

City of North Bonneville Shoreline Master Program

WORKING DRAFT Shoreline Inventory and Characterization Report

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Acronyms and Abbreviations

City	City of North Bonneville, Washington
CAO	critical areas ordinance
cfs	cubic feet per second
CWA	Clean Water Act
Ecology	Washington Department of Ecology
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
HPA	Hydraulic Project Approval
LFA	Limiting Factor Analysis
LWD	large woody debris
NBCP	North Bonneville Comprehensive Plan
NBMC	North Bonneville Municipal Code
NMFS	National Marine Fisheries Service
NOAA Fisheries	National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NWI	National Wetland Inventory
NWPCC	Northwest Power and Conservation Council
OFM	Washington Office of Financial Management
OHWM	Ordinary High Water Mark
PHS	priority habitats and species
RCW	Revised Code of Washington
report	Shoreline Inventory and Characterization Report

SMA	Shoreline Management Act
SMP	Shoreline Master Program
TMDL	Total Maximum Daily Load
USACE	U.S. Army Corps of Engineers
USDA NRCS	U.S. Department of Agriculture – Natural Resources Conservation Service
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WRIA	Water Resource Inventory Area
WDFW	Washington State Department of Fish and Wildlife
WRCC	Western Regional Climate Center

1.0 Introduction

The City of North Bonneville, Washington (City) is conducting a Shoreline Master Program (SMP) update with assistance of a grant from the Washington Department of Ecology (Ecology). Cities and counties are required to update their SMPs to comply with the state Shoreline Management Act (SMA), Revised Code of Washington (RCW) 90.58, and implementing guidelines, Washington Administrative Code (WAC) 173.26.

This Shoreline Inventory and Characterization Report (report) provides a basis for updating shoreline management goals, policies, and regulations and for identifying opportunities for public access to and restoration of the City's shorelines.

The information presented in this report is organized in the following sections:

- **Section 1** provides an introduction to the report, including definition and identification of the City's shoreline jurisdiction, and the relationship of the City's SMP to other plans and programs.
- **Section 2** provides an overview of the methods used to conduct the shoreline inventory and characterization.
- **Section 3** provides an ecosystem-wide profile of the ecological functions and processes affecting the City's shorelines.
- **Section 4** identifies shoreline reaches and provides shoreline inventory information at the reach scale for the City's shoreline jurisdiction.
- **Section 5** provides a list of references for information utilized in the shoreline inventory and characterization.
- **Appendix A** includes the City's shoreline inventory mapbook and a summary of data sources utilized in the shoreline inventory and characterization.

The City will utilize this report in the next steps of the SMP process, which include developing shoreline environment designations; preparing draft SMP goals, policies, and regulations; and developing a restoration plan to take advantage of restoration opportunities in the City's shoreline jurisdiction.

1.1 Shoreline Jurisdiction

1.1.1 Regulatory Overview and Definitions

Shorelines of the State

The SMP update process begins with the identification of "shorelines of the state" and associated "shorelands" which comprise the geographic area where the SMA applies within a local jurisdiction. The SMA applies to the following:

- All marine waters.
- Rivers and streams with more than 20 cubic feet per second (cfs) mean annual flow.
- Lakes and reservoirs greater than 20 acres in area.
- Associated wetlands.
- Shorelands adjacent to these water bodies.

1 Specific shorelines are identified by the SMA as “shorelines of statewide significance,”
2 such as the Columbia River.

3 **Ordinary High Water Mark**

4 The shoreline jurisdiction is identified using the Ordinary High Water Mark (OHWM). The
5 OHWM is not a fixed elevation; the OHWM and shoreline jurisdiction can move over time
6 as the shoreline changes. It is difficult to precisely map the location of the OHWM during
7 the SMP update process, so Ecology does not require the City to show a precise location
8 in the SMP. Therefore, the City’s shoreline jurisdiction, as presented in Figure 1-1, is
9 considered an approximate location¹.

10 **Shorelands**

11 Shorelands are land areas, wetlands, river deltas, or floodplains that border shorelines of
12 the state. The minimum shoreline jurisdiction for shorelands is the greater of the
13 following:

- 14 • Lands extending landward 200 feet in all directions from the OHWM.
- 15 • The floodway plus contiguous floodplain 200 feet landward of the floodway.
- 16 • Associated wetlands and river deltas².

17 **1.1.2 North Bonneville Preliminary Shoreline Jurisdiction**

18 The City’s preliminary shoreline jurisdiction is identified in Figure 1. The City’s shoreline
19 jurisdiction includes all water bodies and land areas within the City limits that meet the
20 definitions of “shorelines of statewide significance,” “shorelines of the state,” and
21 “shorelands,” as described above.

22 The City’s shoreline jurisdiction includes the following shorelines and shorelands:

- 23 • Shorelines of the State (Greenleaf Creek, Greenleaf Lake, and Hamilton Creek)
24 located within the City limits;
- 25 • Shorelines of Statewide Significance (Columbia River) located within the City limits;
26 and
- 27 • Shorelands associated with the above-referenced shorelines:
 - 28 ◦ Shorelands 200 feet from the OHWM;
 - 29 ◦ FEMA FIRM Zone A (100-year floodplain) where the zone extends beyond 200
30 feet from the OHWM; and
 - 31 ◦ Associated wetlands identified in the National Wetland Inventory (NWI) and/or
32 field-verified.

¹ The City’s updated SMP will require verification of the OHWM and shoreline jurisdiction as part of the permitting process for future shoreline development.

² The term “associated” means wetlands or river deltas that are in proximity to and/or influenced by waters subject to the SMA. This term may also be used to describe wetlands or other critical areas located within the City’s shoreline jurisdiction.

Figure 1. City of North Bonneville Preliminary Shoreline Jurisdiction

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1 Information collected during the September 20th field visit resulted in the following
2 refinements to the City's preliminary shoreline jurisdiction:

- 3 • Revision of the extent of a wetland adjacent to north shoreline of Greenleaf Lake at
4 confluence of Carpenter Creek – identification of upland plant species in some areas
5 and wetland species in others resulted in the revision.
- 6 • Exclusion of portion of FEMA floodplain at Pacific Coast Trail trailhead on the north
7 side of Highway 14 – much of this area has been graded and paved, and the area is
8 completely separated from the Columbia River by the Bonneville Dam and Highway
9 14.

