | <b>Defect or Problem</b> | <b>Condition When Maintenance is Needed</b>                                                                                                                                                                | <b>Results Expected When Maintenance Is Performed</b>                  |
|                              | Rock missing             | Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. Rip-rap on inside slopes need not be replaced. | Spillway restored to design standards.                                 |
| Inlet/Outlet Pipe            | Sediment accumulation    | Sediment filling 20% or more of the pipe.                                                                                                                                                                  | Inlet/outlet pipes clear of sediment.                                  |
|                              | Trash and debris         | Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).                                                                                                               | No trash or debris in pipes.                                           |
|                              | Damaged                  | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.                                                                  | No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe. |

| <b>NO. 17 – WETVAULT</b>     |                                                       |                                                                                                                                                                                                          |                                                                                                                                                                               |
|------------------------------|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maintenance Component</b> | <b>Defect or Problem</b>                              | <b>Condition When Maintenance is Needed</b>                                                                                                                                                              | <b>Results Expected When Maintenance is Performed</b>                                                                                                                         |
| Site                         | Trash and debris                                      | Trash and debris accumulated on facility site.                                                                                                                                                           | Trash and debris removed from facility site.                                                                                                                                  |
| Treatment Area               | Trash and debris                                      | Any trash and debris accumulated in vault (includes floatables and non-floatables).                                                                                                                      | No trash or debris in vault.                                                                                                                                                  |
|                              | Sediment accumulation                                 | Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6 inches.                                                                                                              | No sediment in vault.                                                                                                                                                         |
|                              | Contaminants and pollution                            | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                                                                                             | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film. |
| Vault Structure              | Damage to wall, frame, bottom, and/or top slab        | Cracks wider than ½-inch, any evidence of soil entering the structure through cracks, vault does not retain water or qualified inspection personnel determines that the vault is not structurally sound. | Vault is sealed and structurally sound.                                                                                                                                       |
|                              | Baffles damaged                                       | Baffles corroding, cracking, warping and/or showing signs of failure or baffle cannot be removed.                                                                                                        | Repair or replace baffles or walls to specifications.                                                                                                                         |
|                              | Ventilation                                           | Ventilation area blocked or plugged.                                                                                                                                                                     | No reduction of ventilation area exists.                                                                                                                                      |
| Inlet/Outlet Pipe            | Sediment accumulation                                 | Sediment filling 20% or more of the pipe.                                                                                                                                                                | Inlet/outlet pipes clear of sediment.                                                                                                                                         |
|                              | Trash and debris                                      | Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).                                                                                                             | No trash or debris in pipes.                                                                                                                                                  |
|                              | Damaged                                               | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.                                                                | No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.                                                                                                        |
| Gravity Drain                | Inoperable valve                                      | Valve will not open and close.                                                                                                                                                                           | Valve opens and closes normally.                                                                                                                                              |
|                              | Valve won't seal                                      | Valve does not seal completely.                                                                                                                                                                          | Valve completely seals closed.                                                                                                                                                |
| Access Manhole               | Access cover/lid damaged or difficult to open         | Access cover/lid cannot be easily opened by one person. Corrosion/deformation of cover/lid.                                                                                                              | Access cover/lid can be opened by one person.                                                                                                                                 |
|                              | Locking mechanism not working                         | Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.                                                                    | Mechanism opens with proper tools.                                                                                                                                            |
|                              | Cover/lid difficult to remove                         | One maintenance person cannot remove cover/lid after applying 80 lbs of lift.                                                                                                                            | Cover/lid can be removed and reinstalled by one maintenance person.                                                                                                           |
|                              | Access doors/plate has gaps, doesn't cover completely | Large access doors not flat and/or access opening not completely covered.                                                                                                                                | Doors close flat and covers access opening completely.                                                                                                                        |
|                              | Lifting Rings missing, rusted                         | Lifting rings not capable of lifting weight of door or plate.                                                                                                                                            | Lifting rings sufficient to lift or remove door or plate.                                                                                                                     |
|                              | Ladder rungs unsafe                                   | Missing rungs, misalignment, rust, or cracks.                                                                                                                                                            | Ladder meets design standards. Allows maintenance person safe access.                                                                                                         |

| <b>NO. 18 – STORMWATER WETLAND</b>                           |                                            |                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                       |
|--------------------------------------------------------------|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maintenance Component</b>                                 | <b>Defect or Problem</b>                   | <b>Condition When Maintenance is Needed</b>                                                                                                                                                                                                                                          | <b>Results Expected When Maintenance Is Performed</b>                                                                                                                                 |
| Site                                                         | Trash and debris                           | Trash and debris accumulated on facility site.                                                                                                                                                                                                                                       | Trash and debris removed from facility site.                                                                                                                                          |
|                                                              | Noxious weeds                              | Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.                                                                                                                                                                                  | Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.                  |
|                                                              | Contaminants and pollution                 | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                                                                                                                                                                         | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.         |
|                                                              | Grass/groundcover                          | Grass or groundcover exceeds 18 inches in height.                                                                                                                                                                                                                                    | Grass or groundcover mowed to a height no greater than 6 inches.                                                                                                                      |
| Side Slopes of Dam, Berm, internal berm or Embankment        | Rodent holes                               | Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.                                                                                                                                           | Rodents removed or destroyed and dam or berm repaired.                                                                                                                                |
|                                                              | Tree growth                                | Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat to dam, berm, or embankment integrity or not interfering with access or maintenance, they do not need to be removed. | Trees do not hinder facility performance or maintenance activities.                                                                                                                   |
|                                                              | Erosion                                    | Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.                                                                                                                | Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion. |
| Top or Side Slopes of Dam, Berm, internal berm or Embankment | Settlement                                 | Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation.                                                                                                                                                                                     | Top or side slope restored to design dimensions. If settlement is significant, a licensed civil engineer should be consulted to determine the cause of the settlement.                |
|                                                              | Irregular surface on internal berm         | Top of berm not uniform and level.                                                                                                                                                                                                                                                   | Top of berm graded flat to design elevation.                                                                                                                                          |
| Pond Areas                                                   | Sediment accumulation (first cell/forebay) | Sediment accumulations in pond bottom that exceeds the depth of sediment storage (1 foot) plus 6 inches.                                                                                                                                                                             | Sediment storage contains no sediment.                                                                                                                                                |
|                                                              | Sediment accumulation (wetland cell)       | Accumulated sediment that exceeds 10% of the designed pond depth.                                                                                                                                                                                                                    | Sediment cleaned out to designed pond shape and depth.                                                                                                                                |
|                                                              | Liner damaged (If Applicable)              | Liner is visible or pond does not hold water as designed.                                                                                                                                                                                                                            | Liner repaired or replaced.                                                                                                                                                           |
|                                                              | Water level (first cell/forebay)           | Cell does not hold 3 feet of water year round.                                                                                                                                                                                                                                       | 3 feet of water retained year round.                                                                                                                                                  |
|                                                              | Water level (wetland cell)                 | Cell does not retain water for at least 10 months of the year or wetland plants are not surviving.                                                                                                                                                                                   | Water retained at least 10 months of the year or wetland plants are surviving.                                                                                                        |
|                                                              | Algae mats (first cell/forebay)            | Algae mats develop over more than 10% of the water surface should be removed.                                                                                                                                                                                                        | Algae mats removed (usually in the late summer before Fall rains, especially in Sensitive Lake Protection Areas.)                                                                     |
|                                                              | Vegetation                                 | Vegetation dead, dying, or overgrown (cattails) or not meeting original planting specifications.                                                                                                                                                                                     | Plants in wetland cell surviving and not interfering with wetland function.                                                                                                           |

**NO. 18 – STORMWATER WETLAND**

| <b>Maintenance Component</b> | <b>Defect or Problem</b> | <b>Condition When Maintenance is Needed</b>                                                                                                                                                                | <b>Results Expected When Maintenance Is Performed</b>                  |
|------------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| Gravity Drain                | Inoperable valve         | Valve will not open and close.                                                                                                                                                                             | Valve opens and closes normally.                                       |
|                              | Valve won't seal         | Valve does not seal completely.                                                                                                                                                                            | Valve completely seals closed.                                         |
| Emergency Overflow Spillway  | Tree growth              | Tree growth impedes flow or threatens stability of spillway.                                                                                                                                               | Trees removed.                                                         |
|                              | Rock missing             | Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. Rip-rap on inside slopes need not be replaced. | Spillway restored to design standards.                                 |
| Inlet/Outlet Pipe            | Sediment accumulation    | Sediment filling 20% or more of the pipe.                                                                                                                                                                  | Inlet/outlet pipes clear of sediment.                                  |
|                              | Trash and debris         | Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).                                                                                                               | No trash or debris in pipes.                                           |
|                              | Damaged                  | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.                                                                  | No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe. |

| <b>NO. 19 – SAND FILTER POND</b> |                                               |                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                       |
|----------------------------------|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maintenance Component</b>     | <b>Defect or Problem</b>                      | <b>Condition When Maintenance is Needed</b>                                                                                                                                                                                                                                          | <b>Results Expected When Maintenance Is Performed</b>                                                                                                                                 |
| Site                             | Trash and debris                              | Trash and debris accumulated on facility site.                                                                                                                                                                                                                                       | Trash and debris removed from facility site.                                                                                                                                          |
|                                  | Noxious weeds                                 | Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.                                                                                                                                                                                  | Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.                  |
|                                  | Contaminants and pollution                    | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                                                                                                                                                                         | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.         |
|                                  | Grass/groundcover (not in the treatment area) | Grass or groundcover exceeds 18 inches in height.                                                                                                                                                                                                                                    | Grass or groundcover mowed to a height no greater than 6 inches.                                                                                                                      |
| Pre-Treatment (if applicable)    | Sediment accumulation                         | Sediment accumulations in pond bottom that exceeds the depth of sediment storage (1 foot) plus 6 inches.                                                                                                                                                                             | Sediment storage contains no sediment.                                                                                                                                                |
|                                  | Liner damaged (If Applicable)                 | Liner is visible or pond does not hold water as designed.                                                                                                                                                                                                                            | Liner repaired or replaced.                                                                                                                                                           |
|                                  | Water level                                   | Cell empty, doesn't hold water.                                                                                                                                                                                                                                                      | Water retained in first cell for most of the year.                                                                                                                                    |
|                                  | Algae mats                                    | Algae mats develop over more than 10% of the water surface should be removed.                                                                                                                                                                                                        | Algae mats removed (usually in the late summer before Fall rains, especially in Sensitive Lake Protection Areas.)                                                                     |
| Pond Area                        | Sediment accumulation                         | Sediment or crust depth exceeds ½-inch over 10 % of surface area of sand filter.                                                                                                                                                                                                     | No sediment or crust deposit on sand filter that would impede permeability of the filter section.                                                                                     |
|                                  | Grass (if applicable)                         | Grass becomes excessively tall (greater than 6 inches) or when nuisance weeds and other vegetation start to take over or thatch build up occurs.                                                                                                                                     | Mow vegetation and/or remove nuisance vegetation.                                                                                                                                     |
| Side Slopes of Pond              | Rodent holes                                  | Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.                                                                                                                                           | Rodents removed or destroyed and dam or berm repaired.                                                                                                                                |
|                                  | Tree growth                                   | Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat to dam, berm, or embankment integrity or not interfering with access or maintenance, they do not need to be removed. | Trees do not hinder facility performance or maintenance activities.                                                                                                                   |
|                                  | Erosion                                       | Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.                                                                                                                | Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion. |

| <b>NO. 19 – SAND FILTER POND</b> |                          |                                                                                                                                                                                                                       |                                                                                                                                           |
|----------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maintenance Component</b>     | <b>Defect or Problem</b> | <b>Condition When Maintenance is Needed</b>                                                                                                                                                                           | <b>Results Expected When Maintenance Is Performed</b>                                                                                     |
| Sand Filter Media                | Plugging                 | Drawdown of water through the sand filter media, takes longer than 24 hours, and/or flow through the overflow pipes occurs frequently. A sieve analysis of >4% -100 or >2% -200 requires replacing sand filter media. | Sand filter media surface is aerated and drawdown rate is normal.                                                                         |
|                                  | Prolonged flows          | Sand is saturated for prolonged periods of time (several weeks) and does not dry out between storms due to continuous base flow or prolonged flows from detention facilities.                                         | Excess flows bypassed or confined to small portion of filter media surface.                                                               |
|                                  | Short circuiting         | Flows become concentrated over one section of the sand filter rather than dispersed or drawdown rate of pool exceeds 12 inches per hour.                                                                              | Flow and percolation of water through the sand filter is uniform and dispersed across the entire filter area and drawdown rate is normal. |
|                                  | Media thickness          | Sand thickness is less than 6 inches.                                                                                                                                                                                 | Rebuild sand thickness to a minimum of 6 inches and preferably to 18 inches.                                                              |
| Underdrains and Clean-Outs       | Sediment/debris          | Underdrains or clean-outs partially plugged or filled with sediment and/or debris. Junction box/cleanout wyes not watertight.                                                                                         | Underdrains and clean-outs free of sediment and debris and are watertight.                                                                |
| Inlet/Outlet Pipe                | Sediment accumulation    | Sediment filling 20% or more of the pipe.                                                                                                                                                                             | Inlet/outlet pipes clear of sediment.                                                                                                     |
|                                  | Trash and debris         | Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).                                                                                                                          | No trash or debris in pipes.                                                                                                              |
|                                  | Damaged                  | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.                                                                             | No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.                                                                    |
| Rock Pad                         | Missing or out of place  | Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.                                                                                                   | Rock pad restored to design standards.                                                                                                    |
| Flow spreader                    | Concentrated flow        | Flow from spreader not uniformly distributed across sand filter.                                                                                                                                                      | Flows spread evenly over sand filter.                                                                                                     |

| <b>NO. 20 – SAND FILTER VAULT</b> |                                                  |                                                                                                                                                                                                                       |                                                                                                                                                                                 |
|-----------------------------------|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maintenance Component</b>      | <b>Defect or Problem</b>                         | <b>Condition When Maintenance is Needed</b>                                                                                                                                                                           | <b>Results Expected When Maintenance is Performed</b>                                                                                                                           |
| Site                              | Trash and debris                                 | Trash and debris accumulated on facility site.                                                                                                                                                                        | Trash and debris removed from facility site.                                                                                                                                    |
|                                   | Noxious weeds                                    | Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.                                                                                                                   | Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.            |
|                                   | Contaminants and pollution                       | Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.                                                                                                                          | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.   |
|                                   | Grass/groundcover                                | Grass or groundcover exceeds 18 inches in height.                                                                                                                                                                     | Grass or groundcover mowed to a height no greater than 6 inches.                                                                                                                |
| Pre-Treatment Chamber             | Sediment accumulation                            | Sediment accumulation exceeds the depth of the sediment zone plus 6 inches.                                                                                                                                           | Sediment storage contains no sediment.                                                                                                                                          |
| Sand Filter Media                 | Sediment accumulation                            | Sediment depth exceeds ½-inch on sand filter media.                                                                                                                                                                   | Sand filter freely drains at normal rate.                                                                                                                                       |
|                                   | Trash and debris                                 | Trash and debris accumulated in vault (floatables and non-floatables).                                                                                                                                                | No trash or debris in vault.                                                                                                                                                    |
|                                   | Plugging                                         | Drawdown of water through the sand filter media, takes longer than 24 hours, and/or flow through the overflow pipes occurs frequently. A sieve analysis of >4% -100 or >2% -200 requires replacing sand filter media. | Sand filter media drawdown rate is normal.                                                                                                                                      |
|                                   | Short circuiting                                 | Seepage or flow occurs along the vault walls and corners. Sand eroding near inflow area. Cleanout wyes are not watertight.                                                                                            | Sand filter media section re-laid and compacted along perimeter of vault to form a semi-seal. Erosion protection added to dissipate force of incoming flow and curtail erosion. |
| Vault Structure                   | Damaged to walls, frame, bottom and/or top slab. | Cracks wider than ½-inch, any evidence of soil entering the structure through cracks or qualified inspection personnel determines that the vault is not structurally sound.                                           | Vault replaced or repaired to provide complete sealing of the structure.                                                                                                        |
|                                   | Ventilation                                      | Ventilation area blocked or plugged.                                                                                                                                                                                  | No reduction of ventilation area exists.                                                                                                                                        |
| Underdrains and Cleanouts         | Sediment/debris                                  | Underdrains or clean-outs partially plugged, filled with sediment and/or debris or not watertight.                                                                                                                    | Underdrains and clean-outs free of sediment and debris and sealed.                                                                                                              |
| Inlet/Outlet Pipe                 | Sediment accumulation                            | Sediment filling 20% or more of the pipe.                                                                                                                                                                             | Inlet/outlet pipes clear of sediment.                                                                                                                                           |
|                                   | Trash and debris                                 | Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).                                                                                                                          | No trash or debris in pipes.                                                                                                                                                    |
|                                   | Damaged                                          | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.                                                                             | No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.                                                                                                          |