10 The City's preliminary shoreline jurisdiction may be modified as the City continues its SMP
11 update process.

12 **1.2 Relationship to Other Plans and Programs**

13 The SMA requires local governments and state agencies to review their plans,
14 regulations, and ordinances that apply to areas adjacent to shoreline jurisdiction and
15 modify those plans, regulations, and ordinances to ensure they are consistent with the
16 SMP. The City's SMP intersects with the City's comprehensive plan, municipal code, and
17 other regulatory plans and programs to manage and regulate development in shorelines.
18 Local plans and regulations that relate to shoreline management include the following:

- 19 • **Comprehensive Plan** – the North Bonneville Comprehensive Plan (NBCP)
20 documents the City's vision for growth and development. The City has created land
21 use regulations consistent with the NBCP (see Appendix A for Land Use
22 Designations Map).
- 23 • **Zoning districts** – The North Bonneville Municipal Code (NBMC) further defines the
24 way in which the City's shorelines are managed. The City has created zoning
25 districts that are consistent with the NBCP that are defined in NBMC Title 20, Zoning
26 (see Appendix A for Zoning Map).
- 27 • **Critical areas ordinance (CAO)** – the City's critical areas ordinance, included in
28 NBMC Title 21, was updated in 2008 and establishes policies, regulations and land
29 use controls to protect environmental sensitive areas including wetlands, critical
30 aquifer recharge areas, frequently flooded areas, geologically hazardous areas, and
31 fish and wildlife habitat conservation areas. The SMA requires that local
32 governments adopt SMPs that protect critical areas within shoreline jurisdiction at a
33 level that is at least equal to the level of protection provided by the local critical areas
34 ordinance for critical areas outside shoreline jurisdiction.
- 35 • **Heritage Trails Plan** – the City's Heritage Trails Plan, part of the NBCP, is designed
36 to unite the City's trails, history, and environment to create a central identity for the
37 City. The City's heritage trails provide public access to many of the City's shorelines.

38 The City's SMP must also be compatible with state and federal regulations and programs
39 that relate to shoreline management. State and federal regulations and programs that
40 intersect with the City's SMP include the following:

- 41 • **Hydraulic Project Approval (HPA)** – the HPA program applies to any construction
42 activity in or near the waters of the state. The program is administered by the
43 Washington State Department of Fish and Wildlife (WDFW). All applicable projects

1 are required to submit permit applications to show that construction is done in a
2 manner to prevent damage to the state's fish, and shellfish, and their habitats.

- 3 • **Clean Water Act (CWA)** – Section 404 of the CWA regulates the discharge of
4 dredged or fill material into waters of the United States. Any project that proposes
5 discharging dredged or fill material into the waters of the United States, including
6 special aquatic sites such as wetlands, must get a Section 404 permit. The U.S. Army
7 Corps of Engineers (USACE) administers the Section 404 permitting process.
8 Applicants receiving a section 404 permit are also required to obtain a section 401
9 water quality certification from Ecology to certify that the project will comply with state
10 water quality standards and other aquatic resource protection requirements under
11 Ecology's authority. In addition, applicants for projects including any work in
12 navigable waters of the U.S must apply to the USACE for a Section 10 permit. The
13 purpose of Section 10 permitting is to prohibit the obstruction or alteration of
14 navigable waters of the U.S.
- 15 • **Endangered Species Act (ESA)** – All projects that have a federal nexus and have
16 the potential to directly or indirectly impact wildlife species listed as endangered or
17 threatened under ESA are subject to environmental review by the U.S. Fish and
18 Wildlife Service (USFWS) or the National Oceanic and Atmospheric Administration
19 Fisheries (NOAA Fisheries).
- 20 • **Water Pollution Control Act** – All projects effecting surface waters in the state,
21 including those that are not subject to the CWA Sections 404/401 must still comply
22 with the provisions of the State's Water Pollution Control Act.
- 23 • **Columbia River Gorge National Scenic Area** – the upper reaches of the streams
24 that comprise the City's shoreline jurisdiction are part of the Columbia River Gorge
25 National Scenic Area, managed by the Columbia River Gorge Commission as
26 authorized under the Columbia River Gorge Scenic Act. The National Scenic Area
27 jurisdiction ends at the city limits. The Columbia River Gorge Commission was
28 established in 1987 to develop and implement policies and programs that protect and
29 enhance the scenic, natural, cultural and recreational resources of the Gorge, while
30 encouraging growth within existing urban areas of the Gorge and allowing
31 development outside urban areas consistent with resource protection.
- 32 • **Pierce National Wildlife Refuge** – part of the City's shoreline jurisdiction lies within
33 the Franz Lake National Wildlife Refuge. Current management emphasis for the
34 refuge is on wetland enhancement and development, and protection and
35 enhancement of anadromous and native fisheries resources. The refuge is not open
36 to the general public.
- 37 • **Bonneville Lock and Dam** – the Bonneville Lock and Dam Project is located just
38 east of the City. The USACE operates the Lock and Dam which was completed in
39 1938 to improve navigation on the Columbia River and provide hydropower to the
40 Pacific Northwest.
- 41 • **Bonneville Power Administration (BPA)** – BPA owns land adjacent to the City's
42 shorelines, and operates and maintains these areas and the power transmission lines
43 and associated infrastructure located in the City's shoreline jurisdiction.

2.0 Methodology

2.1.1 Study Area

The study area for this shoreline inventory and characterization includes the City's shoreline jurisdiction (see Figure 1). The City's shorelines are part of Water Resource Inventory Area (WRIA) 28 (Salmon/Washougal). Information about WRIA 28, particularly with regard to the portions of Hamilton and Greenleaf Creeks that are located outside the City limits, was also considered as part of the analysis of the study area.