**NO. 20 – SAND FILTER VAULT**

| <b>Maintenance Component</b> | <b>Defect or Problem</b>       | <b>Condition When Maintenance is Needed</b>                                                                                           | <b>Results Expected When Maintenance is Performed</b>                 |
|------------------------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Access Manhole               | Cover/lid not in place         | Cover/lid is missing or only partially in place. Any open manhole requires immediate maintenance.                                     | Manhole access covered.                                               |
|                              | Locking mechanism not working  | Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work. | Mechanism opens with proper tools.                                    |
|                              | Cover/lid difficult to remove  | One maintenance person cannot remove cover/lid after applying 80 lbs of lift.                                                         | Cover/lid can be removed and reinstalled by one maintenance person.   |
|                              | Ladder rungs unsafe            | Missing rungs, misalignment, rust, or cracks.                                                                                         | Ladder meets design standards. Allows maintenance person safe access. |
| Large access doors/plate     | Damaged or difficult to open   | Large access doors or plates cannot be opened/removed using normal equipment.                                                         | Replace or repair access door so it can be opened as designed.        |
|                              | Gaps, doesn't cover completely | Large access doors not flat and/or access opening not completely covered.                                                             | Doors close flat and covers access opening completely.                |
|                              | Lifting Rings missing, rusted  | Lifting rings not capable of lifting weight of door or plate.                                                                         | Lifting rings sufficient to lift or remove door or plate.             |



| <b>NO. 21 – STORMFILTER (CARTRIDGE TYPE)</b> |                                                |                                                                                                                                                                                                    |                                                                                                                                                                               |
|----------------------------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maintenance Component</b>                 | <b>Defect or Problem</b>                       | <b>Condition When Maintenance is Needed</b>                                                                                                                                                        | <b>Results Expected When Maintenance is Performed</b>                                                                                                                         |
| Site                                         | Trash and debris                               | Any trash or debris which impairs the function of the facility.                                                                                                                                    | Trash and debris removed from facility.                                                                                                                                       |
|                                              | Contaminants and pollution                     | Any evidence of contaminants or pollution such as oils, gasoline, concrete slurries or paint.                                                                                                      | Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film. |
|                                              | Life cycle                                     | System has not been inspected for three years.                                                                                                                                                     | Facility is re-inspected and any needed maintenance performed.                                                                                                                |
| Vault Treatment Area                         | Sediment on vault floor                        | Greater than 2 inches of sediment.                                                                                                                                                                 | Vault is free of sediment.                                                                                                                                                    |
|                                              | Sediment on top of cartridges                  | Greater than ½ inch of sediment.                                                                                                                                                                   | Vault is free of sediment.                                                                                                                                                    |
|                                              | Multiple scum lines above top of cartridges    | Thick or multiple scum lines above top of cartridges. Probably due to plugged canisters or underdrain manifold.                                                                                    | Cause of plugging corrected, canisters replaced if necessary.                                                                                                                 |
| Vault Structure                              | Damage to wall, Frame, Bottom, and/or Top Slab | Cracks wider than ½-inch and any evidence of soil particles entering the structure through the cracks, or qualified inspection personnel determines the vault is not structurally sound.           | Vault replaced or repaired to design specifications.                                                                                                                          |
|                                              | Baffles damaged                                | Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.                                                                               | Repair or replace baffles to specification.                                                                                                                                   |
| Filter Media                                 | Standing water in vault                        | 9 inches or greater of static water in the vault for more than 24 hours following a rain event and/or overflow occurs frequently. Probably due to plugged filter media, underdrain or outlet pipe. | No standing water in vault 24 hours after a rain event.                                                                                                                       |
|                                              | Short circuiting                               | Flows do not properly enter filter cartridges.                                                                                                                                                     | Flows go through filter media.                                                                                                                                                |
| Underdrains and Clean-Outs                   | Sediment/debris                                | Underdrains or clean-outs partially plugged or filled with sediment and/or debris.                                                                                                                 | Underdrains and clean-outs free of sediment and debris.                                                                                                                       |
| Inlet/Outlet Pipe                            | Sediment accumulation                          | Sediment filling 20% or more of the pipe.                                                                                                                                                          | Inlet/outlet pipes clear of sediment.                                                                                                                                         |
|                                              | Trash and debris                               | Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).                                                                                                       | No trash or debris in pipes.                                                                                                                                                  |
|                                              | Damaged                                        | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.                                                          | No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.                                                                                                        |
| Access Manhole                               | Cover/lid not in place                         | Cover/lid is missing or only partially in place. <b>Any open manhole requires immediate maintenance.</b>                                                                                           | Manhole access covered.                                                                                                                                                       |
|                                              | Locking mechanism not working                  | Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.                                                              | Mechanism opens with proper tools.                                                                                                                                            |
|                                              | Cover/lid difficult to remove                  | One maintenance person cannot remove cover/lid after applying 80 lbs of lift.                                                                                                                      | Cover/lid can be removed and reinstalled by one maintenance person.                                                                                                           |
|                                              | Ladder rungs unsafe                            | Missing rungs, misalignment, rust, or cracks.                                                                                                                                                      | Ladder meets design standards. Allows maintenance person safe access.                                                                                                         |
| Large access doors/plate                     | Damaged or difficult to open                   | Large access doors or plates cannot be opened/removed using normal equipment.                                                                                                                      | Replace or repair access door so it can be opened as designed.                                                                                                                |

| <b>NO. 21 – STORMFILTER (CARTRIDGE TYPE)</b> |                                |                                                                           |                                                           |
|----------------------------------------------|--------------------------------|---------------------------------------------------------------------------|-----------------------------------------------------------|
| <b>Maintenance Component</b>                 | <b>Defect or Problem</b>       | <b>Condition When Maintenance is Needed</b>                               | <b>Results Expected When Maintenance is Performed</b>     |
|                                              | Gaps, doesn't cover completely | Large access doors not flat and/or access opening not completely covered. | Doors close flat and cover access opening completely.     |
|                                              | Lifting Rings missing, rusted  | Lifting rings not capable of lifting weight of door or plate.             | Lifting rings sufficient to lift or remove door or plate. |

| <b>NO. 22 – BAFFLE OIL/WATER SEPARATOR</b> |                                                |                                                                                                                                                                                            |                                                                        |
|--------------------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| <b>Maintenance Component</b>               | <b>Defect</b>                                  | <b>Condition When Maintenance is Needed</b>                                                                                                                                                | <b>Results Expected When Maintenance is Performed</b>                  |
| Site                                       | Trash and debris                               | Any trash or debris which impairs the function of the facility.                                                                                                                            | Trash and debris removed from facility.                                |
|                                            | Contaminants and pollution                     | Floating oil in excess of 1 inch in first chamber, any oil in other chambers or other contaminants of any type in any chamber.                                                             | No contaminants present other than a surface oil film.                 |
| Vault Treatment Area                       | Sediment accumulation                          | Sediment accumulates exceeds 6 inches in the vault.                                                                                                                                        | No sediment in the vault.                                              |
|                                            | Discharge water not clear                      | Inspection of discharge water shows obvious signs of poor water quality- effluent discharge from vault shows thick visible sheen.                                                          | Effluent discharge is clear.                                           |
|                                            | Trash or debris accumulation                   | Any trash and debris accumulation in vault (floatables and non-floatables).                                                                                                                | Vault is clear of trash and debris.                                    |
|                                            | Oil accumulation                               | Oil accumulations that exceed 1 inch, at the surface of the water in the oil/water separator chamber.                                                                                      | No visible oil depth on water.                                         |
| Vault Structure                            | Damage to Wall, Frame, Bottom, and/or Top Slab | Cracks wider than ½-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound. | Vault replaced or repaired to design specifications.                   |
|                                            | Baffles damaged                                | Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance inspection personnel.                                                                    | Repair or replace baffles to specifications.                           |
| Gravity Drain                              | Inoperable valve                               | Valve will not open and close.                                                                                                                                                             | Valve opens and closes normally.                                       |
|                                            | Valve won't seal                               | Valve does not seal completely.                                                                                                                                                            | Valve completely seals closed.                                         |
| Inlet/Outlet Pipe                          | Sediment accumulation                          | Sediment filling 20% or more of the pipe.                                                                                                                                                  | Inlet/outlet pipes clear of sediment.                                  |
|                                            | Trash and debris                               | Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).                                                                                               | No trash or debris in pipes.                                           |
|                                            | Damaged                                        | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.                                                  | No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe. |
| Access Manhole                             | Cover/lid not in place                         | Cover/lid is missing or only partially in place.<br><b>Any open manhole requires immediate maintenance.</b>                                                                                | Manhole access covered.                                                |
|                                            | Locking mechanism not working                  | Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.                                                      | Mechanism opens with proper tools.                                     |
|                                            | Cover/lid difficult to remove                  | One maintenance person cannot remove cover/lid after applying 80 lbs of lift.                                                                                                              | Cover/lid can be removed and reinstalled by one maintenance person.    |
|                                            | Ladder rungs unsafe                            | Missing rungs, misalignment, rust, or cracks.                                                                                                                                              | Ladder meets design standards. Allows maintenance person safe access.  |
| Large access doors/plate                   | Damaged or difficult to open                   | Large access doors or plates cannot be opened/removed using normal equipment.                                                                                                              | Replace or repair access door so it can be opened as designed.         |
|                                            | Gaps, doesn't cover completely                 | Large access doors not flat and/or access opening not completely covered.                                                                                                                  | Doors close flat and cover access opening completely.                  |
|                                            | Lifting Rings missing, rusted                  | Lifting rings not capable of lifting weight of door or cover/lid.                                                                                                                          | Lifting rings sufficient to lift or remove cover/lid.                  |

| <b>NO. 23 – COALESCING PLATE OIL/WATER SEPARATOR</b> |                                                |                                                                                                                                                                                                 |                                                                                           |
|------------------------------------------------------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| <b>Maintenance Component</b>                         | <b>Defect</b>                                  | <b>Condition When Maintenance is Needed</b>                                                                                                                                                     | <b>Results Expected When Maintenance is Performed</b>                                     |
| Site                                                 | Trash and debris                               | Any trash or debris which impairs the function of the facility.                                                                                                                                 | Trash and debris removed from facility.                                                   |
|                                                      | Contaminants and pollution                     | Floating oil in excess of 1 inch in first chamber, any oil in other chambers or other contaminants of any type in any chamber.                                                                  | No contaminants present other than a surface oil film.                                    |
| Vault Treatment Area                                 | Sediment accumulation in the forebay           | Sediment accumulation of 6 inches or greater in the forebay.                                                                                                                                    | No sediment in the forebay.                                                               |
|                                                      | Discharge water not clear                      | Inspection of discharge water shows obvious signs of poor water quality - effluent discharge from vault shows thick visible sheen.                                                              | Repair function of plates so effluent is clear.                                           |
|                                                      | Trash or debris accumulation                   | Trash and debris accumulation in vault (floatables and non-floatables).                                                                                                                         | Trash and debris removed from vault.                                                      |
|                                                      | Oil accumulation                               | Oil accumulation that exceeds 1 inch at the water surface in the in the coalescing plate chamber.                                                                                               | No visible oil depth on water and coalescing plates clear of oil.                         |
| Coalescing Plates                                    | Damaged                                        | Plate media broken, deformed, cracked and/or showing signs of failure.                                                                                                                          | Replace that portion of media pack or entire plate pack depending on severity of failure. |
|                                                      | Sediment accumulation                          | Any sediment accumulation which interferes with the operation of the coalescing plates.                                                                                                         | No sediment accumulation interfering with the coalescing plates.                          |
| Vault Structure                                      | Damage to Wall, Frame, Bottom, and/or Top Slab | Cracks wider than ½-inch and any evidence of soil particles entering the structure through the cracks, or maintenance inspection personnel determines that the vault is not structurally sound. | Vault replaced or repaired to design specifications.                                      |
|                                                      | Baffles damaged                                | Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.                                                                            | Repair or replace baffles to specifications.                                              |
| Ventilation Pipes                                    | Plugged                                        | Any obstruction to the ventilation pipes.                                                                                                                                                       | Ventilation pipes are clear.                                                              |
| Shutoff Valve                                        | Damaged or inoperable                          | Shutoff valve cannot be opened or closed.                                                                                                                                                       | Shutoff valve operates normally.                                                          |
| Inlet/Outlet Pipe                                    | Sediment accumulation                          | Sediment filling 20% or more of the pipe.                                                                                                                                                       | Inlet/outlet pipes clear of sediment.                                                     |
|                                                      | Trash and debris                               | Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).                                                                                                    | No trash or debris in pipes.                                                              |
|                                                      | Damaged                                        | Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.                                                       | No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.                    |
| Access Manhole                                       | Cover/lid not in place                         | Cover/lid is missing or only partially in place.<br><b>Any open manhole requires immediate maintenance.</b>                                                                                     | Manhole access covered.                                                                   |
|                                                      | Locking mechanism not working                  | Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.                                                           | Mechanism opens with proper tools.                                                        |
|                                                      | Cover/lid difficult to remove                  | One maintenance person cannot remove cover/lid after applying 80 lbs of lift.                                                                                                                   | Cover/lid can be removed and reinstalled by one maintenance person.                       |
|                                                      | Ladder rungs unsafe                            | Missing rungs, misalignment, rust, or cracks.                                                                                                                                                   | Ladder meets design standards. Allows maintenance person safe access.                     |

**NO. 23 – COALESCING PLATE OIL/WATER SEPARATOR**

| <b>Maintenance Component</b> | <b>Defect</b>                  | <b>Condition When Maintenance is Needed</b>                                   | <b>Results Expected When Maintenance is Performed</b>       |
|------------------------------|--------------------------------|-------------------------------------------------------------------------------|-------------------------------------------------------------|
| Large access doors/plate     | Damaged or difficult to open   | Large access doors or plates cannot be opened/removed using normal equipment. | Replace or repair access door so it can opened as designed. |
|                              | Gaps, doesn't cover completely | Large access doors not flat and/or access opening not completely covered.     | Doors close flat and cover access opening completely.       |
|                              | Lifting Rings missing, rusted  | Lifting rings not capable of lifting weight of door or plate.                 | Lifting rings sufficient to lift or remove door or plate.   |

**NO. 24 – CATCH BASIN INSERT**

| <b>Maintenance Component</b> | <b>Defect or Problem</b>                 | <b>Conditions When Maintenance is Needed</b>                                                           | <b>Results Expected When Maintenance is Performed</b>                                                                                        |
|------------------------------|------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Media Insert                 | Visible Oil                              | Visible oil sheen passing through media                                                                | Media inset replaced.                                                                                                                        |
|                              | Insert does not fit catch basin properly | Flow gets into catch basin without going through media.                                                | All flow goes through media.                                                                                                                 |
|                              | Filter media plugged                     | Filter media plugged.                                                                                  | Flow through filter media is normal.                                                                                                         |
|                              | Oil absorbent media saturated            | Media oil saturated.                                                                                   | Oil absorbent media replaced.                                                                                                                |
|                              | Water saturated                          | Catch basin insert is saturated with water, which no longer has the capacity to absorb.                | Insert replaced.                                                                                                                             |
|                              | Service life exceeded                    | Regular interval replacement due to typical average life of media insert product, typically one month. | Media replaced at manufacturer's recommended interval.                                                                                       |
|                              | Seasonal maintenance                     | When storms occur and during the wet season.                                                           | Remove, clean and replace or install new insert after major storms, monthly during the wet season or at manufacturer's recommended interval. |

**APPENDIX C**

**SEPA CHECKLIST**

ENVIRONMENTAL CHECKLIST  
for

City of North Bend

**PURPOSE OF CHECKLIST:**

The State Environmental Policy Act (SEPA), Chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making a decision. An environmental impact statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

**INSTRUCTIONS FOR APPLICANTS:**

This environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or give the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer or if a question does not apply to your proposal, write "do not know" or "does not apply". Complete answers to the questions now may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effect. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

**USE OF CHECKLIST FOR NON-PROJECT PROPOSAL:**

Complete this checklist for non-project proposals, even though questions may be answered "does not apply". In addition, complete the SUPPLEMENTAL SHEET FOR NON-PROJECT ACTIONS (Part D).

For non-project actions, the references in the checklist to the words "project", "applicant", and "property or site" should be read as "proposal", "proposer", and "affected geographic area", respectively.



A. **BACKGROUND**

1. Name of proposed project, if applicable:  
**Stormwater Comprehensive Plan Update**
2. Name of applicant:  
**City of North Bend**
3. Address and phone number of applicant and contact person:  
**City of North Bend  
1155 E. North Bend Way  
North Bend, WA 98045  
(425) 888-7652**  
**Contact person: Frank Page**
4. Date checklist prepared:  
**November 18, 2013**
5. Agency requesting checklist:  
**City of North Bend**
6. Proposed timing or schedule (including phasing), if applicable:  
**The Stormwater Management Plan will be completed in fall/winter of 2013.**
7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.  
**Individual stormwater projects are to be completed per the management plan in the future. Additional environmental documents will be completed as required.**
8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this project.  
**None known.**
9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposals? If yes, explain.  
**None known.**

10. List any government approvals or permits that will be needed for your proposal, if known.

**Adoption of the Stormwater Comprehensive Plan Update by the City of North Bend City Council.**

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)

**The Stormwater Comprehensive Plan Update is being completed for the purpose of maintaining and improving the management of the City's stormwater system.**

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If proposal would occur over a range of area, provide the range of boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

N/A

**B. ENVIRONMENTAL ELEMENTS**

**1. EARTH**

- a. General description of the site (circle one) Flat, rolling, hilly, steep slopes, mountainous, other\_\_\_\_\_.

- b. What is the steepest slope on the site (approximate percent slope)?

N/A

- c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.

N/A

- d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

N/A

**Checklist information**

- e. Describe the purpose, type, and approximate quantities of filling or grading proposed. Indicate source of fill.  
  
N/A
  - f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.  
  
N/A
  - g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?  
  
N/A
  - h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:  
  
N/A
2. AIR
- a. What types of emissions to the air would result from the proposal (i.e. dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.  
  
N/A
  - b. Are there any off-site sources of emissions of odor that may affect your proposal? If so, generally describe.  
  
N/A
  - c. Proposed measures to reduce or control emissions or other impacts to air, if any:  
  
N/A
3. WATER
- a. Surface:  
  
1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.  
  
**Middle Fork Snoqualmie River, South Fork Snoqualmie River, Gardiner Creek, Ribary Creek, and Silver Creek.**

**Checklist information**

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

**N/A**

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the areas of the site that would be affected. Indicate the source of fill materials.

**N/A**

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

**N/A**

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

**Portions of the City are within designated FEMA floodplains.**

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

**N/A**

**b. Ground:**

1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities if known.

**N/A**

2) Describe material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial containing the following chemicals...; agricultural; etc.). Describe the general size of the system, the number of animals or humans the system(s) are expected to serve.

**N/A**

**Checklist information**

c. Water Runoff (including storm water):

1) Describe the source of runoff (including storm water) and method of collection and disposal. If any (including quantities, if known). Where will this water flow? Will water flow into other waters? If so, describe.

N/A

2) Could waste materials enter the ground or surface waters? If so, generally describe.

N/A

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

N/A

4. PLANTS

a. Check and circle types of vegetation found on the site:

- ☐ deciduous tree: alder, maple, aspen, other: fruit trees
- ☐ evergreen tree: fir, cedar, pine, other
- ☐ shrubs
- ☐ grass
- ☐ pasture crop or grain
- ☐ wet soils: cattail, buttercup, bullrush, skunk cabbage, other
- ☐ water plants: water lily, eelgrass, milfoil, other
- ☐ other types of vegetation:

b. What kind and amount of vegetation will be removed or altered?

N/A

c. List threatened or endangered species known to be on or near the site.

N/A

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

N/A

5. ANIMALS

a. Circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

birds: hawk, heron, eagle, songbirds, other :blackbirds & quail  
mammals: deer, bear, elk, beaver, other: coyotes

**Checklist information**

fish: bass, salmon, trout, herring, shellfish, other:

- b. List any threatened or endangered species known to be on or near the site.

N/A

- c. Is the site part of a migration route? If so, explain.

N/A

- d. Proposed measures to preserve or enhance wildlife, if any:

N/A

**6. ENERGY AND NATURAL RESOURCES**

- a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

N/A

- b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

N/A

- c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

N/A

**7. ENVIRONMENTAL HEALTH**

- a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

N/A

1) Describe special emergency services that might be required.

N/A

2) Proposed measures to reduce or control environmental health hazards, if any:

N/A

- b. Noise

**Checklist information**

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

**N/A**

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

**N/A**

3) Proposed measures to reduce or control noise impacts, if any:

**N/A**

**8. LAND AND SHORE LAND USE**

a. What is the current use of the site and adjacent properties?

**N/A**

b. Has the site been used for agriculture? If so, describe.

**N/A**

c. Describe any structures on the site.

**N/A**

d. Will any structures be demolished? If so, what?

**N/A**

e. What is the current zoning classification of the site?

**N/A**

f. What is the current comprehensive plan designation of the site?

**N/A**

g. If applicable, what is the current shoreline master program designation of the site?

**N/A**

h. Has any part of the site been classified as an "environmentally sensitive" area? If so specify.

**N/A**

**Checklist information**

- I. Approximately how many people would reside or work in the completed project?

**N/A**

- j. Approximately how many people would the completed project displace?

**N/A**

- k. Proposed measures to avoid or reduce displacement impacts, if any:

**N/A**

- l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

**N/A**

**9. HOUSING**

- a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

**N/A**

- b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, low-income housing.

**N/A**

- c. Proposed measures to reduce or control housing impacts, if any:

**N/A**

**10. AESTHETICS**

- a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

**N/A**

- b. What views in the immediate vicinity would be altered or obstructed?

**N/A**

- c. Proposed measures to reduce or control aesthetic impacts, if any:

**N/A**



11. LIGHT AND GLARE

- a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

N/A

- b. Could light or glare from the finished project be a safety hazard or interfere with views?

N/A

- c. What existing off-site sources of light or glare may affect your proposal?

N/A

- d. Proposed measures to reduce or control light and glare impacts, if any:

N/A

12. RECREATION

- a. What designated and informal recreational opportunities are in the immediate vicinity?

N/A

- b. Would the proposed project displace any existing recreational uses? If so, describe.

N/A

- c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

N/A

13. HISTORIC AND CULTURAL PRESERVATION

- a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.

N/A

**Checklist information**

- b. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural important known to be on or next to the site.

N/A

- c. Proposed measures to reduce or control impacts, if any:

N/A

14. **TRANSPORTATION**

- a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.

N/A

- b. Is site currently serviced by public transit? If not, what is the approximate distance to the nearest transit stop?

N/A

- c. How many parking spaces would the completed project have? How many would the project eliminate?

N/A

- d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).

N/A

- e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation.

N/A

- f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.

N/A

- g. Proposed measures to reduce or control transportation impacts, if any:

N/A

## 15. PUBLIC SERVICES

- a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe:

N/A

- b. Proposed measures to reduce or control direct impacts on public services, if any:

N/A

## 16. UTILITIES

- a. Circle utilities currently available at the site: electricity, water, refuse service, telephone, septic system, sanitary sewer, other.
- b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activity on the site or in the immediate vicinity which might be needed.

N/A

## C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature



Date Submitted

11-18-2013

## Checklist information

For Agency  
use only

TO BE COMPLETED BY APPLICANT

EVALUATION FOR  
AGENCY USE ONLY

### D. SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS

(do not use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. *How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?*

**The intent of the proposal is to provide a plan to reduce flooding and improve water quality within the City. In accomplishing this, some changes in stormwater release rates are likely as flooded areas are drained more efficiently. However, the plan will not produce a significant increase in flow or any type of pollution. It offers recommendations on reducing the amount of pollution entering local waters.**

*Proposed measures to avoid or reduce such increases are:*

**Adherence to City codes and the requirements of the King County Design Manual.**

2. *How would the proposal be likely to affect plants, animals, fish, or marine life?*

**The plan will not directly affect plants, animals, fish, or marine life. Through implementation of best management practices, and the requirements identified in the King County Surface Water Design Manual, the plan will likely have a positive impact of plants and wildlife**

*Proposed measures to protect or conserve plants, animals, fish, or marine life are:*

**Adherence to City codes and the requirements of the King County Design Manual.**

3. *How would the proposal be likely to deplete energy or natural resources?*

**The proposal will not deplete energy or natural resources.**

*Proposed measures to protect or conserve energy and natural resources are:*

**N/A**

4. *How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?*

**The proposal will not directly affect environmentally sensitive areas. Through the course of future project implementation, it is expected that environmentally sensitive areas will benefit.**

*Proposed measures to protect such resources or to avoid or reduce impacts are:*

**Adherence to City codes and the requirements of the King County Design Manual.**

5. *How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?*

**The proposal will not affect land use.**

*Proposed measures to avoid or reduce shoreline and land use impacts are:*

N/A

6. *How would the proposal be likely to increase demands on transportation or public services and utilities?*