For the purpose of the shoreline inventory and characterization, the shoreline jurisdiction was divided into segments called reaches based on shoreline type. The criteria used to designate reaches are typically based upon physical and biological conditions of the shoreline. Significant changes in existing land use are also used to determine a shoreline reach break. The inventory was created by reviewing available and existing data and reports listed in Section 2.1.2. Existing geographic information system data were used to characterize shoreline conditions at the water body scale, and the mapping analysis was verified during a field visit on September 20th, 2011. The City's shoreline reaches are described in detail in Section 4.

2.1.2 Data Sources

Local, regional, state and federal agency data sources, maps, and technical reports were reviewed to compile this shoreline inventory and characterization. Information pertaining to watershed conditions and ecosystem-wide processes was reviewed, as well as data on the land use patterns and ecological conditions of the City's shorelines. Appendix A provides a summary of the data sources and maps utilized in this shoreline inventory and characterization. Additional reference materials are described in Section 5, References.

2.1.3 Inventory and Characterization Approach

The analysis of ecosystem-wide processes was based on available information and reports that describe WRIA 28. The purpose of the ecosystem-wide characterization is to identify key processes and aquatic resource functions in the watershed that affect the City's shorelines. This information can then be used to determine the extent to which the City's shorelines are affected by processes affecting areas located outside its jurisdiction, and identify strategies and potential opportunities for protecting and restoring these areas.

The inventory and characterization of the City's shoreline reaches was based on available data and information, including land use, zoning, water quality, priority habitats and species (PHS), and shoreline modifications. A site visit was conducted to verify this information to the extent feasible.

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3.0 Ecosystem-wide Profile

3.1 Introduction

The SMA requires local jurisdictions to consider the ecosystem-wide processes and conditions that affect the ecological functions of the shorelines within their jurisdiction. This section of the shoreline inventory and characterization describes conditions and process that occur throughout the watershed in which the City's shorelines are located.

3.2 Watershed Overview

The City is located within the Salmon/Washougal WRIA 28. WRIA 28 is divided into subbasins; the City is located within the Lower Columbia Tributaries subbasin.

The Lower Columbia Tributaries subbasin has a drainage area of approximately 85 square miles and includes several relatively small creeks (HDR/EES 2006). The watershed is approximately 87 percent forested.

The topography is relatively steep because most of the subbasin is within the Columbia River Gorge. There are only a small amount of low gradient stream reaches in the subbasin; the gradients quickly become too steep for fish to migrate (HDR/EES 2006).

The climate is similar to most of Western Washington and is generally characterized by mild, wet fall to spring months, and cool, dry summer months. The average monthly precipitation ranges from less than two inches in July and August up to 12 more than inches in December and January (WRCC 2011).

The Lower Columbia Tributaries subbasin was highlighted in the Watershed Management Plan for WRIA 28 (HDR/EES 2006) as playing an important role in salmon recovery efforts. Priority actions identified by in the plan for this subbasin include (HDR/EES 2006):

- Restoring floodplain function, riparian conditions, and stream habitat diversity,
- Using available planning tools (e.g., GMA, comprehensive planning, zoning, best management practices, etc.) managing growth and development to protect watershed processes and habitat conditions. This includes limiting the effects of conversion of agricultural and timber lands to developed uses,
- Managing forests to restore watershed processes,
- Restoring passage at culverts and other artificial barriers,
- Addressing immediate risks with short term habitat fixes,
- Aligning hatchery priorities with conservation objectives, and
- Reducing out-of-subbasin impacts.

3.2.1 Fish and Wildlife

A number of fish and wildlife species use the shorelines in the Lower Columbia River Tributaries subbasin for habitat. These habitats occur in both the aquatic and terrestrial portions of the basin. This section describes some of the key habitats and the ecological functions they provide.

3.2.1.1 InStream and Riparian Habitat

The most basic functions of an aquatic area are the storage, purification, or transport of water. They also function as habitat for a large number of plants and animals. The

1 Columbia River, its tributaries, and their associated wetlands support anadromous salmon
2 and other aquatic life. Chinook salmon (*Oncorhynchus tshawytscha*), chum salmon
3 (*Oncorhynchus keta*), coho salmon (*Oncorhynchus kisutch*), steelhead (*Oncorhynchus*
4 *mykiss*), bull trout (*Salvelinus confluentus*), coastal cutthroat trout (*Oncorhynchus clarkii*
5 *clarkia*), Pacific eulachon (*Thaleichthys pacificus*), Pacific lamprey (*Lampetra tridentata*)
6 are documented to utilize the rivers and streams of WRIA 28 (Wade 2001; WDFW 2011;
7 NMFS 2010).

8 Natural flow regime in the subbasin has been altered at lower reaches by the construction
9 of Bonneville Dam, railroad, and roadway. Pool frequency in the Columbia River
10 tributaries are generally limited within most of the reaches according to the stream
11 surveys conducted by USFS from 1994 through 1998. Substrate is primarily gravel with
12 cobbles and boulders. A large amount of fine sediments are also observed in some of the
13 reaches that are adjacent to roadways (Wade 2001).

14 Riparian areas are the zones where aquatic and terrestrial ecosystems interact. Riparian
15 vegetation provides habitat for many species of wildlife, and streamside or shoreline
16 vegetation provides habitat functions for streams and fish, such as shade, bank stability,
17 sediment/nutrient filtering, and organic nutrient input.

18 Riparian corridor continuity is particularly important in smaller headwater streams because
19 smaller streams generally make up most of the stream length within a watershed, and the
20 influence of riparian vegetation on some stream habitat functions is greater for small
21 streams (Binford and Bucheneau 1993; Wenger 1999; Beschta et al. 1987). Such areas
22 upstream of fish-bearing waters help determine water quality, the magnitude and timing of
23 flows, stream temperature, sediment loads, nutrient inputs, and prey production in
24 downstream waters.

25 Large woody debris (LWD) in streams influences coarse sediment storage, creates
26 hydraulic heterogeneity, moderates flow disturbances, provides cover, and contributes to
27 overall channel complexity. LWD traps and accumulates sediment, small woody debris,
28 and other organic matter (Bilby 1981). The complex, submerged structure formed by LWD
29 and entrapped smaller woody debris provides flow refugia and essential cover in which
30 salmonids conceal themselves from predators and competitors and find profitable feeding
31 positions, as inferred from observations under both natural and laboratory conditions
32 (McMahon and Hartman 1989; Fausch 1984). The removal of riparian forest reduces
33 woody debris in streams, which in turn leads to adverse changes in channel and habitat-
34 forming processes (Heifetz et al. 1986; McDade et al. 1990; Van Sickle and Gregory
35 1990; Bilby and Ward 1991).

36 According to the Conservation Commission's Limiting Factor Analysis (LFA) Report
37 (2001), riparian habitat along lower reaches of the streams in the project subbasin is
38 considered poor or unknown. LWD in the Lower Columbia River tributaries are relatively
39 infrequent. Areas where LWD surveys have been conducted indicated that LWD levels
40 are low, especially in the lower reaches, and the near-term recruitment potential is also
41 low because of the lack of woody vegetation along the riparian corridor (Wade 2001).

42 **3.2.1.2 Wetlands**

43 The USACE (Federal Register 1982 and 1986) and the SMA define wetlands as "areas
44 that are inundated or saturated by surface or ground water at a frequency and duration
45 sufficient to support, and that under normal circumstances do support, a prevalence of
46 vegetation typically adapted for life in saturated soil conditions."

1 Wetlands potentially perform a variety of unique physical, chemical, and biological
2 functions which are beneficial for both the human and biological environment (NRC 1995;
3 Brinson and Rheinhardt 1996). These functions include flood storage and retention,
4 stream base flow maintenance and ground water support, improving water quality,
5 shoreline protection, and biological support for fish and wildlife habitat (Null et al. 2000;
6 Adamus et al. 1987; Hruby et al. 1999).

7 Existing wetlands in the subbasin are primarily associated with streams including the
8 Columbia River and its tributaries. According to the NWI map, common wetlands found
9 within the subbasin are palustrine and riverine wetlands (Cowardin et al. 1979) and are
10 shown in Figures 3 – 5.

11 **3.2.1.3 Terrestrial Habitat**

12 Other habitat sources within the subbasin include terrestrial forests. The lower Columbia
13 River Tributaries subbasin is located within the western hemlock forest zone of the Puget
14 Trough province described in *Natural Vegetation of Oregon and Washington* (Franklin and
15 Dyrness 1988). Western hemlock and western red cedar are the dominant upland forest
16 species in this zone, although Douglas fir is also very common. Forests provide breeding,
17 feeding, and migration areas for a wide variety of wildlife species including, but not limited
18 to, black bear, deer, elk, coyote, and many rodents as well as a various species of
19 amphibians and reptiles (Marriott et al. 2002). Within the subbasin, relatively undisturbed
20 vegetation exists on the north side of Highway 14.

21 Many of the terrestrial species also rely on shorelines and their associated wetlands for
22 breeding, rearing, foraging, and migration habitat. The lower Columbia River is one of the
23 most important migratory corridors for shorebirds known as the Pacific Flyway, and many
24 wildlife refuges are located along the Columbia River that provide feeding and resting
25 areas for wintering waterfowl (Marriott et al. 2002).

26 The WDFW maintains a spatial database of PHS in the state of Washington. Priority
27 habitats are those habitat types or elements with unique or significant value to a diverse
28 assemblage of species. Priority species require protective measures for their population
29 status, sensitivity to habitat alteration, and/or recreational, commercial, or tribal
30 importance (WDFW 2011). Priority species include state endangered, threatened,
31 sensitive, and candidate species; animal aggregations considered vulnerable; and those
32 species of recreational, commercial, or tribal importance that are vulnerable.

33 Priority wildlife habitats mapped in the City and the adjacent areas include wetlands,
34 riparian areas, oak woodlands, herbaceous bald, and talus slopes/cliffs. The PHS
35 database also identifies priority species within the City and adjacent areas such as bald
36 eagle (*Haliaeetus leucocephalus*), great blue heron (*Ardea herodias*), osprey (*Pandion*
37 *haliaetus*), peregrine falcon (*Falco peregrinus*), and western toad (*Bufo boreas*) (WDFW
38 2011).

39 **3.2.2 Land Use, Demographics, and Land Ownership**

40 The land uses within the Lower Columbia Tributaries subbasin are predominantly rural in
41 nature. The large majority of the subbasin is forested. Approximately 80 percent of the
42 County's land area is comprised of the Gifford Pinchot National Forest or the Mount St.
43 Helens National Monument.

44 Skamania County had a population of 11,066 in 2010; the large majority of the population
45 lives in unincorporated areas (U.S. Census 2011; OFM 2011). The population of the City
46 of North Bonneville is 956 (OFM 2011).

1 Future development in the subbasin will likely occur along Highway 14, but the population
2 of this subbasin is anticipated to remain small due in large part to the location of the
3 subbasin within the Columbia River Gorge National Scenic Area (HDR/EES 2006).
4 Because of the National Scenic Area status, and due to the physical constraints of the
5 gorge itself, future development is expected to be quite limited in this area (HDR/EES
6 2006). Specifically, most growth will be confined to the few urban areas in the County,
7 including North Bonneville and the neighboring town of Stevenson.

8 Much of the land area in the subbasin and County is federally managed, either as part of
9 the Gifford Pinchot National Forest, the Columbia River Gorge National Scenic Area, the
10 Franz Lake National Wildlife Refuge, or areas related to operation of the Bonneville Lock
11 and Dam. Approximately 80 percent of the County's land area is federally exempt
12 (Skamania County 2011). The City also owns a substantial amount of land within the City
13 limits. Figure 2 shows the land ownership within the City and its shoreline jurisdiction.

14 **3.3 Ecosystem Processes and Alterations**

15 **3.3.1 Hydrology**

16 The construction of railroad and roads (e.g., Highway 14) has created alterations to the
17 lower reaches of streams in the Lower Columbia Tributaries subbasin. In addition, the
18 operation of Bonneville Dam and other Columbia River dams upstream of the project area
19 have altered the natural flow regime in the subbasin (Wade, 2000, cited in HDR/EES
20 2006). The entire subbasin is considered to be likely impaired hydrologically with respect
21 to peak flows because of immature forest cover (Wade 2001). However, the WRIA 28
22 Limiting Factors Analysis indicated that low flows are the more significant issue in the
23 subbasin, specifically in Woodward, Hamilton, Hardy, and Duncan Creeks (Wade 2001).