**The plan will recommend enhanced and increased maintenance activities for the City's stormwater utility.**

*Proposed measures to reduce or respond to such demand(s) are:*

N/A

7. *Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.*

**The plan will not conflict with any laws regarding protection of the environment.**

**APPENDIX D**

**CIP COST ESTIMATE**

| CITY OF NORTH BEND<br>20 YEAR STORMWATER CAPITAL IMPROVEMENT PLAN                                          |   |                                   |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               |               |               |
|------------------------------------------------------------------------------------------------------------|---|-----------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Year                                                                                                       |   |                                   | 2013      | 2014      | 2015      | 2016      | 2017      | 2018      | 2019      | 2020       | 2021          | 2022          | 2023          | 2024          | 2025          | 2026          | 2027          | 2028          | 2029          | 2030          | 2031          | 2032          | 2033          |
| Beginning Fund Balance                                                                                     |   | Growth Factor                     | \$309,345 | \$374,421 | \$337,613 | \$222,723 | \$392,845 | \$559,676 | \$381,180 | \$327,120  | \$116,964     | (\$1,230,240) | (\$1,371,882) | (\$2,517,700) | (\$2,387,560) | (\$2,428,918) | (\$2,479,110) | (\$2,458,628) | (\$2,425,322) | (\$2,436,185) | (\$2,350,008) | (\$2,419,831) | (\$2,344,375) |
| ESUs                                                                                                       |   | 0.5%                              | 5,591     | 5,619     | 5,647     | 5,675     | 5,704     | 5,732     | 5,761     | 5,790      | 5,819         | 5,848         | 5,877         | 5,906         | 5,936         | 5,966         | 5,995         | 6,025         | 6,055         | 6,086         | 6,116         | 6,147         | 6,177         |
| Annual ESU Increase                                                                                        |   |                                   | 0         | 28        | 28        | 28        | 28        | 29        | 29        | 29         | 29            | 29            | 29            | 29            | 30            | 30            | 30            | 30            | 30            | 30            | 30            | 31            | 31            |
| Monthly Storm Service Rate                                                                                 |   | 0%                                | \$9.86    | \$9.86    | \$9.86    | \$9.86    | \$9.86    | \$9.86    | \$9.86    | \$9.86     | \$9.86        | \$9.86        | \$9.86        | \$9.86        | \$9.86        | \$9.86        | \$9.86        | \$9.86        | \$9.86        | \$9.86        | \$9.86        | \$9.86        | \$9.86        |
| Annual Rate Revenue                                                                                        |   |                                   | \$661,527 | \$664,835 | \$668,159 | \$671,500 | \$674,857 | \$678,232 | \$681,623 | \$685,031  | \$688,456     | \$691,898     | \$695,358     | \$698,834     | \$702,329     | \$705,840     | \$709,370     | \$712,916     | \$716,481     | \$720,063     | \$723,664     | \$727,282     | \$730,918     |
|                                                                                                            |   |                                   |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               |               |               |
| Seattle ENR Construction Cost Index (2001=7335)                                                            |   | 2%                                | 9418      | 9606      | 9798      | 9994      | 10194     | 10398     | 10606     | 10818      | 11035         | 11255         | 11480         | 11710         | 11944         | 12183         | 12427         | 12675         | 12929         | 13187         | 13451         | 13720         | 13995         |
| Capital Facilities Charge/ESU                                                                              |   |                                   | \$872.22  | \$889.67  | \$907.46  | \$925.61  | \$944.12  | \$963.00  | \$982.26  | \$1,001.91 | \$1,021.95    | \$1,042.38    | \$1,063.23    | \$1,084.50    | \$1,106.19    | \$1,128.31    | \$1,150.88    | \$1,173.89    | \$1,197.37    | \$1,221.32    | \$1,245.75    | \$1,270.66    | \$1,296.07    |
| Annual CFC Revenue                                                                                         |   |                                   | \$0.00    | \$24,871  | \$25,495  | \$26,135  | \$26,791  | \$27,463  | \$28,153  | \$28,859   | \$29,584      | \$30,326      | \$31,087      | \$31,868      | \$32,667      | \$33,487      | \$34,328      | \$35,190      | \$36,073      | \$36,978      | \$37,906      | \$38,858      | \$39,833      |
|                                                                                                            |   |                                   |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               |               |               |
| Yearly O&M                                                                                                 |   | 2%                                | \$344,107 | \$350,989 | \$358,009 | \$365,169 | \$372,472 | \$379,922 | \$387,520 | \$395,271  | \$403,176     | \$411,240     | \$419,465     | \$427,854     | \$436,411     | \$445,139     | \$454,042     | \$463,123     | \$472,385     | \$481,833     | \$491,470     | \$501,299     | \$511,325     |
| Public Works Shop Debt                                                                                     |   |                                   | \$44,344  | \$44,344  | \$44,344  | \$44,344  | \$44,344  | \$44,344  | \$44,344  | \$44,344   | \$44,344      | \$0           | \$0           | \$0           | \$0           | \$0           | \$0           | \$0           | \$0           | \$0           | \$0           | \$0           | \$0           |
| Priority 1 Storm Projects Loan                                                                             |   |                                   | \$118,000 | \$118,000 | \$118,000 | \$118,000 | \$118,000 | \$118,000 | \$118,000 | \$118,000  | \$118,000     | \$118,000     | \$118,000     | \$118,000     | \$118,000     | \$118,000     | \$0           | \$0           | \$0           | \$0           | \$0           | \$0           | \$0           |
| Capital Reserve                                                                                            |   |                                   | \$464,421 | \$550,793 | \$510,914 | \$392,845 | \$559,676 | \$723,105 | \$541,091 | \$483,395  | \$269,484     | (\$1,037,256) | (\$1,182,901) | (\$2,332,852) | (\$2,206,975) | (\$2,252,729) | (\$2,189,455) | (\$2,173,645) | (\$2,145,154) | (\$2,160,976) | (\$2,079,908) | (\$2,154,990) | (\$2,084,948) |
| <i>CIP Projects</i>                                                                                        |   |                                   |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               |               |               |
| Cost Increase Factor @                                                                                     |   | 2%<br>Priority Present Value 2013 | 1.000     | 1.020     | 1.040     | 1.061     | 1.082     | 1.104     | 1.126     | 1.149      | 1.172         | 1.195         | 1.219         | 1.243         | 1.268         | 1.294         | 1.319         | 1.346         | 1.373         | 1.400         | 1.428         | 1.457         | 1.486         |
| CIP 3.3                                                                                                    | 2 | \$ 90,000                         | \$90,000  |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               |               |               |
| CIP 12.1                                                                                                   | 2 | \$ 209,000                        |           | \$213,180 |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               |               |               |
| CIP 5.1                                                                                                    | 2 | \$ 130,000                        |           |           | \$135,252 |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               |               |               |
| CIP 4.2                                                                                                    | 2 | \$ 147,000                        |           |           | \$152,939 |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               |               |               |
| CIP 1.5                                                                                                    | 1 | \$ 309,692                        |           |           |           |           |           | \$341,925 |           |            |               |               |               |               |               |               |               |               |               |               |               |               |               |
| CIP 7.1                                                                                                    | 3 | \$ 190,000                        |           |           |           |           |           |           | \$213,971 |            |               |               |               |               |               |               |               |               |               |               |               |               |               |
|                                                                                                            |   |                                   |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               |               |               |
| CIP 1.3                                                                                                    | 1 | \$ 1,280,000                      |           |           |           |           |           |           |           |            | \$1,499,724   |               |               |               |               |               |               |               |               |               |               |               |               |
| CIP 6.1                                                                                                    | 1 | \$ 187,000                        |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               | \$251,677     |               |               |               |               |               |
| CIP 6.2                                                                                                    | 1 | \$ 204,000                        |           |           |           |           |           |           |           |            |               |               |               |               |               |               | \$269,174     |               |               |               |               |               |               |
| CIP 6.3                                                                                                    | 1 | \$ 175,000                        |           |           |           |           |           |           |           |            |               |               |               |               |               | \$226,381     |               |               |               |               |               |               |               |
| CIP 6.4                                                                                                    | 1 | \$ 175,000                        |           |           |           |           |           |           |           |            |               |               |               |               | \$221,942     |               |               |               |               |               |               |               |               |
| CIP 6.6                                                                                                    | 1 | \$ 178,000                        |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               |               | \$264,499     |
| CIP 6.7                                                                                                    | 1 | \$ 130,000                        |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               | \$189,385     |               |
| CIP 6.8                                                                                                    | 1 | \$ 238,000                        |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               | \$339,923     |               |               |
| CIP 6.9                                                                                                    | 1 | \$ 135,000                        |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               | \$189,033     |               |               |               |
| CIP 1.1                                                                                                    | 2 | \$ 1,095,000                      |           |           |           |           |           |           |           |            |               |               | \$1,334,799   |               |               |               |               |               |               |               |               |               |               |
| CIP 1.2                                                                                                    | 2 | \$ 280,000                        |           |           |           |           |           |           |           |            |               | \$334,626     |               |               |               |               |               |               |               |               |               |               |               |
| CIP 3.1                                                                                                    | 2 | \$ 319,000                        |           |           |           |           |           |           |           | \$366,431  |               |               |               |               |               |               |               |               |               |               |               |               |               |
| CIP 5.2                                                                                                    | 2 | \$ 150,000                        |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               |               | \$222,892     |
| CIP 6.10                                                                                                   | 1 | \$ 212,000                        |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               | \$291,031     |               |               |               |               |
| CIP 8.1                                                                                                    | 2 | \$ 44,000                         |           |           |           |           |           |           |           |            |               |               |               | \$54,708      |               |               |               |               |               |               |               |               |               |
| CIP 12.4                                                                                                   | 3 | \$ 225,000                        |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               |               | \$334,338     |
| CIP 12.5                                                                                                   | 3 | \$ 298,000                        |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               |               | \$442,812     |
| CIP 2.1                                                                                                    | 3 | \$ 2,133,000                      |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               |               | \$3,169,526   |
| CIP 2.4                                                                                                    | 3 | \$ 890,000                        |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               |               | \$1,322,493   |
| CIP Total                                                                                                  |   | \$ 9,423,692                      | \$90,000  | \$213,180 | \$288,191 | \$0       | \$0       | \$341,925 | \$213,971 | \$366,431  | \$1,499,724   | \$334,626     | \$1,334,799   | \$54,708      | \$221,942     | \$226,381     | \$269,174     | \$251,677     | \$291,031     | \$189,033     | \$339,923     | \$189,385     | \$5,756,560   |
| Year End Total                                                                                             |   |                                   | \$374,421 | \$337,613 | \$222,723 | \$392,845 | \$559,676 | \$381,180 | \$327,120 | \$116,964  | (\$1,230,240) | (\$1,371,882) | (\$2,517,700) | (\$2,387,560) | (\$2,428,918) | (\$2,479,110) | (\$2,458,628) | (\$2,425,322) | (\$2,436,185) | (\$2,350,008) | (\$2,419,831) | (\$2,344,375) | (\$7,841,509) |
|                                                                                                            |   |                                   |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               |               |               |
| 2013 Equipment Purchases for sweeper and mower are already reflected in the cash balances provided by City |   |                                   |           |           |           |           |           |           |           |            |               |               |               |               |               |               |               |               |               |               |               |               |               |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**

**CIP 1.1 - North Side of North Bend Way to Intersection of Ballarat Ave N and E 2nd St**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> | <u>Total</u>        |
|-----------------------------------------------------|-----------------|----|------------------|---------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$ 57,000        | \$ 57,000           |
| 2 Minor Changes                                     | 1               | LS | \$ 10,000        | \$ 10,000           |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$ 11,000        | \$ 11,000           |
| 4 Traffic Control                                   | 1               | LS | \$ 11,000        | \$ 11,000           |
| 5 Environmental Controls                            | 1               | LS | \$ 11,000        | \$ 11,000           |
| 6 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$ 1,000         | \$ 1,000            |
| 7 Trench Excavation Safety Systems                  | 1               | LS | \$ 5,000         | \$ 5,000            |
| 8 Dewatering                                        | 1               | LS | \$ 5,000         | \$ 5,000            |
| 9 Temporary Bypass Pumping                          | 1               | LS | \$ 22,000        | \$ 22,000           |
| 10 Locate Existing Utilities                        | 1               | LS | \$ 5,000         | \$ 5,000            |
| 11 Removal of Structures and Obstructions           | 1               | LS | \$ 44,000        | \$ 44,000           |
| 12 Connection to Existing System                    | 2               | EA | \$ 2,500         | \$ 5,000            |
| 13 54" Precast Type 2 Catch Basin (Basic to 8')     | 11              | EA | \$ 3,000         | \$ 33,000           |
| 14 30" CPEP (Including bedding, backfill)           | 2,175           | LF | \$ 100           | \$ 217,500          |
| 15 Bankrun Gravel                                   | 830             | TN | \$ 25            | \$ 20,750           |
| 16 Special Excavation of Unsuitable Material        | 70              | CY | \$ 30            | \$ 2,100            |
| 17 Remove/Replace Concrete Sidewalk                 | 1,329           | SY | \$ 40            | \$ 53,160           |
| 18 Sawcutting                                       | 4,350           | LF | \$ 3             | \$ 13,050           |
| 19 Restore Pavement Markings                        | 2,175           | LF | \$ 0.50          | \$ 1,088            |
| 20 Foundation Gravel                                | 10              | TN | \$ 20            | \$ 200              |
| 21 Gravel Base                                      | 719             | TN | \$ 25            | \$ 17,975           |
| 22 Asphalt Treated Base                             | 445             | TN | \$ 100           | \$ 44,500           |
| 23 Asphalt Concrete Pavement                        | 297             | TN | \$ 100           | \$ 29,700           |
| Subtotal                                            |                 |    |                  | \$ 620,023          |
| Contingency (30%)                                   |                 |    |                  | \$ 186,007          |
| Subtotal                                            |                 |    |                  | \$ 806,030          |
| Sales Tax (8.6%)                                    |                 |    |                  | \$ 69,319           |
| Total                                               |                 |    |                  | \$ 875,349          |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  | <b>\$ 876,000</b>   |
| All Overhead (25%)                                  |                 |    |                  | \$ 219,000          |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  | <b>\$ 1,095,000</b> |



**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 1.2 - Janet Ave Culvert to E 2nd St to Ballarat Ave**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> |        | <u>Total</u>      |
|-----------------------------------------------------|-----------------|----|------------------|--------|-------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$               | 14,000 | \$ 14,000         |
| 2 Minor Changes                                     | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$               | 3,000  | \$ 3,000          |
| 4 Traffic Control                                   | 1               | LS | \$               | 3,000  | \$ 3,000          |
| 5 Environmental Controls                            | 1               | LS | \$               | 3,000  | \$ 3,000          |
| 6 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 7 Trench Excavation Safety Systems                  | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 8 Dewatering                                        | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 9 Temporary Bypass Pumping                          | 1               | LS | \$               | 5,000  | \$ 5,000          |
| 10 Locate Existing Utilities                        | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 11 Removal of Structures and Obstructions           | 1               | LS | \$               | 5,000  | \$ 5,000          |
| 12 Sawcutting                                       | 1,000           | LF | \$               | 3      | \$ 3,000          |
| 13 Restore Pavement Markings                        | 500             | LF | \$               | 0.50   | \$ 250            |
| 14 Connection to Existing System                    | 2               | EA | \$               | 2,500  | \$ 5,000          |
| 15 54" Precast Type 2 Catch Basin (Basic to 8')     | 3               | EA | \$               | 3,000  | \$ 9,000          |
| 16 30" CPEP (Including bedding, backfill)           | 500             | LF | \$               | 100    | \$ 50,000         |
| 17 Bankrun Gravel                                   | 190             | TN | \$               | 25     | \$ 4,750          |
| 18 Special Excavation of Unsuitable Material        | 20              | CY | \$               | 30     | \$ 600            |
| 19 Remove/Replace Concrete Sidewalk                 | 306             | SY | \$               | 40     | \$ 12,222         |
| 20 Foundation Gravel                                | 3               | TN | \$               | 20     | \$ 60             |
| 21 Gravel Base                                      | 166             | TN | \$               | 25     | \$ 4,150          |
| 22 Asphalt Treated Base                             | 103             | TN | \$               | 100    | \$ 10,300         |
| 23 Asphalt Concrete Pavement                        | 69              | TN | \$               | 100    | \$ 6,900          |
| Subtotal                                            |                 |    |                  |        | \$ 153,232        |
| Contingency (30%)                                   |                 |    |                  |        | \$ 45,970         |
| Subtotal                                            |                 |    |                  |        | \$ 199,202        |
| Sales Tax (8.6%)                                    |                 |    |                  |        | \$ 17,131         |
| Total                                               |                 |    |                  |        | \$ 216,333        |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  |        | <b>\$ 220,000</b> |
| All Overhead (25%)                                  |                 |    |                  |        | \$ 60,000         |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  |        | <b>\$ 280,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 1.3 - E 2nd St from Ballarat Ave N to Bendigo**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> |        | <u>Total</u>        |
|-----------------------------------------------------|-----------------|----|------------------|--------|---------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$               | 70,000 | \$ 70,000           |
| 2 Minor Changes                                     | 1               | LS | \$               | 10,000 | \$ 10,000           |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$               | 4,200  | \$ 4,200            |
| 4 Traffic Control                                   | 1               | LS | \$               | 9,000  | \$ 9,000            |
| 5 Environmental Controls                            | 1               | LS | \$               | 5,000  | \$ 5,000            |
| 6 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$               | 1,000  | \$ 1,000            |
| 7 Trench Excavation Safety Systems                  | 1               | LS | \$               | 2,000  | \$ 2,000            |
| 8 Dewatering                                        | 1               | LS | \$               | 2,000  | \$ 2,000            |
| 9 Temporary Bypass Pumping                          | 1               | LS | \$               | 9,000  | \$ 9,000            |
| 10 Locate Existing Utilities                        | 1               | LS | \$               | 2,000  | \$ 2,000            |
| 11 Removal of Structures and Obstructions           | 1               | LS | \$               | 9,000  | \$ 9,000            |
| 12 Box Culvert (4'x3.5')                            | 825             | LF | \$               | 500    | \$ 412,500          |
| Excavation, Haul, Backfill, Compaction, Grading     | 2,371           | CY | \$               | 50     | \$ 118,553          |
| 13 for Box Culvert                                  |                 |    |                  |        |                     |
| 14 48" Precast Type 2 Catch Basin (Basic to 8')     | 5               | EA | \$               | 2,500  | \$ 12,500           |
| 15 Connection to Existing System                    | 2               | EA | \$               | 2,500  | \$ 5,000            |
| 16 Special Excavation of Unsuitable Material        | 30              | CY | \$               | 30     | \$ 900              |
| 17 Sawcutting                                       | 1,650           | LF | \$               | 3      | \$ 4,950            |
| 18 Restore Pavement Markings                        | 825             | LF | \$               | 0.50   | \$ 413              |
| 19 Remove/Replace Concrete Sidewalk                 | 46              | SY | \$               | 40     | \$ 1,833            |
| 20 Foundation Gravel                                | 491             | TN | \$               | 20     | \$ 9,820            |
| 21 Gravel Base                                      | 273             | TN | \$               | 25     | \$ 6,825            |
| 22 Asphalt Treated Base                             | 169             | TN | \$               | 100    | \$ 16,900           |
| 23 Asphalt Concrete Pavement                        | 113             | TN | \$               | 100    | \$ 11,300           |
| Subtotal                                            |                 |    |                  |        | \$ 724,694          |
| Contingency (30%)                                   |                 |    |                  |        | <u>\$ 217,408</u>   |
| Subtotal                                            |                 |    |                  |        | \$ 942,102          |
| Sales Tax (8.6%)                                    |                 |    |                  |        | <u>\$ 81,021</u>    |
| Total                                               |                 |    |                  |        | \$ 1,023,123        |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  |        | <b>\$ 1,024,000</b> |
| All Overhead (25%)                                  |                 |    |                  |        | <u>\$ 256,000</u>   |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  |        | <b>\$ 1,280,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 2.1 - Storm Drain Along BNRR From SE Orchard Dr to Outfall**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> | <u>Total</u>        |
|-----------------------------------------------------|-----------------|----|------------------|---------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$ 110,000       | \$ 110,000          |
| 2 Minor Changes                                     | 1               | LS | \$ 10,000        | \$ 10,000           |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$ 16,000        | \$ 16,000           |
| 4 Traffic Control                                   | 1               | LS | \$ 31,000        | \$ 31,000           |
| 5 Environmental Controls                            | 1               | LS | \$ 16,000        | \$ 16,000           |
| 6 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$ 1,000         | \$ 1,000            |
| 7 Trench Excavation Safety Systems                  | 1               | LS | \$ 7,000         | \$ 7,000            |
| 8 Dewatering                                        | 1               | LS | \$ 7,000         | \$ 7,000            |
| 9 Temporary Bypass Pumping                          | 1               | LS | \$ 31,000        | \$ 31,000           |
| 10 Locate Existing Utilities                        | 1               | LS | \$ 7,000         | \$ 7,000            |
| 11 Removal of Structures and Obstructions           | 1               | LS | \$ 31,000        | \$ 31,000           |
| 12 54" CPEP (Including bedding, backfill)           | 1,400           | LF | \$ 220           | \$ 308,000          |
| 13 48" CPEP (Including bedding, backfill)           | 1,150           | LF | \$ 200           | \$ 230,000          |
| 14 30" CPEP (Including bedding, backfill)           | 520             | LF | \$ 100           | \$ 52,000           |
| 15 48" Diameter Flap Gate                           | 1               | EA | \$ 9,000         | \$ 9,000            |
| 16 Quarry Spalls                                    | 10              | TN | \$ 30            | \$ 300              |
| 17 54" Precast Type 2 Catch Basin (Basic to 8')     | 3               | EA | \$ 3,000         | \$ 9,000            |
| 18 72" Precast Type 2 Catch Basin (Basic to 8')     | 6               | EA | \$ 5,000         | \$ 30,000           |
| 19 84" Precast Type 2 Catch Basin (Basic to 8')     | 7               | EA | \$ 6,000         | \$ 42,000           |
| 20 Bankrun Gravel                                   | 1,170           | TN | \$ 25            | \$ 29,250           |
| 21 Connection to Existing System                    | 1               | EA | \$ 2,500         | \$ 2,500            |
| 22 Sawcutting                                       | 6,140           | LF | \$ 3             | \$ 18,420           |
| 23 Restore Pavement Markings                        | 3,070           | LF | \$ 0.50          | \$ 1,535            |
| 24 Remove/Replace Concrete Sidewalk                 | 1,876           | SY | \$ 40            | \$ 75,044           |
| 25 Special Excavation of Unsuitable Material        | 100             | CY | \$ 30            | \$ 3,000            |
| 26 Foundation Gravel                                | 19              | TN | \$ 20            | \$ 380              |
| 27 Gravel Base                                      | 1,020           | TN | \$ 25            | \$ 25,500           |
| 28 Asphalt Treated Base                             | 630             | TN | \$ 100           | \$ 63,000           |
| 29 Asphalt Concrete Pavement                        | 420             | TN | \$ 100           | \$ 42,000           |
| Subtotal                                            |                 |    |                  | \$ 1,207,929        |
| Contingency (30%)                                   |                 |    |                  | \$ 362,379          |
| Subtotal                                            |                 |    |                  | \$ 1,570,308        |
| Sales Tax (8.6%)                                    |                 |    |                  | \$ 135,047          |
| Total                                               |                 |    |                  | \$ 1,705,355        |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  | <b>\$ 1,706,000</b> |
| All Overhead (25%)                                  |                 |    |                  | \$ 427,000          |

**Total Project Cost (Rounded) \$ 2,133,000**

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 2.4 - East Bank of South Fork from Pond 2 to Pond 1**

| <u>Item</u>                                                           | <u>Quantity</u> |    | <u>Unit Cost</u> | <u>Total</u>      |
|-----------------------------------------------------------------------|-----------------|----|------------------|-------------------|
| 1 Mobilization/Demobilization                                         | 1               | LS | \$ 36,000        | \$ 36,000         |
| 2 Minor Changes                                                       | 1               | LS | \$ 10,000        | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                                  | 1               | LS | \$ 1,000         | \$ 1,000          |
| 4 Traffic Control                                                     | 1               | LS | \$ 1,000         | \$ 1,000          |
| 5 Environmental Controls                                              | 1               | LS | \$ 1,000         | \$ 1,000          |
| 6 Spill Prevention Control and Countermeasures Plan                   | 1               | LS | \$ 1,000         | \$ 1,000          |
| 7 Trench Excavation Safety Systems                                    | 1               | LS | \$ 1,000         | \$ 1,000          |
| 8 Dewatering                                                          | 1               | LS | \$ 1,000         | \$ 1,000          |
| 9 Temporary Bypass Pumping                                            | 1               | LS | \$ 1,000         | \$ 1,000          |
| 10 Locate Existing Utilities                                          | 1               | LS | \$ 1,000         | \$ 1,000          |
| 11 Removal of Structures and Obstructions                             | 1               | LS | \$ 1,000         | \$ 1,000          |
| 12 48" CPEP (Including bedding, backfill)                             | 50              | LF | \$ 200           | \$ 10,000         |
| 13 Box Culvert (8'x4')                                                | 180             | LF | \$ 635           | \$ 114,300        |
| 14 Excavation, Haul, Backfill, Compaction, Grading<br>for Box Culvert | 1,115           | CY | \$ 50            | \$ 55,738         |
| 15 48" diameter Flap Gate                                             | 1               | EA | \$ 9,000         | \$ 9,000          |
| 16 Bankrun Gravel                                                     | 80              | TN | \$ 25            | \$ 2,000          |
| 17 Special Excavation of Unsuitable Material                          | 10              | CY | \$ 30            | \$ 300            |
| 18 Channel Excavation, Grade, Stabilize                               | 1,600           | LF | \$ 80            | \$ 128,000        |
| 19 Landscaping Restoration                                            | 1               | LS | \$ 10,000        | \$ 10,000         |
| 20 Remove/Replace Concrete Sidewalk                                   | 31              | SY | \$ 40            | \$ 1,222          |
| 21 Gravel Base                                                        | 20              | TN | \$ 25            | \$ 500            |
| 22 Asphalt Treated Base                                               | 20              | TN | \$ 100           | \$ 2,000          |
| 23 Asphalt Concrete Pavement                                          | 10              | TN | \$ 100           | \$ 1,000          |
| Subtotal                                                              |                 |    |                  | \$ 389,060        |
| Contingency (30%)                                                     |                 |    |                  | <u>\$ 116,718</u> |
| Subtotal                                                              |                 |    |                  | \$ 505,778        |
| Land/ROW Acquisition                                                  |                 |    |                  | \$ 140,000        |
| Sales Tax (8.6%)                                                      |                 |    |                  | <u>\$ 55,537</u>  |
| Total                                                                 |                 |    |                  | \$ 701,315        |
| <b>Total Construction Cost (Rounded)</b>                              |                 |    |                  | <b>\$ 710,000</b> |
| All Overhead (25%)                                                    |                 |    |                  | <u>\$ 180,000</u> |
| <b>Total Project Cost (Rounded)</b>                                   |                 |    |                  | <b>\$ 890,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 3.1 - Southwest of Cedar Ave S and E Park St Along Main Ave S**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> | <u>Total</u>      |
|-----------------------------------------------------|-----------------|----|------------------|-------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$ 17,000        | \$ 17,000         |
| 2 Minor Changes                                     | 1               | LS | \$ 10,000        | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$ 4,000         | \$ 4,000          |
| 4 Traffic Control                                   | 1               | LS | \$ 8,000         | \$ 8,000          |
| 5 Environmental Controls                            | 1               | LS | \$ 4,000         | \$ 4,000          |
| 6 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$ 1,000         | \$ 1,000          |
| 7 Trench Excavation Safety Systems                  | 1               | LS | \$ 2,000         | \$ 2,000          |
| 8 Dewatering                                        | 1               | LS | \$ 2,000         | \$ 2,000          |
| 9 Temporary Bypass Pumping                          | 1               | LS | \$ 4,000         | \$ 4,000          |
| 10 Locate Existing Utilities                        | 1               | LS | \$ 2,000         | \$ 2,000          |
| 11 Removal of Structures and Obstructions           | 1               | LS | \$ 8,000         | \$ 8,000          |
| 12 24" CPEP (Including bedding, backfill)           | 750             | LF | \$ 80            | \$ 60,000         |
| in ROW                                              | 570             | LF |                  |                   |
| Outfall                                             | 180             | LF |                  |                   |
| 13 48" Type 2 Catch Basin (Basic to 8')             | 3               | EA | \$ 2,500         | \$ 7,500          |
| 14 Connection to Existing System                    | 1               | EA | \$ 2,500         | \$ 2,500          |
| 15 Bankrun Gravel                                   | 190             | TN | \$ 25            | \$ 4,750          |
| 16 Special Excavation of Unsuitable Material        | 30              | CY | \$ 30            | \$ 900            |
| 17 Sawcutting                                       | 1,140           | LF | \$ 3             | \$ 3,420          |
| 18 Restore Pavement Markings                        | 570             | LF | \$ 0.50          | \$ 285            |
| 19 Remove/Replace Concrete Sidewalk                 | 348             | SY | \$ 40            | \$ 13,933         |
| 20 Foundation Gravel                                | 3               | TN | \$ 20            | \$ 60             |
| 21 Gravel Base                                      | 190             | TN | \$ 25            | \$ 4,750          |
| 22 Asphalt Treated Base                             | 120             | TN | \$ 100           | \$ 12,000         |
| 23 Asphalt Concrete Pavement                        | 80              | TN | \$ 100           | \$ 8,000          |
| Subtotal                                            |                 |    |                  | \$ 180,098        |
| Contingency (30%)                                   |                 |    |                  | \$ 54,030         |
| Subtotal                                            |                 |    |                  | \$ 234,128        |
| Sales Tax (8.6%)                                    |                 |    |                  | \$ 20,135         |
| Total                                               |                 |    |                  | \$ 254,263        |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  | <b>\$ 255,000</b> |
| All Overhead (25%)                                  |                 |    |                  | \$ 64,000         |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  | <b>\$ 319,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**

**CIP 3.3 - Pump Station with Surface Storage [New - purchase portable pump]**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> | <u>Total</u>      |
|-----------------------------------------------------|-----------------|----|------------------|-------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$ 20,000        | \$ 20,000         |
| 2 Minor Changes                                     | 1               | LS | \$ 10,000        | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$ 1,000         | \$ 1,000          |
| 4 Traffic Control                                   | 1               | LS | \$ 2,000         | \$ 2,000          |
| 5 Environmental Controls                            | 1               | LS | \$ 2,000         | \$ 2,000          |
| 6 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$ 1,000         | \$ 1,000          |
| 7 Trench Excavation Safety Systems                  | 1               | LS | \$ 1,000         | \$ 1,000          |
| 8 Dewatering                                        | 1               | LS | \$ 1,000         | \$ 1,000          |
| 9 Temporary Bypass Pumping                          | 1               | LS | \$ 1,000         | \$ 1,000          |
| 10 Locate Existing Utilities                        | 1               | LS | \$ 1,000         | \$ 1,000          |
| 11 Clearing and Grubbing                            | 1               | LS | \$ 1,000         | \$ 1,000          |
| 12 Removal of Structures and Obstructions           | 1               | LS | \$ 2,000         | \$ 2,000          |
| 13 24" CPEP (Including bedding, backfill)           | 180             | LF | \$ 80            | \$ 14,400         |
| 14 84" Precast Type 2 Catch Basin (Basic to 8')     | 1               | EA | \$ 6,000         | \$ 6,000          |
| 15 Excavation for Detention Pond                    | 800             | CY | \$ 50            | \$ 40,000         |
| 16 Pump Station                                     | 1               | LS | \$ 100,000       | \$ 100,000        |
| 17 Connection to Existing System                    | 1               | EA | \$ 2,500         | \$ 2,500          |
| 18 Bankrun Gravel                                   | 70              | TN | \$ 25            | \$ 1,750          |
| 19 Special Excavation of Unsuitable Material        | 10              | CY | \$ 30            | \$ 300            |
| 20 Remove/Replace Concrete Sidewalk                 | 110             | SY | \$ 40            | \$ 4,400          |
| 21 Foundation Gravel                                | 2               | TN | \$ 20            | \$ 40             |
| 22 Gravel Base                                      | 60              | TN | \$ 25            | \$ 1,500          |
| 23 Asphalt Treated Base                             | 0               | TN | \$ 100           | \$ -              |
| 24 Asphalt Concrete Pavement                        | 0               | TN | \$ 100           | \$ -              |
| Subtotal                                            |                 |    |                  | \$ 213,890        |
| Contingency (30%)                                   |                 |    |                  | \$ 64,167         |
| Subtotal                                            |                 |    |                  | \$ 278,057        |
| Sales Tax (8.6%)                                    |                 |    |                  | \$ 23,913         |
| Total                                               |                 |    |                  | \$ 301,970        |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  | <b>\$ 310,000</b> |
| All Overhead (25%)                                  |                 |    |                  | \$ 80,000         |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  | <b>\$ 390,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 4.2 -NE 12th St Culvert**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> | <u>Total</u>      |
|-----------------------------------------------------|-----------------|----|------------------|-------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$ 11,000        | \$ 11,000         |
| 2 Minor Changes                                     | 1               | LS | \$ 10,000        | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$ 1,000         | \$ 1,000          |
| 4 Traffic Control                                   | 1               | LS | \$ 1,000         | \$ 1,000          |
| 5 Environmental Controls                            | 1               | LS | \$ 1,000         | \$ 1,000          |
| 6 Stream Restoration                                | 1               | LS | \$ 10,000        | \$ 10,000         |
| 7 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$ 1,000         | \$ 1,000          |
| 8 Trench Excavation Safety Systems                  | 1               | LS | \$ 1,000         | \$ 1,000          |
| 9 Dewatering                                        | 1               | LS | \$ 1,000         | \$ 1,000          |
| 10 Temporary Bypass Pumping                         | 1               | LS | \$ 1,000         | \$ 1,000          |
| 11 Locate Existing Utilities                        | 1               | LS | \$ 1,000         | \$ 1,000          |
| 12 Clearing and Grubbing                            | 1               | LS | \$ 1,000         | \$ 1,000          |
| 13 Removal of Structures and Obstructions           | 1               | LS | \$ 1,000         | \$ 1,000          |
| 14 48" CPEP (Including bedding, backfill)           | 65              | LF | \$ 200           | \$ 13,000         |
| 15 Headwall (for 48" pipe, includes excav/backfill) | 4               | EA | \$ 5,500         | \$ 22,000         |
| 16 Quarry Spalls                                    | 10              | TN | \$ 30            | \$ 300            |
| 17 Special Excavation of Unsuitable Material        | 10              | CY | \$ 30            | \$ 300            |
| 18 Sawcutting                                       | 130             | LF | \$ 3             | \$ 390            |
| 19 Restore Pavement Markings                        | 65              | LF | \$ 0.50          | \$ 33             |
| 20 Remove/Replace Concrete Sidewalk                 | 40              | SY | \$ 40            | \$ 1,589          |
| 21 Bankrun Gravel                                   | 30              | TN | \$ 25            | \$ 750            |
| 22 Gravel Base                                      | 22              | TN | \$ 25            | \$ 550            |
| 23 Asphalt Treated Base                             | 14              | TN | \$ 100           | \$ 1,400          |
| 24 Asphalt Concrete Pavement                        | 9               | TN | \$ 100           | \$ 900            |
| Subtotal                                            |                 |    |                  | \$ 82,211         |
| Contingency (30%)                                   |                 |    |                  | <u>\$ 24,663</u>  |
| Subtotal                                            |                 |    |                  | \$ 106,874        |
| Sales Tax (8.6%)                                    |                 |    |                  | <u>\$ 9,191</u>   |
| Total                                               |                 |    |                  | \$ 116,065        |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  | <b>\$ 117,000</b> |
| All Overhead (25%)                                  |                 |    |                  | <u>\$ 30,000</u>  |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  | <b>\$ 147,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 5.1 - NE 12th St Culvert**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> | <u>Total</u>      |
|-----------------------------------------------------|-----------------|----|------------------|-------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$ 9,000         | \$ 9,000          |
| 2 Minor Changes                                     | 1               | LS | \$ 10,000        | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$ 1,000         | \$ 1,000          |
| 4 Traffic Control                                   | 1               | LS | \$ 1,000         | \$ 1,000          |
| 5 Environmental Controls                            | 1               | LS | \$ 1,000         | \$ 1,000          |
| 6 Stream Restoration                                | 1               | LS | \$ 10,000        | \$ 10,000         |
| 7 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$ 1,000         | \$ 1,000          |
| 8 Trench Excavation Safety Systems                  | 1               | LS | \$ 1,000         | \$ 1,000          |
| 9 Dewatering                                        | 1               | LS | \$ 1,000         | \$ 1,000          |
| 10 Temporary Bypass Pumping                         | 1               | LS | \$ 1,000         | \$ 1,000          |
| 11 Locate Existing Utilities                        | 1               | LS | \$ 1,000         | \$ 1,000          |
| 12 Clearing and Grubbing                            | 1               | LS | \$ 1,000         | \$ 1,000          |
| 13 Removal of Structures and Obstructions           | 1               | LS | \$ 1,000         | \$ 1,000          |
| 14 48" CPEP (Including bedding, backfill)           | 50              | LF | \$ 200           | \$ 10,000         |
| 15 Headwall (for 48" pipe, includes excav/backfill) | 2               | EA | \$ 5,500         | \$ 11,000         |
| 16 Quarry Spalls                                    | 10              | TN | \$ 30            | \$ 300            |
| 17 Special Excavation of Unsuitable Material        | 10              | CY | \$ 30            | \$ 300            |
| 18 Sawcutting                                       | 100             | LF | \$ 3             | \$ 300            |
| 19 Restore Pavement Markings                        | 50              | LF | \$ 0.50          | \$ 25             |
| 20 Remove/Replace Concrete Sidewalk                 | 31              | SY | \$ 40            | \$ 1,222          |
| 21 Bankrun Gravel                                   | 20              | TN | \$ 25            | \$ 500            |
| 22 Gravel Base                                      | 20              | TN | \$ 25            | \$ 500            |
| 23 Asphalt Treated Base                             | 11              | TN | \$ 100           | \$ 1,100          |
| 24 Asphalt Concrete Pavement                        | 7               | TN | \$ 100           | \$ 700            |
| Subtotal                                            |                 |    |                  | \$ 64,947         |
| Contingency (30%)                                   |                 |    |                  | <u>\$ 19,484</u>  |
| Subtotal                                            |                 |    |                  | \$ 84,431         |
| Sales Tax (8.6%)                                    |                 |    |                  | <u>\$ 7,261</u>   |
| Total                                               |                 |    |                  | \$ 91,692         |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  | <b>\$ 100,000</b> |
| All Overhead (25%)                                  |                 |    |                  | <u>\$ 30,000</u>  |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  | <b>\$ 130,000</b> |