24 There is a limited amount of low gradient floodplains in this subbasin. The naturally steep
25 tributaries, Highway 14, railroads, and development have reduced or eliminated many
26 floodplains in the subbasin (HDR/EES 2006). The 28 Watershed Management Plan
27 recommended that low flow and habitat limitations could be improved by restoring natural
28 channel processes and sediment transport affected by Highway 14 and the railroad
29 (HDR/EES 2006).

30 **3.3.2 Water Quality**

31 The federal CWA requires that each state identify its polluted waterbody segments and
32 submit a list of these water quality limited estuaries, lakes, and streams to the USEPA.
33 Waterbodies that are found to be impaired are documented in Ecology's 303(d) list and
34 the Washington Water Quality Assessment Report. The primary vehicle for achieving
35 compliance with State criteria for surface water quality is Ecology's Total Maximum Daily
36 Load (TMDL) program.

37 The 2008 303(d) list does not identify any impaired waterbodies in the Lower Columbia
38 Tributaries subbasin; however, the Columbia River is listed at several locations in the
39 vicinity of the City for temperature (Ecology 2011).

40 **3.4 Summary of Ecosystem Conditions**

41 *This section is still under development.*

Figure 2. Land Ownership in the Preliminary Shoreline Jurisdiction

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4.0 Reach Inventory and Analysis

4.1 Reach 1 – Lower Hamilton Creek and Floodplain

4.1.1 Reach Summary

Reach 1 contains the downstream portion of Hamilton Creek from south of the railroad to the southern city boundary and the 100-year floodplain area associated with the Columbia River within the city boundary. As shown in Figure 3 the floodplain area in Reach 1 is bounded by the railroad to the north and the city boundary to the west. This reach contains 287 acres in shoreline jurisdiction and 2.5 miles of shoreline.

4.1.2 Physical Characterization

Hamilton Creek is one of the largest and most productive drainage systems in the Lower Columbia River Tributaries subbasin. Hamilton Creek originates near Three Corner Rock, a mountain pillar located in Skamania County. The creek flows south for approximately 8 miles and drains into the Columbia River at River Mile (RM) 143. Hamilton Creek has two named tributaries (Greenleaf Creek and Cedar Creek) and a number of smaller tributaries.

Within Reach 1, Hamilton Creek runs for approximately 1.4 miles from the railroad, flowing through the residential area and open space. The Columbia River 100-year floodplain is also encompassed by shoreline jurisdiction and included in this reach. Within the floodplain area, Hardy Creek runs near the western city boundary and enters the Columbia River at RM 142.

The reach is relatively flat and separated from upstream, steeper gradient reaches by the railroad. Soils within the reach are primarily composed of McBee silt loam, Pilchuck very fine sandy loam, and Arents, 0 to 5 percent slopes (USDA NRCS 2011). According to the 2008 Washington State Water Quality Assessment (Ecology 2011), Hamilton Creek and Hardy Creek are not listed on the Category 5 [303(d)] list. However, the upstream reach of Hamilton Creek outside of the City limits has been listed as a Category 2 (water of concern) for temperature.

4.1.3 Biological Resources and Critical Areas

Wetlands

According to the NWI, most wetlands are located along Hamilton Creek and Hardy Creek within Reach 1. Areas along Hamilton Creek are primarily mapped as wetlands for most of the length of the stream. Wetlands found in this reach are typically riverine wetlands with palustrine emergent, scrub-shrub, and forest habitat types. There are approximately 31 acres of wetlands that are mapped by NWI within Reach 1. Wetlands along both streams likely support aquatic habitat by providing sources of food, shelter, and refuge.

Fish and Wildlife Habitat Areas

The City's critical area map classifies Hamilton Creek and Hardy Creek as fish bearing (Type F) streams. According to the PHS data, lower Hamilton Creek and Hardy Creek in Reach 1 support fall Chinook, coho, and chum salmon, summer/winter steelhead, and resident cutthroat (WDFW 2011). Lower reaches of Hamilton Creek were reported to have minimal LWD but have relatively good pool habitat and side channel habitat, which provide good spawning and rearing habitat. Hamilton and Hardy creeks in this reach are also known to support good spawning habitat for chum salmon, and the spawning areas have been monitored by USFWS and WDFW personnel every year (Wade 2001). Pacific

1 lamprey and western toad are also reported to be present in and/or near Hardy Creek
2 (WDFW 2011).

3 No bald eagle nests are located within the City limit; however, they are located in the
4 vicinity along the Columbia River, and bald eagles likely use the area as foraging habitat.
5 The PHS map also identifies the majority of the reach as the bald eagle regular
6 concentration and wintering area (WDFW 2011).

7 The western portion for Reach 1 is located within Pierce National Wildlife Refuge, which is
8 a 329-acre of a wildlife sanctuary along the north shore of the Columbia River. The refuge
9 provides wintering habitat for waterfowl such as Canada geese, ducks, and other aquatic
10 birds. Wetlands within the refuge provide habitat for western pond turtles as well.

11 **Geologically Hazardous Areas**

12 Geological hazard areas are areas “that because of the susceptibility to erosion, sliding,
13 earthquake, or other geological events, are not suited to siting commercial, residential, or
14 industrial development consistent with public health or safety concerns”(NBMC
15 21.10.020). Geological hazard areas include erosion, landslide, mine, seismic, and
16 volcanic hazard areas. According to the City of North Bonneville Critical Areas Map, there
17 are no geological hazardous areas mapped within this reach.

18 **Frequently Flooded Areas**

19 Frequently flooded areas are defined in the City of Bonneville Municipal Code as
20 “floodplains and other areas subject to a one (1.0) percent or greater chance of flooding in
21 any given year (NBMC 21.10.020). These areas are typically identified on the Federal
22 Emergency Management Agency (FEMA) flood insurance rate maps as the 100-year
23 floodplain. Within Reach 1, the 100-year floodplain of the Columbia River extends up to
24 the highway. The 100-year floodplain of the lower portion of Hamilton Creek is primarily
25 confined to the river channel. Residential houses are located adjacent to the floodplain
26 area,

27 **Critical Aquifer Recharge Areas**

28 According to the City’s Critical Area Map, there are no critical aquifer recharge areas
29 identified within this reach.