**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 5.2 - Ballarat Ave NE Culvert**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> | <u>Total</u>      |
|-----------------------------------------------------|-----------------|----|------------------|-------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$ 11,000        | \$ 11,000         |
| 2 Minor Changes                                     | 1               | LS | \$ 10,000        | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$ 1,000         | \$ 1,000          |
| 4 Traffic Control                                   | 1               | LS | \$ 1,000         | \$ 1,000          |
| 5 Environmental Controls                            | 1               | LS | \$ 1,000         | \$ 1,000          |
| 6 Stream Restoration                                | 1               | LS | \$ 10,000        | \$ 10,000         |
| 7 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$ 1,000         | \$ 1,000          |
| 8 Trench Excavation Safety Systems                  | 1               | LS | \$ 1,000         | \$ 1,000          |
| 9 Dewatering                                        | 1               | LS | \$ 1,000         | \$ 1,000          |
| 10 Temporary Bypass Pumping                         | 1               | LS | \$ 1,000         | \$ 1,000          |
| 11 Locate Existing Utilities                        | 1               | LS | \$ 1,000         | \$ 1,000          |
| 12 Clearing and Grubbing                            | 1               | LS | \$ 1,000         | \$ 1,000          |
| 13 Removal of Structures and Obstructions           | 1               | LS | \$ 1,000         | \$ 1,000          |
| 14 42" CPEP (Including bedding, backfill)           | 100             | LF | \$ 160           | \$ 16,000         |
| 15 Headwall (for 42" pipe, includes excav/backfill) | 4               | EA | \$ 5,000         | \$ 20,000         |
| 16 Quarry Spalls                                    | 10              | TN | \$ 30            | \$ 300            |
| 17 Special Excavation of Unsuitable Material        | 10              | CY | \$ 30            | \$ 300            |
| 18 Sawcutting                                       | 100             | LF | \$ 3             | \$ 300            |
| 19 Restore Pavement Markings                        | 50              | LF | \$ 0.50          | \$ 25             |
| 20 Remove/Replace Concrete Sidewalk                 | 31              | SY | \$ 40            | \$ 1,222          |
| 21 Bankrun Gravel                                   | 20              | TN | \$ 25            | \$ 500            |
| 22 Gravel Base                                      | 20              | TN | \$ 25            | \$ 500            |
| 23 Asphalt Treated Base                             | 20              | TN | \$ 100           | \$ 2,000          |
| 24 Asphalt Concrete Pavement                        | 7               | TN | \$ 100           | \$ 700            |
| Subtotal                                            |                 |    |                  | \$ 82,847         |
| Contingency (30%)                                   |                 |    |                  | <u>\$ 24,854</u>  |
| Subtotal                                            |                 |    |                  | \$ 107,701        |
| Sales Tax (8.6%)                                    |                 |    |                  | <u>\$ 9,262</u>   |
| Total                                               |                 |    |                  | \$ 116,963        |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  | <b>\$ 120,000</b> |
| All Overhead (25%)                                  |                 |    |                  | <u>\$ 30,000</u>  |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  | <b>\$ 150,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 6.1 - NE 6th St Culvert**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> | <u>Total</u>      |
|-----------------------------------------------------|-----------------|----|------------------|-------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$ 10,000        | \$ 10,000         |
| 2 Minor Changes                                     | 1               | LS | \$ 10,000        | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$ 1,000         | \$ 1,000          |
| 4 Traffic Control                                   | 1               | LS | \$ 1,000         | \$ 1,000          |
| 5 Environmental Controls                            | 1               | LS | \$ 1,000         | \$ 1,000          |
| 6 Stream Restoration                                | 1               | LS | \$ 10,000        | \$ 10,000         |
| 7 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$ 1,000         | \$ 1,000          |
| 8 Trench Excavation Safety Systems                  | 1               | LS | \$ 1,000         | \$ 1,000          |
| 9 Dewatering                                        | 1               | LS | \$ 1,000         | \$ 1,000          |
| 10 Temporary Bypass Pumping                         | 1               | LS | \$ 1,000         | \$ 1,000          |
| 11 Locate Existing Utilities                        | 1               | LS | \$ 1,000         | \$ 1,000          |
| 12 Clearing and Grubbing                            | 1               | LS | \$ 1,000         | \$ 1,000          |
| 13 Removal of Structures and Obstructions           | 1               | LS | \$ 1,000         | \$ 1,000          |
| 14 72" CPEP (Including bedding, backfill)           | 100             | LF | \$ 300           | \$ 30,000         |
| 15 Headwall (for 72" pipe, includes excav/backfill) | 4               | EA | \$ 7,500         | \$ 30,000         |
| 16 Quarry Spalls                                    | 10              | TN | \$ 30            | \$ 300            |
| 17 Special Excavation of Unsuitable Material        | 10              | CY | \$ 30            | \$ 300            |
| 18 Sawcutting                                       | 100             | LF | \$ 3             | \$ 300            |
| 19 Restore Pavement Markings                        | 50              | LF | \$ 0.50          | \$ 25             |
| 20 Remove/Replace Concrete Sidewalk                 | 31              | SY | \$ 40            | \$ 1,222          |
| 21 Bankrun Gravel                                   | 20              | TN | \$ 25            | \$ 500            |
| 22 Gravel Base                                      | 17              | TN | \$ 25            | \$ 425            |
| 23 Asphalt Treated Base                             | 11              | TN | \$ 100           | \$ 1,100          |
| 24 Asphalt Concrete Pavement                        | 7               | TN | \$ 100           | \$ 700            |
| Subtotal                                            |                 |    |                  | \$ 104,872        |
| Contingency (30%)                                   |                 |    |                  | <u>\$ 31,462</u>  |
| Subtotal                                            |                 |    |                  | \$ 136,334        |
| Sales Tax (8.6%)                                    |                 |    |                  | <u>\$ 11,725</u>  |
| Total                                               |                 |    |                  | \$ 148,059        |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  | <b>\$ 149,000</b> |
| All Overhead (25%)                                  |                 |    |                  | <u>\$ 38,000</u>  |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  | <b>\$ 187,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 6.2 - Thrasher Avenue Culvert**

| <u>Item</u>                                                           | <u>Quantity</u> |    | <u>Unit Cost</u> |        | <u>Total</u>      |
|-----------------------------------------------------------------------|-----------------|----|------------------|--------|-------------------|
| 1 Mobilization/Demobilization                                         | 1               | LS | \$               | 15,000 | \$ 15,000         |
| 2 Minor Changes                                                       | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                                  | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 4 Traffic Control                                                     | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 5 Environmental Controls                                              | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 6 Stream Restoration                                                  | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 7 Spill Prevention Control and Countermeasures Plan                   | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 8 Trench Excavation Safety Systems                                    | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 9 Dewatering                                                          | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 10 Temporary Bypass Pumping                                           | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 11 Locate Existing Utilities                                          | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 12 Removal of Structures and Obstructions                             | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 13 Box Culvert (6'x5')                                                | 65              | LF | \$               | 620    | \$ 40,300         |
| 14 Excavation, Haul, Backfill, Compaction, Grading<br>for Box Culvert | 325             | CY | \$               | 50     | \$ 16,226         |
| 15 Headwall                                                           | 2               | EA | \$               | 4,200  | \$ 8,400          |
| 16 Quarry Spalls                                                      | 10              | TN | \$               | 30     | \$ 300            |
| 17 Special Excavation of Unsuitable Material                          | 10              | CY | \$               | 30     | \$ 300            |
| 18 Sawcutting                                                         | 130             | LF | \$               | 3      | \$ 390            |
| 19 Restore Pavement Markings                                          | 65              | LF | \$               | 0.50   | \$ 33             |
| 20 Remove/Replace Concrete Sidewalk                                   | 40              | SY | \$               | 40     | \$ 1,589          |
| 21 Foundation Gravel                                                  | 20              | TN | \$               | 20     | \$ 400            |
| 22 Gravel Base                                                        | 22              | TN | \$               | 25     | \$ 550            |
| 23 Asphalt Treated Base                                               | 14              | TN | \$               | 100    | \$ 1,400          |
| 24 Asphalt Concrete Pavement                                          | 9               | TN | \$               | 100    | \$ 900            |
| Subtotal                                                              |                 |    |                  |        | \$ 114,788        |
| Contingency (30%)                                                     |                 |    |                  |        | \$ 34,436         |
| Subtotal                                                              |                 |    |                  |        | \$ 149,224        |
| Sales Tax (8.6%)                                                      |                 |    |                  |        | \$ 12,833         |
| Total                                                                 |                 |    |                  |        | \$ 162,057        |
| <b>Total Construction Cost (Rounded)</b>                              |                 |    |                  |        | <b>\$ 163,000</b> |
| All Overhead (25%)                                                    |                 |    |                  |        | \$ 41,000         |
| <b>Total Project Cost (Rounded)</b>                                   |                 |    |                  |        | <b>\$ 204,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 6.3 - Merritt Ave NE Culvert**

| <u>Item</u>                                                        | <u>Quantity</u> |    | <u>Unit Cost</u> |        | <u>Total</u>      |
|--------------------------------------------------------------------|-----------------|----|------------------|--------|-------------------|
| 1 Mobilization/Demobilization                                      | 1               | LS | \$               | 13,000 | \$ 13,000         |
| 2 Minor Changes                                                    | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                               | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 4 Traffic Control                                                  | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 5 Environmental Controls                                           | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 6 Stream Restoration                                               | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 7 Spill Prevention Control and Countermeasures Plan                | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 8 Trench Excavation Safety Systems                                 | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 9 Dewatering                                                       | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 10 Temporary Bypass Pumping                                        | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 11 Locate Existing Utilities                                       | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 12 Removal of Structures and Obstructions                          | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 13 Box Culvert (8'x4')                                             | 45              | LF | \$               | 635    | \$ 28,575         |
| 14 Excavation, Haul, Backfill, Compaction, Grading for Box Culvert | 279             | CY | \$               | 50     | \$ 13,926         |
| 15 Headwall                                                        | 2               | EA | \$               | 4,800  | \$ 9,600          |
| 16 Quarry Spalls                                                   | 10              | TN | \$               | 30     | \$ 300            |
| 17 Special Excavation of Unsuitable Material                       | 10              | CY | \$               | 30     | \$ 300            |
| 18 Sawcutting                                                      | 90              | LF | \$               | 3      | \$ 270            |
| 19 Restore Pavement Markings                                       | 45              | LF | \$               | 0.50   | \$ 23             |
| 20 Remove/Replace Concrete Sidewalk                                | 28              | SY | \$               | 40     | \$ 1,100          |
| 21 Foundation Gravel                                               | 18              | TN | \$               | 20     | \$ 360            |
| 22 Gravel Base                                                     | 20              | TN | \$               | 25     | \$ 500            |
| 23 Asphalt Treated Base                                            | 10              | TN | \$               | 100    | \$ 1,000          |
| 24 Asphalt Concrete Pavement                                       | 7               | TN | \$               | 100    | \$ 700            |
| Subtotal                                                           |                 |    |                  |        | \$ 98,654         |
| Contingency (30%)                                                  |                 |    |                  |        | \$ 29,596         |
| Subtotal                                                           |                 |    |                  |        | \$ 128,250        |
| Sales Tax (8.6%)                                                   |                 |    |                  |        | \$ 11,029         |
| Total                                                              |                 |    |                  |        | \$ 139,279        |
| <b>Total Construction Cost (Rounded)</b>                           |                 |    |                  |        | <b>\$ 140,000</b> |
| All Overhead (25%)                                                 |                 |    |                  |        | \$ 35,000         |
| <b>Total Project Cost (Rounded)</b>                                |                 |    |                  |        | <b>\$ 175,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 6.4 - Orchard Ave NE Culvert**

| <u>Item</u>                                                        | <u>Quantity</u> |    | <u>Unit Cost</u> | <u>Total</u>      |
|--------------------------------------------------------------------|-----------------|----|------------------|-------------------|
| 1 Mobilization/Demobilization                                      | 1               | LS | \$ 13,000        | \$ 13,000         |
| 2 Minor Changes                                                    | 1               | LS | \$ 10,000        | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                               | 1               | LS | \$ 1,000         | \$ 1,000          |
| 4 Traffic Control                                                  | 1               | LS | \$ 1,000         | \$ 1,000          |
| 5 Environmental Controls                                           | 1               | LS | \$ 1,000         | \$ 1,000          |
| 6 Stream Restoration                                               | 1               | LS | \$ 10,000        | \$ 10,000         |
| 7 Spill Prevention Control and Countermeasures Plan                | 1               | LS | \$ 1,000         | \$ 1,000          |
| 8 Trench Excavation Safety Systems                                 | 1               | LS | \$ 1,000         | \$ 1,000          |
| 9 Dewatering                                                       | 1               | LS | \$ 1,000         | \$ 1,000          |
| 10 Temporary Bypass Pumping                                        | 1               | LS | \$ 1,000         | \$ 1,000          |
| 11 Locate Existing Utilities                                       | 1               | LS | \$ 1,000         | \$ 1,000          |
| 12 Removal of Structures and Obstructions                          | 1               | LS | \$ 1,000         | \$ 1,000          |
| 13 Box Culvert (8'x4')                                             | 45              | LF | \$ 635           | \$ 28,575         |
| 14 Excavation, Haul, Backfill, Compaction, Grading for Box Culvert | 279             | CY | \$ 50            | \$ 13,938         |
| 15 Headwall                                                        | 2               | EA | \$ 4,800         | \$ 9,600          |
| 16 Quarry Spalls                                                   | 10              | TN | \$ 30            | \$ 300            |
| 17 Special Excavation of Unsuitable Material                       | 10              | CY | \$ 30            | \$ 300            |
| 18 Sawcutting                                                      | 90              | LF | \$ 3             | \$ 270            |
| 19 Restore Pavement Markings                                       | 45              | LF | \$ 0.50          | \$ 23             |
| 20 Remove/Replace Concrete Sidewalk                                | 28              | SY | \$ 40            | \$ 1,100          |
| 21 Foundation Gravel                                               | 18              | TN | \$ 20            | \$ 360            |
| 22 Gravel Base                                                     | 20              | TN | \$ 25            | \$ 500            |
| 23 Asphalt Treated Base                                            | 10              | TN | \$ 100           | \$ 1,000          |
| 24 Asphalt Concrete Pavement                                       | 10              | TN | \$ 100           | \$ 1,000          |
| Subtotal                                                           |                 |    |                  | \$ 98,965         |
| Contingency (30%)                                                  |                 |    |                  | \$ 29,690         |
| Subtotal                                                           |                 |    |                  | \$ 128,655        |
| Sales Tax (8.6%)                                                   |                 |    |                  | \$ 11,064         |
| Total                                                              |                 |    |                  | \$ 139,719        |
| <b>Total Construction Cost (Rounded)</b>                           |                 |    |                  | <b>\$ 140,000</b> |
| All Overhead (25%)                                                 |                 |    |                  | \$ 35,000         |
| <b>Total Project Cost (Rounded)</b>                                |                 |    |                  | <b>\$ 175,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 6.6 - Snoqualmie Valley Trail Culvert**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> | <u>Total</u>      |
|-----------------------------------------------------|-----------------|----|------------------|-------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$ 10,000        | \$ 10,000         |
| 2 Minor Changes                                     | 1               | LS | \$ 10,000        | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$ 1,000         | \$ 1,000          |
| 4 Traffic Control                                   | 1               | LS | \$ 1,000         | \$ 1,000          |
| 5 Environmental Controls                            | 1               | LS | \$ 1,000         | \$ 1,000          |
| 6 Stream Restoration                                | 1               | LS | \$ 10,000        | \$ 10,000         |
| 7 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$ 1,000         | \$ 1,000          |
| 8 Trench Excavation Safety Systems                  | 1               | LS | \$ 1,000         | \$ 1,000          |
| 9 Dewatering                                        | 1               | LS | \$ 1,000         | \$ 1,000          |
| 10 Temporary Bypass Pumping                         | 1               | LS | \$ 1,000         | \$ 1,000          |
| 11 Locate Existing Utilities                        | 1               | LS | \$ 1,000         | \$ 1,000          |
| 12 Removal of Structures and Obstructions           | 1               | LS | \$ 1,000         | \$ 1,000          |
| 13 60" CPEP (Including bedding, backfill)           | 130             | LF | \$ 220           | \$ 28,600         |
| 14 Headwall (for 60" pipe, includes excav/backfill) | 4               | EA | \$ 6,500         | \$ 26,000         |
| 15 Quarry Spalls                                    | 10              | TN | \$ 30            | \$ 300            |
| 16 Special Excavation of Unsuitable Material        | 3               | CY | \$ 30            | \$ 90             |
| 17 Landscaping Restoration                          | 1               | LS | \$ 5,000         | \$ 5,000          |
| 18 Hydroseeding                                     | 370             | SY | \$ 3             | \$ 1,110          |
| Subtotal                                            |                 |    |                  | \$ 100,100        |
| Contingency (30%)                                   |                 |    |                  | <u>\$ 30,030</u>  |
| Subtotal                                            |                 |    |                  | \$ 130,130        |
| Sales Tax (8.6%)                                    |                 |    |                  | <u>\$ 11,191</u>  |
| Total                                               |                 |    |                  | \$ 141,321        |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  | <b>\$ 142,000</b> |
| All Overhead (25%)                                  |                 |    |                  | <u>\$ 36,000</u>  |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  | <b>\$ 178,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 6.7 - Private Driveway End of Merrit Place NE Culvert**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> |        | <u>Total</u>      |
|-----------------------------------------------------|-----------------|----|------------------|--------|-------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 2 Minor Changes                                     | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 4 Traffic Control                                   | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 5 Environmental Controls                            | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 6 Stream Restoration                                | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 7 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 8 Trench Excavation Safety Systems                  | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 9 Dewatering                                        | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 10 Temporary Bypass Pumping                         | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 11 Locate Existing Utilities                        | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 12 Clearing and Grubbing                            | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 13 Removal of Structures and Obstructions           | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 14 60" CPEP (Including bedding, backfill)           | 55              | LF | \$               | 220    | \$ 12,100         |
| 15 Headwall (for 60" pipe, includes excav/backfill) | 2               | EA | \$               | 6,500  | \$ 13,000         |
| 16 Quarry Spalls                                    | 10              | TN | \$               | 30     | \$ 300            |
| 17 Special Excavation of Unsuitable Material        | 10              | CY | \$               | 30     | \$ 300            |
| 18 Sawcutting                                       | 110             | LF | \$               | 3      | \$ 330            |
| 19 Restore Pavement Markings                        | 55              | LF | \$               | 0.50   | \$ 28             |
| 20 Remove/Replace Concrete Sidewalk                 | 34              | SY | \$               | 40     | \$ 1,344          |
| 21 Gravel Base                                      | 20              | TN | \$               | 25     | \$ 500            |
| 22 Asphalt Treated Base                             | 20              | TN | \$               | 100    | \$ 2,000          |
| 23 Asphalt Concrete Pavement                        | 8               | TN | \$               | 100    | \$ 800            |
| Subtotal                                            |                 |    |                  |        | \$ 70,702         |
| Contingency (30%)                                   |                 |    |                  |        | \$ 21,211         |
| Subtotal                                            |                 |    |                  |        | \$ 91,913         |
| Sales Tax (8.6%)                                    |                 |    |                  |        | \$ 7,905          |
| Total                                               |                 |    |                  |        | \$ 99,818         |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  |        | <b>\$ 100,000</b> |
| All Overhead (25%)                                  |                 |    |                  |        | \$ 30,000         |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  |        | <b>\$ 130,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 6.8 - NE 4th St Culvert**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> | <u>Total</u>      |
|-----------------------------------------------------|-----------------|----|------------------|-------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$ 13,000        | \$ 13,000         |
| 2 Minor Changes                                     | 1               | LS | \$ 10,000        | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$ 1,000         | \$ 1,000          |
| 4 Traffic Control                                   | 1               | LS | \$ 1,000         | \$ 1,000          |
| 5 Environmental Controls                            | 1               | LS | \$ 1,000         | \$ 1,000          |
| 6 Stream Restoration                                | 1               | LS | \$ 10,000        | \$ 10,000         |
| 7 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$ 1,000         | \$ 1,000          |
| 8 Trench Excavation Safety Systems                  | 1               | LS | \$ 1,000         | \$ 1,000          |
| 9 Dewatering                                        | 1               | LS | \$ 1,000         | \$ 1,000          |
| 10 Temporary Bypass Pumping                         | 1               | LS | \$ 1,000         | \$ 1,000          |
| 11 Locate Existing Utilities                        | 1               | LS | \$ 1,000         | \$ 1,000          |
| 12 Clearing and Grubbing                            | 1               | LS | \$ 1,000         | \$ 1,000          |
| 13 Removal of Structures and Obstructions           | 1               | LS | \$ 1,000         | \$ 1,000          |
| 14 72" CPEP (Including bedding, backfill)           | 180             | LF | \$ 300           | \$ 54,000         |
| 15 Headwall (for 72" pipe, includes excav/backfill) | 4               | EA | \$ 7,500         | \$ 30,000         |
| 16 Quarry Spalls                                    | 10              | TN | \$ 30            | \$ 300            |
| 17 Special Excavation of Unsuitable Material        | 10              | CY | \$ 30            | \$ 300            |
| 18 Sawcutting                                       | 180             | LF | \$ 3             | \$ 540            |
| 19 Restore Pavement Markings                        | 90              | LF | \$ 0.50          | \$ 45             |
| 20 Remove/Replace Concrete Sidewalk                 | 55              | SY | \$ 40            | \$ 2,200          |
| 21 Gravel Base                                      | 30              | TN | \$ 25            | \$ 750            |
| 22 Asphalt Treated Base                             | 19              | TN | \$ 100           | \$ 1,900          |
| 23 Asphalt Concrete Pavement                        | 13              | TN | \$ 100           | \$ 1,300          |
| Subtotal                                            |                 |    |                  | \$ 134,335        |
| Contingency (30%)                                   |                 |    |                  | <u>\$ 40,301</u>  |
| Subtotal                                            |                 |    |                  | \$ 174,636        |
| Sales Tax (8.6%)                                    |                 |    |                  | <u>\$ 15,019</u>  |
| Total                                               |                 |    |                  | \$ 189,655        |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  | <b>\$ 190,000</b> |
| All Overhead (25%)                                  |                 |    |                  | <u>\$ 48,000</u>  |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  | <b>\$ 238,000</b> |