30 **4.1.4 Land and Shoreline Use**

31 Within Reach 1, Hamilton Creek runs through the City center. The City owns much of the
32 land immediately adjacent to the creek; this area is zoned as Open Space Preserve (see
33 Appendix A for zoning map). Beyond this open space, several public facilities are located
34 to the east of Hamilton creek, including City Hall, the library, post office, public parks, and
35 a senior living facility. The City’s central business district is also located to the east of
36 Hamilton Creek, outside of the shoreline jurisdiction. Two commercial properties adjacent
37 to a gas station and convenience store are located within the shoreline jurisdiction near
38 Hamilton Creek just below the railroad bridge crossing. There are also single family
39 residential areas located to the east and west of Hamilton Creek, with a few parcels
40 located within the shoreline jurisdiction.

41 The portion of Reach 1 located to the west in the Columbia River floodplain is located
42 almost entirely within the Pierce National Wildlife Refuge. This area is federally owned
43 and managed. The portion of this floodplain area that is outside the refuge is zoned by
44 the City for Commercial Recreation, and is part of the Beacon Rock Golf Course.

1 Cascade Drive generally follows along the west side of Hamilton Creek and then crosses
2 the creek to allow access to the residential areas on the west side of the creek. At the
3 bridge crossing there is informal public access to the Creek on either side of the bridge.
4 The heritage trail system also provides visual access to Hamilton Creek within this reach
5 (see Appendix A for Heritage Trails Map). Pierce National Wildlife Refuge is closed to the
6 general public.

7 There are no known archaeological or historic resources within this reach.

8 **4.1.5 Restoration Opportunities**

9 *This section is still under development.*

10 The Habitat Limiting Factors Report (2001) suggested protecting chum spawning areas in
11 Hamilton and Hardy Creeks, and restoration activities have been completed in 2011 by
12 Lower Columbia Fish Enhancement Group (LCFEG). LCFEG was awarded a grant to
13 restore a portion of the lower Hamilton Creek located immediately downstream from the
14 railroad bridge. This restoration project added log jams in the stream channel to create
15 pools and a branching island network, as well as to sort spawning gravels and stabilize
16 eroding banks. Native woody species were also planted along the channel to increase
17 shade, help stabilize the stream bank, and promote recruitment of woody debris. Ongoing
18 maintenance and monitoring for controlling non-native species such as Himalayan
19 blackberry and red canarygrass would be recommended in this area.

20 Although some properties are privately owned, the remainder of this reach is relatively
21 well vegetated. The Pierce Wildlife National Refuge will continue to protect this area, and
22 protection and enhancement of the rest of the open space would further help maintain
23 good quality of refuge habitat for juvenile salmonids as well as other wildlife.

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Figure 3. Lower Hamilton Creek and Floodplain (Reach 1)

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4.2 Reach 2 – Greenleaf Lake

4.2.1 Reach Summary

Reach 2 consists of Greenleaf Lake from the confluence of Greenleaf Creek to the confluence of Hamilton Creek and a downstream portion of Carpenter Creek. Figure 4 identifies this reach. The shoreline jurisdiction of Carpenter Creek extends 2,100 feet upstream from the confluence of Greenleaf Lake. The Greenleaf Lake shoreline is approximately 150 acres in size and includes approximately 3,100 feet of shoreline.

4.2.2 Physical Characterization

Greenleaf Lake is a slough-like lake located downstream of Greenleaf Creek and was likely an overflow channel for the Columbia River that was disconnected as a result of the construction of Bonneville Dam (Wade 2001). Because of the modification, flow within the lake is sluggish, likely contributing increase in water temperature.

Soils within the reach include: Pilchuck very fine sandy loam, Bonneville stony sandy loam, and Steever stony clay loam, 30 to 65 percent slopes (USDA NRCS 2011). According to the 2008 Washington State Water Quality Assessment (Ecology 2011), Greenleaf Lake and Carpenter Creek are not listed on the Category 5 [303(d)] list.

4.2.3 Biological Resources and Critical Areas

Wetlands

Within the Greenleaf Lake reach, there are approximately 42 acres of riverine wetlands that are associated with Greenleaf Lake and Carpenter Creek according to the NWI. Wetlands found in this reach generally include palustrine emergent, scrub-shrub, and forest habitat types. Wetlands located along Greenleaf Lake and Carpenter Creek likely support aquatic habitat by providing sources of food, shelter, and refuge.

Fish and Wildlife Habitat Areas

The City's critical area map classifies Greenleaf Lake and Carpenter Creek as fish bearing (Type F) streams. Greenleaf Lake provides a transportation corridor and rearing habitat for coho and chum salmon, steelhead, rainbow trout, and resident cutthroat, and Carpenter Creek is documented to support resident cutthroat. However, the potential for rearing habitat in the lake is limited by resident bass and other predator species.

The PHS data and the City's critical area map also identify oak woodlands at the confluence of Carpenter Creek with Greenleaf Lake. The habitat is approximately 27 acres in size. Oregon white oak (*Quercus garryana*), the only native oak present in Washington, is known to provide habitat for a variety of birds, mammals, reptiles, and amphibians, as well as providing aesthetic, economic, and recreational values to the Washington citizens (Larsen and Morgan 1998). Distribution of Oregon white oak woodland is known to be limited and declining due to conversion to agriculture and urban and suburban development (Larsen and Morgan 1998; Vesely and Rosenberg 2010).

Geologically Hazardous Areas

According to the City's Critical Areas Map, Reach 2 includes approximately 13 acres of geologic hazard areas that are located north of Cascade Drive.

Flood Hazard Areas

The mapped floodplain for Greenleaf Lake is relatively narrow and confined to the channel.

Critical Aquifer Recharge Areas

According to the City's Critical Area Map, there are no critical aquifer recharge areas identified within this reach.