**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 6.9 - Private Drive upstream of Ogle Ave NE Culvert**

| <u>Item</u>                                                           | <u>Quantity</u> |    | <u>Unit Cost</u> |        | <u>Total</u>      |
|-----------------------------------------------------------------------|-----------------|----|------------------|--------|-------------------|
| 1 Mobilization/Demobilization                                         | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 2 Minor Changes                                                       | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                                  | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 4 Traffic Control                                                     | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 5 Environmental Controls                                              | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 6 Stream Restoration                                                  | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 7 Spill Prevention Control and Countermeasures Plan                   | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 8 Trench Excavation Safety Systems                                    | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 9 Dewatering                                                          | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 10 Temporary Bypass Pumping                                           | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 11 Locate Existing Utilities                                          | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 12 Clearing and Grubbing                                              | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 13 Removal of Structures and Obstructions                             | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 14 Box Culvert (10'x4')                                               | 25              | LF | \$               | 690    | \$ 17,250         |
| 15 Excavation, Haul, Backfill, Compaction, Grading<br>for Box Culvert | 129             | CY | \$               | 50     | \$ 6,461          |
| 16 Headwall                                                           | 2               | EA | \$               | 4,800  | \$ 9,600          |
| 17 Special Excavation of Unsuitable Material                          | 10              | CY | \$               | 30     | \$ 300            |
| 18 Quarry Spalls                                                      | 10              | TN | \$               | 30     | \$ 300            |
| 19 Sawcutting                                                         | 50              | LF | \$               | 3      | \$ 150            |
| 20 Restore Pavement Markings                                          | 25              | LF | \$               | 0.50   | \$ 13             |
| 21 Remove/Replace Concrete Sidewalk                                   | 15              | SY | \$               | 40     | \$ 611            |
| 22 Foundation Gravel                                                  | 13              | TN | \$               | 20     | \$ 260            |
| 23 Gravel Base                                                        | 10              | TN | \$               | 25     | \$ 250            |
| 24 Asphalt Treated Base                                               | 6               | TN | \$               | 100    | \$ 600            |
| 25 Asphalt Concrete Pavement                                          | 4               | TN | \$               | 100    | \$ 400            |
| Subtotal                                                              |                 |    |                  |        | \$ 76,195         |
| Contingency (30%)                                                     |                 |    |                  |        | \$ 22,858         |
| Subtotal                                                              |                 |    |                  |        | \$ 99,053         |
| Sales Tax (8.6%)                                                      |                 |    |                  |        | \$ 8,519          |
| Total                                                                 |                 |    |                  |        | \$ 107,572        |
| <b>Total Construction Cost (Rounded)</b>                              |                 |    |                  |        | <b>\$ 108,000</b> |
| All Overhead (25%)                                                    |                 |    |                  |        | \$ 27,000         |
| <b>Total Project Cost (Rounded)</b>                                   |                 |    |                  |        | <b>\$ 135,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 6.10 - Ogle Ave NE Culvert**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> | <u>Total</u>      |
|-----------------------------------------------------|-----------------|----|------------------|-------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$ 11,000        | \$ 11,000         |
| 2 Minor Changes                                     | 1               | LS | \$ 10,000        | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$ 1,000         | \$ 1,000          |
| 4 Traffic Control                                   | 1               | LS | \$ 1,000         | \$ 1,000          |
| 5 Environmental Controls                            | 1               | LS | \$ 1,000         | \$ 1,000          |
| 6 Stream Restoration                                | 1               | LS | \$ 10,000        | \$ 10,000         |
| 7 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$ 1,000         | \$ 1,000          |
| 8 Trench Excavation Safety Systems                  | 1               | LS | \$ 1,000         | \$ 1,000          |
| 9 Dewatering                                        | 1               | LS | \$ 1,000         | \$ 1,000          |
| 10 Temporary Bypass Pumping                         | 1               | LS | \$ 1,000         | \$ 1,000          |
| 11 Locate Existing Utilities                        | 1               | LS | \$ 1,000         | \$ 1,000          |
| 12 Removal of Structures and Obstructions           | 1               | LS | \$ 1,000         | \$ 1,000          |
| 13 Box Culvert (10'x4')                             | 60              | LF | \$ 690           | \$ 41,400         |
| Excavation, Haul, Backfill, Compaction, Grading     |                 |    |                  |                   |
| 14 for Box Culvert                                  | 309             | CY | \$ 50            | \$ 15,468         |
| 15 Headwall                                         | 2               | EA | \$ 4,800         | \$ 9,600          |
| 16 Quarry Spalls                                    | 10              | TN | \$ 30            | \$ 300            |
| 17 Special Excavation of Unsuitable Material        | 2               | CY | \$ 30            | \$ 60             |
| 18 Sawcutting                                       | 619             | LF | \$ 3             | \$ 1,856          |
| 19 Restore Pavement Markings                        | 309             | LF | \$ 0.50          | \$ 155            |
| 20 Remove/Replace Concrete Sidewalk                 | 189             | SY | \$ 40            | \$ 7,562          |
| 21 Foundation Gravel                                | 30              | TN | \$ 20            | \$ 600            |
| 22 Gravel Base                                      | 20              | TN | \$ 25            | \$ 500            |
| 23 Asphalt Treated Base                             | 13              | TN | \$ 100           | \$ 1,300          |
| 24 Asphalt Concrete Pavement                        | 9               | TN | \$ 100           | \$ 900            |
| Subtotal                                            |                 |    |                  | \$ 119,701        |
| Contingency (30%)                                   |                 |    |                  | \$ 35,910         |
| Subtotal                                            |                 |    |                  | \$ 155,611        |
| Sales Tax (8.6%)                                    |                 |    |                  | \$ 13,383         |
| Total                                               |                 |    |                  | \$ 168,994        |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  | <b>\$ 169,000</b> |
| All Overhead (25%)                                  |                 |    |                  | \$ 43,000         |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  | <b>\$ 212,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 7.1 - Ballarat Ave NE Culvert**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> |        | <u>Total</u>      |
|-----------------------------------------------------|-----------------|----|------------------|--------|-------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 2 Minor Changes                                     | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 4 Traffic Control                                   | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 5 Environmental Controls                            | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 6 Stream Restoration                                | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 7 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 8 Trench Excavation Safety Systems                  | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 9 Dewatering                                        | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 10 Temporary Bypass Pumping                         | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 11 Locate Existing Utilities                        | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 12 Removal of Structures and Obstructions           | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 13 Box Culvert (10'x4')                             | 50              | LF | \$               | 690    | \$ 34,500         |
| Excavation, Haul, Backfill, Compaction, Grading     | 258             | CY | \$               | 50     | \$ 12,922         |
| 14 for Box Culvert                                  |                 |    |                  |        |                   |
| 15 Headwall                                         | 2               | EA | \$               | 4,800  | \$ 9,600          |
| 16 Quarry Spalls                                    | 10              | TN | \$               | 30     | \$ 300            |
| 17 Special Excavation of Unsuitable Material        | 2               | CY | \$               | 30     | \$ 60             |
| 18 Sawcutting                                       | 517             | LF | \$               | 3      | \$ 1,551          |
| 19 Restore Pavement Markings                        | 258             | LF | \$               | 0.50   | \$ 129            |
| 20 Remove/Replace Concrete Sidewalk                 | 158             | SY | \$               | 40     | \$ 6,317          |
| 21 Foundation Gravel                                | 25              | TN | \$               | 20     | \$ 500            |
| 22 Gravel Base                                      | 17              | TN | \$               | 25     | \$ 425            |
| 23 Asphalt Treated Base                             | 11              | TN | \$               | 100    | \$ 1,100          |
| 24 Asphalt Concrete Pavement                        | 7               | TN | \$               | 100    | \$ 700            |
| Subtotal                                            |                 |    |                  |        | \$ 107,104        |
| Contingency (30%)                                   |                 |    |                  |        | \$ 32,131         |
| Subtotal                                            |                 |    |                  |        | \$ 139,235        |
| Sales Tax (8.6%)                                    |                 |    |                  |        | \$ 11,974         |
| Total                                               |                 |    |                  |        | \$ 151,209        |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  |        | <b>\$ 152,000</b> |
| All Overhead (25%)                                  |                 |    |                  |        | \$ 38,000         |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  |        | <b>\$ 190,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 8.1 - Si View Outfall**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> | <u>Total</u>     |
|-----------------------------------------------------|-----------------|----|------------------|------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$ 4,000         | \$ 4,000         |
| 2 Minor Changes                                     | 1               | LS | \$ 10,000        | \$ 10,000        |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$ 1,000         | \$ 1,000         |
| 4 Traffic Control                                   | 1               | LS | \$ 1,000         | \$ 1,000         |
| 5 Environmental Controls                            | 1               | LS | \$ 1,000         | \$ 1,000         |
| 6 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$ 1,000         | \$ 1,000         |
| 7 Trench Excavation Safety Systems                  | 1               | LS | \$ 1,000         | \$ 1,000         |
| 8 Dewatering                                        | 1               | LS | \$ 1,000         | \$ 1,000         |
| 9 Temporary Bypass Pumping                          | 1               | LS | \$ 1,000         | \$ 1,000         |
| 10 Locate Existing Utilities                        | 1               | LS | \$ 1,000         | \$ 1,000         |
| 11 48" Precast Type 2 Catch Basin (Basic to 8')     | 1               | EA | \$ 2,500         | \$ 2,500         |
| Subtotal                                            |                 |    |                  | \$ 24,500        |
| Contingency (30%)                                   |                 |    |                  | <u>\$ 7,350</u>  |
| Subtotal                                            |                 |    |                  | \$ 31,850        |
| Sales Tax (8.6%)                                    |                 |    |                  | <u>\$ 2,739</u>  |
| Total                                               |                 |    |                  | \$ 34,589        |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  | <b>\$ 35,000</b> |
| All Overhead (25%)                                  |                 |    |                  | <u>\$ 9,000</u>  |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  | <b>\$ 44,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 12.1 - Upgrade 540 LF of Ribary Creek downstream of I-90**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> | <u>Total</u>      |
|-----------------------------------------------------|-----------------|----|------------------|-------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$ 8,000         | \$ 8,000          |
| 2 Minor Changes                                     | 1               | LS | \$ 10,000        | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$ 3,000         | \$ 3,000          |
| 4 Environmental Controls                            | 1               | LS | \$ 3,000         | \$ 3,000          |
| 5 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$ 1,000         | \$ 1,000          |
| 6 Trench Excavation Safety Systems                  | 1               | LS | \$ 2,000         | \$ 2,000          |
| 7 Dewatering                                        | 1               | LS | \$ 2,000         | \$ 2,000          |
| 8 Clearing and Grubbing                             | 1               | LS | \$ 2,000         | \$ 2,000          |
| 9 Temporary Bypass Pumping                          | 1               | LS | \$ 3,000         | \$ 3,000          |
| 10 Locate Existing Utilities                        | 1               | LS | \$ 2,000         | \$ 2,000          |
| 11 Channel Excavation/Restoration                   | 540             | LF | \$ 80            | \$ 43,200         |
| Subtotal                                            |                 |    |                  | \$ 79,200         |
| Contingency (30%)                                   |                 |    |                  | <u>\$ 23,760</u>  |
| Subtotal                                            |                 |    |                  | \$ 102,960        |
| Land/ROW Acquisition                                |                 |    |                  | \$ 50,000         |
| Sales Tax (8.6%)                                    |                 |    |                  | <u>\$ 13,155</u>  |
| Total                                               |                 |    |                  | \$ 166,115        |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  | <b>\$ 167,000</b> |
| All Overhead (25%)                                  |                 |    |                  | <u>\$ 42,000</u>  |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  | <b>\$ 209,000</b> |

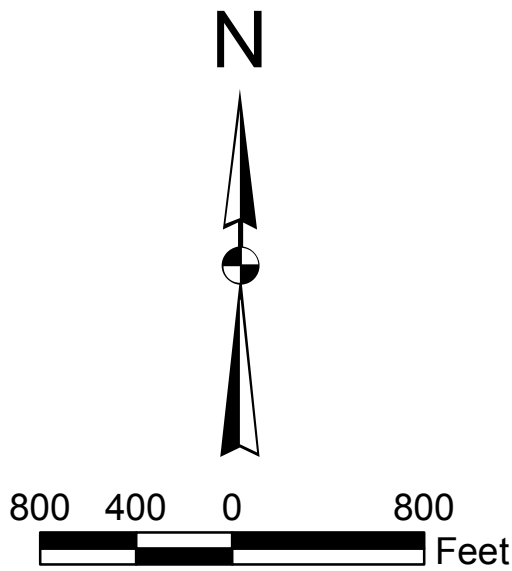
**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 12.4 - Gardiner Creek at NW 8th Street Culvert**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> |        | <u>Total</u>      |
|-----------------------------------------------------|-----------------|----|------------------|--------|-------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$               | 12,000 | \$ 12,000         |
| 2 Minor Changes                                     | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 4 Traffic Control                                   | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 5 Environmental Controls                            | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 6 Stream Restoration                                | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 7 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 8 Trench Excavation Safety Systems                  | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 9 Dewatering                                        | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 10 Temporary Bypass Pumping                         | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 11 Locate Existing Utilities                        | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 12 Removal of Structures and Obstructions           | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 13 Box Culvert (6'x5')                              | 80              | LF | \$               | 620    | \$ 49,600         |
| Excavation, Haul, Backfill, Compaction, Grading     | 313             | CY | \$               | 50     | \$ 15,662         |
| 14 for Box Culvert                                  |                 |    |                  |        |                   |
| 15 Headwall                                         | 4               | EA | \$               | 4,200  | \$ 16,800         |
| 16 Quarry Spalls                                    | 10              | TN | \$               | 30     | \$ 300            |
| 17 Special Excavation of Unsuitable Material        | 3               | CY | \$               | 30     | \$ 90             |
| 18 Sawcutting                                       | 80              | LF | \$               | 3      | \$ 240            |
| 19 Restore Pavement Markings                        | 40              | LF | \$               | 0.50   | \$ 20             |
| 20 Remove/Replace Concrete Sidewalk                 | 24              | SY | \$               | 40     | \$ 978            |
| 21 Foundation Gravel                                | 24              | TN | \$               | 20     | \$ 480            |
| 22 Gravel Base                                      | 14              | TN | \$               | 25     | \$ 350            |
| 23 Asphalt Treated Base                             | 9               | TN | \$               | 100    | \$ 900            |
| 24 Asphalt Concrete Pavement                        | 6               | TN | \$               | 100    | \$ 600            |
| Subtotal                                            |                 |    |                  |        | \$ 127,020        |
| Contingency (30%)                                   |                 |    |                  |        | \$ 38,106         |
| Subtotal                                            |                 |    |                  |        | \$ 165,126        |
| Sales Tax (8.6%)                                    |                 |    |                  |        | \$ 14,201         |
| Total                                               |                 |    |                  |        | \$ 179,327        |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  |        | <b>\$ 180,000</b> |
| All Overhead (25%)                                  |                 |    |                  |        | \$ 45,000         |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  |        | <b>\$ 225,000</b> |

**City of North Bend**  
**2013 Stormwater Management Plan Update**  
**Capital Improvement Plan**  
**CIP 12.5 - Gardiner Creek at Bendigo Ave S Culvert**

| <u>Item</u>                                         | <u>Quantity</u> |    | <u>Unit Cost</u> |        | <u>Total</u>      |
|-----------------------------------------------------|-----------------|----|------------------|--------|-------------------|
| 1 Mobilization/Demobilization                       | 1               | LS | \$               | 16,000 | \$ 16,000         |
| 2 Minor Changes                                     | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 3 Surveying, Staking and Record Dwgs                | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 4 Traffic Control                                   | 1               | LS | \$               | 2,000  | \$ 2,000          |
| 5 Environmental Controls                            | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 6 Stream Restoration                                | 1               | LS | \$               | 10,000 | \$ 10,000         |
| 7 Spill Prevention Control and Countermeasures Plan | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 8 Trench Excavation Safety Systems                  | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 9 Dewatering                                        | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 10 Temporary Bypass Pumping                         | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 11 Locate Existing Utilities                        | 1               | LS | \$               | 1,000  | \$ 1,000          |
| 12 Removal of Structures and Obstructions           | 1               | LS | \$               | 2,000  | \$ 2,000          |
| 13 Box Culvert (6'x5')                              | 120             | LF | \$               | 620    | \$ 74,400         |
| Excavation, Haul, Backfill, Compaction, Grading     | 489             | CY | \$               | 50     | \$ 24,429         |
| 14 for Box Culvert                                  |                 |    |                  |        |                   |
| 15 Headwall                                         | 4               | EA | \$               | 4,200  | \$ 16,800         |
| 16 Quarry Spalls                                    | 10              | TN | \$               | 30     | \$ 300            |
| 17 Special Excavation of Unsuitable Material        | 4               | CY | \$               | 30     | \$ 120            |
| 18 Sawcutting                                       | 120             | LF | \$               | 3      | \$ 360            |
| 19 Restore Pavement Markings                        | 60              | LF | \$               | 0.50   | \$ 30             |
| 20 Remove/Replace Concrete Sidewalk                 | 37              | SY | \$               | 40     | \$ 1,467          |
| 21 Foundation Gravel                                | 36              | TN | \$               | 20     | \$ 720            |
| 22 Gravel Base                                      | 20              | TN | \$               | 25     | \$ 500            |
| 23 Asphalt Treated Base                             | 13              | TN | \$               | 100    | \$ 1,300          |
| 24 Asphalt Concrete Pavement                        | 9               | TN | \$               | 100    | \$ 900            |
| Subtotal                                            |                 |    |                  |        | \$ 168,326        |
| Contingency (30%)                                   |                 |    |                  |        | \$ 50,498         |
| Subtotal                                            |                 |    |                  |        | \$ 218,824        |
| Sales Tax (8.6%)                                    |                 |    |                  |        | \$ 18,819         |
| Total                                               |                 |    |                  |        | \$ 237,643        |
| <b>Total Construction Cost (Rounded)</b>            |                 |    |                  |        | <b>\$ 238,000</b> |
| All Overhead (25%)                                  |                 |    |                  |        | \$ 60,000         |
| <b>Total Project Cost (Rounded)</b>                 |                 |    |                  |        | <b>\$ 298,000</b> |





**LEGEND:**

- CB TYPE 1
- CB TYPE 2
- UNKNOWN
- CATCH BASIN
- STORM MAHMOLE
- CLEANOUT
- ENERGY DISSIPATOR
- YARD DRAIN
- FL
- INLET STRUCTURE
- OUTFALL
- ROOF DRAIN
- STORM VAULT
- ▲ SOLID
- UNKNOWN
- DITCH
- PIPE
- POND
- CITY LIMITS
- UGA LIMITS
- RIVERS
- PARCELS
- STREAMS

**CITY STORMLINES  
PIPESIZE**

- 4-INCH
- 6-INCH
- 8-INCH
- 10-INCH
- 12-INCH
- 15-INCH
- 16-INCH
- 18-INCH
- 20-INCH
- 21-INCH
- 24-INCH
- 30-INCH
- 36-INCH
- 48-INCH
- 60-INCH
- 72-INCH
- 96-INCH
- UNKNOWN

**CITY OF NORTH BEND**

STORM DRAINAGE FACILITIES MAP