4.2.4 Land and Shoreline Use Patterns

The north shoreline of Greenleaf Lake and the portion of Carpenter Creek included in the shoreline jurisdiction are bordered by mostly private property, with the exception of the easement for the BPA transmission line that crosses the lake. Existing land use is primarily residential. Most of property on the north shoreline of the lake is zoned for Commercial Recreation, with some parcels zoned for Single Family Residential at the east end of the lake.

On the south shoreline of Greenleaf Lake, the City owns approximately one third of the land within the shoreline jurisdiction; this area is zoned as Open Space. A similar portion of the south shoreline toward the east end of the lake is federally owned and occupied by BPA substation. There are also private residential lots located on the south shoreline toward the west end of the lake. This area is zoned for Mixed Use.

The City owns a parcel at the eastern end of Greenleaf Lake which is used as a boat launch and for access for fishing in the lake. This parcel provides the primary public access point to Greenleaf Lake. The heritage trail system also provides access to the boat launch (see Appendix A for Heritage Trails Map).

There is a known archaeological site near the eastern end of this reach. It is possible that some portion of this site may extend into the shoreline jurisdiction.

4.2.5 Restoration Opportunities

This section is still under development.

There are no proposed restoration sites along the Greenleaf Lake. Because most properties within this reach are privately owned and occupied, opportunities for restoration are limited without property owner's involvement or property acquisition. Conservation or restoration activities, especially for oak woodlands areas, would be recommended through a community education and incentive program to inform property owners on ways to minimize impacts to fish and wildlife habitat areas or enhance the reach with native landscaping and invasive species removal.

Figure 4. Greenleaf Lake, Upper Hamilton Creek, and Greenleaf Creek (Reaches 2, 3, and 4)

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4.3 Reach 3 – Upper Hamilton Creek

4.3.1 Reach Summary

Reach 3 includes the upper Hamilton Creek area extending upstream from the confluence of Greenleaf Lake to the northern city boundary (Figure 4). The Upper Hamilton Creek reach contains approximately 18 acres in shoreline jurisdiction and 2,070 feet of shoreline, primarily between the BPA transmission line and the railroad.

4.3.2 Physical Characterization

This reach of Hamilton Creek has been diked and disconnected from its floodplain due to the surrounding development. Historically, alterations of the stream channel and riparian conditions upstream of the highway have caused accumulation of sediments and large bedloads. In the late 1970's, containment levees were constructed along Hamilton Creek upstream from the railroad bridge (LCFEG 2010). According to the Habitat Limiting Factors Report (2001), there are over 17 miles of roadways located adjacent to streams, which are also likely the cause of fine sediment inputs downstream. The stream channel in this reach has historically been dredged to prevent downstream flooding (LCFEG 2010). In addition, culverts along SR 14 and the railroad restrict the movement of coarse sediments downstream. Sedimentation presents an ongoing threat to infrastructure in this reach.

Hamilton Creek is one of the tributaries of the Columbia River that are intermittent or have subsurface flow during summer months (Wade 2001). During the site visit, no surface water was observed within this reach of Hamilton Creek.

Soils within the reach are primarily Bonneville stony sandy loam (USDA NRCS 2011). According to the 2008 Washington State Water Quality Assessment (Ecology 2011), Hamilton Creek is not listed on the Category 5 [303(d)] list. However, the upstream reach of Hamilton Creek outside of the City limits has been listed as a Category 2 (water of concern) for temperature.

4.3.3 Biological Resources and Critical Areas

Wetlands

No wetlands are identified within this reach.

Fish and Wildlife Habitat Areas

The City's critical area map classifies Hamilton Creek as a fish bearing (Type F) stream. Hamilton Creek in Reach 3 provides rearing habitat for Chinook, coho, and chum salmon, steelhead, and resident cutthroat. No other priority habitat or species are identified in this reach.

Geologically Hazardous Areas

According to the City's Critical Areas Map, Reach 3 includes approximately 0.8 acre of geologic hazard areas that are located on the east bank of the stream channel and north of the transmission line corridor.

Flood Hazard Areas

There are no flood hazard areas mapped within this reach.

1 **Critical Aquifer Recharge Areas**

2 According to the City's Critical Area Map, there are no critical aquifer recharge areas
3 identified within this reach.

4 **4.3.4 Land and Shoreline Use Patterns**

5 The upper portion of Hamilton Creek runs through mostly private land, with one shoreline
6 parcel at the northern end of the reach owned by Skamania County. Most of the land in
7 this reach is zoned for Commercial Recreation; the County parcel is zoned for
8 Industrial/Business Park and is located in the developed industrial area outside the
9 shoreline (see Appendix A for zoning map). A recreational vehicle park is located
10 adjacent to the shoreline.

11 The reach extends to Evergreen Drive and the railroad bridge crossings to the south. At
12 the Evergreen Drive bridge crossing there is informal public access to the Creek on either
13 side of the bridge. The heritage trail system also provides visual access to Hamilton Creek
14 within this reach (see Appendix A for Heritage Trails Map).

15 There are no known archaeological or historic resources within this reach.

16 **4.3.5 Restoration Opportunities**

17 *This section is still under development.*

18 Some of the conditions in this reach are largely caused by factors outside of the City's
19 jurisdiction, which include upstream land use and alterations to hydrology. However,
20 potential opportunities for restoration in reach 3 are still available within the City, which
21 include, but are not limited to, restoring riparian buffer with native trees and shrubs and
22 remove non-native species.

23 **4.4 Reach 4 – Greenleaf Creek**

24 **4.4.1 Reach Summary**

25 Reach 4 extends from the northern city boundary along Greenleaf Creek to the confluence
26 of Greenleaf Lake (Figure 4). This reach contains approximately 31 acres in shoreline
27 jurisdiction and approximately 2,600 feet of shoreline. Reach 4 contains a forested
28 riparian corridor with relatively good pool habitat and substrate conditions.

29 **4.4.2 Physical Characterization**

30 Greenleaf Creek originates near Greenleaf Peak and Table Mountain located in Skamania
31 County. The creek flows south for approximately 2.8 miles and enters Greenleaf Lake.
32 Several small lakes outside the City limits drain to Moffet Creek, which is tributary to
33 Greenleaf Creek. Within Reach 4, Greenleaf Creek runs for approximately 2,600 feet
34 from the northern City limits.

35 Soils within the reach are primarily stony clay loam, 2 to 30 percent slopes (USDA NRCS
36 2011). Steep slopes occur upstream of the City limits, where Greenleaf Creek crosses a
37 series of falls before entering the City; the falls present a natural fish passage barrier.
38 According to the 2008 Washington State Water Quality Assessment (Ecology 2011),
39 Greenleaf Creek is not listed on the Category 5 [303(d)] list.

4.4.3 Biological Resources and Critical Areas

Wetlands

Within Reach 4, there are approximately 21 acres of riverine wetlands that are associated with Greenleaf Creek according to the NWI. Wetlands found in this reach are typically forest habitat types and likely support habitat for salmonid species that utilize Greenleaf Creek in this reach.

Fish and Wildlife Habitat Areas

The City's critical area map classifies Greenleaf Creek as a fish bearing (Type F) stream. Greenleaf Creek provides rearing habitat for coho and chum salmon, steelhead, rainbow trout, and resident cutthroat. No other priority habitat or species are identified in this reach.

Geologically Hazardous Areas

There are no geological hazardous areas mapped within this reach.

Flood Hazard Areas

The 100-year floodplain of Greenleaf Creek extends approximately 1,800 feet upstream from the confluence of Greenleaf Lake. It is relatively confined to the stream channel.

Critical Aquifer Recharge Areas

According to the City's Critical Area Map, there are no critical aquifer recharge areas identified within this reach.

4.4.4 Land and Shoreline Use Patterns

Greenleaf Creek runs through private land that is zoned primarily for Commercial Recreation; one small area on the east side of the creek is zoned for Single Family Residential (see Appendix A for zoning map). Bonneville Hot Springs Resort is located near the north end of this reach.

East Cascade Drive crosses Greenleaf Creek near Bonneville Hot Springs Resort. At the bridge crossing there is informal public access to the creek on either side of the bridge. The heritage trail system also provides visual access to Greenleaf Creek within this reach (see Appendix A for Heritage Trails Map).

There are no known archaeological or historic resources within this reach.

4.4.5 Restoration Opportunities

This section is still under development.

Similar to Reach 2, most properties within the Greenleaf Creek reach are privately owned. Therefore, opportunities for restoration are limited in this reach without property owner's involvement or property acquisition. Conservation or restoration activities for in-stream habitat, riparian buffer, and wetlands, would be recommended through a community education and incentive program to inform property owners on ways to minimize impacts to fish and wildlife habitat areas or enhance the reach with native landscaping and invasive species removal.

4.5 Reach 5 – Columbia River

4.5.1 Reach Summary

Reach 5 contains a portion of the Columbia River at the Bonneville Dam (Figure 45). This reach contains approximately 31 acres in shoreline jurisdiction and approximately 1.9 miles of shoreline. Reach 5 is located within the City limit; however, the U.S. Corps of Engineer (USACE) owns and manages the entire reach.

Soils within the reach include: Arents, 0 to 5 percent slopes, Bonneville stony sandy loam, and Steever stony clay loam, 30 to 65 percent slopes (USDA NRCS 2011). According to the 2008 Washington State Water Quality Assessment (Ecology 2011), this portion of the Columbia River listed on the Category 5 [303(d)] list for temperature.

4.5.2 Physical Characterization

The Columbia River is one of the largest rivers in North America, draining 258,000 square miles in Washington and Canada to its mouth on the Pacific Ocean near Astoria, Oregon (NWPC 2011). The portion of the Columbia River that lies within the City is a 4,300-foot stretch between approximately river miles (RM) 145 and 148 at the Bonneville Dam. Figure 5 identifies this reach. Upstream of the dam, the river flows through a gorge, and it opens up to a wide estuary at downstream of the dam.

4.5.3 Biological Resources and Critical Areas

Wetlands

No wetlands are identified within this reach.

Fish and Wildlife Habitat Areas

The Columbia River provides habitat for bull trout, Chinook salmon, chum salmon, coho salmon, sockeye salmon, and Pacific eulachon (NMFS). The Columbia River within the study area is designated critical habitat for all of the anadromous salmonid populations, except for coho salmon. Critical habitat for the lower Columbia River coho salmon has not been designated at this time and is currently under review. These anadromous fish primarily use the Columbia River as rearing and migration. Fall chum salmon are known to spawn in the reach of Columbia River near Ives Island located west of the City (WDFW 2011).

Geologically Hazardous Areas

There are no geological hazardous areas mapped within this reach.

Flood Hazard Areas

Within this reach, the river channel has been significantly altered due to the construction of the Bonneville Dam; therefore, the 100-year floodplain for the Columbia River in this reach is primarily confined to the river channel and does not extend beyond the embankment along the channel.

Critical Aquifer Recharge Areas

According to the City's Critical Area Map, there are no critical aquifer recharge areas identified within this reach.

1 **4.5.4 Land and Shoreline Use Patterns**

2 The land within this reach is entirely federally owned and managed. The USACE
3 operates the Bonneville Lock and Dam and thus would manage any activities associated
4 with the shoreline of the Columbia River located within this reach.

5 There is a visitor center at the dam powerhouse off Highway 14 where the public can view
6 the powerhouse and dam. Visual access is available along Highway 14.

7 There are no known archaeological or historic resources within this reach. The Bonneville
8 Dam is designated a National Historic Landmark.

9 **4.5.5 Restoration Opportunities**

10 *This section is still under development.*

11 As mentioned above, this reach is owned and managed by USACE. Collaboration with
12 the Corps will be required for any conservation or restoration activities in this reach.

13 Currently, there are no known proposed restoration sites along this reach.

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Figure 5. Columbia River (Reach 5)

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1 **4.6 Summary of Ecological Functions, Issues, and Opportunities**

2 **4.6.1 Assessment of Ecological Functions**

3 *This section is still under development.*

4 **4.6.2 Shoreline Management Issues and Opportunities**

5 *This section is still under development.*

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Appendix A: Shoreline Inventory Mapbook and Data Sources

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