FINAL

CITY OF GRANITE FALLS

GRANT NO. 1100006

SHORELINE ANALYSIS REPORT

for City of Granite Falls' Shoreline: South Fork Stillaguamish River and Pilchuck River

Prepared for:

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1 INTRODUCTION

1.1 Background and Purpose

The City of Granite Falls (City) obtained a grant from the Washington Department of Ecology (Ecology) in 2009 to complete a comprehensive Shoreline Master Program (SMP) update. One of the first steps of the update process is to inventory and characterize the City's shorelines as defined by the state's Shoreline Management Act (SMA) (RCW 90.58). This inventory was conducted in accordance with the Shoreline Master Program Guidelines (Guidelines, Chapter 173-26 WAC) and project Scope of Work promulgated by Ecology, and includes all areas within current City limits and the Urban Growth Area (UGA). Under these Guidelines, the City must identify and assemble the most current, accurate and complete scientific and technical information available that is applicable. This shoreline inventory and analysis will describe existing conditions and characterize ecological functions in the shoreline jurisdiction. This will serve as the baseline against which the impacts of future development actions in the shoreline will be measured. The Guidelines require that the City demonstrate that its updated SMP yields "no net loss" in shoreline ecological functions relative to the baseline due to its implementation.

A list of potential information sources was compiled and an information request letter was distributed to potential interested parties and agencies that may have relevant information. Collected information was supplemented with other resources such as City documents, scientific literature, personal communications, aerial photographs, internet data, and a physical inventory of the City's shorelines.

1.2 Shoreline Jurisdiction

As defined by the Shoreline Management Act of 1971, shorelines include certain waters of the state plus their associated "shorelands." At a minimum, the waterbodies designated as shorelines of the state are streams whose mean annual flow is 20 cubic feet per second (cfs) or greater, lakes whose area is greater than 20 acres, and all marine waters. Shorelands are defined as:

> "those lands extending landward for 200 feet in all directions as measured on a horizontal plane from the ordinary high water mark; floodways and contiguous floodplain areas landward 200 feet from such floodways; and all

> wetlands and river deltas associated with the streams, lakes, and tidal waters which are subject to the provisions of this chapter…Any county or city may determine that portion of a one-hundred-year-floodplain to be included in its master program as long as such portion includes, as a minimum, the floodway and the adjacent land extending landward two hundred feet there from… Any city or county may also include in its master program land necessary for buffers for critical areas (RCW 90.58.030)"

The entirety of the South Fork Stillaguamish River and the Pilchuck River within City limits and the UGA are regulated Shorelines. The South Fork Stillaguamish River is considered a Shoreline of Statewide Significance (≥ 1,000 cubic feet per second). Any associated wetlands, designated and mapped floodway, and contiguous floodplains are also to be considered part of shoreline jurisdiction.

The mapping of floodplains and floodways uses the latest information developed by Snohomish County and is in the final stages of review by FEMA. The Pilchuck River and the South Fork Stillaguamish River have floodplains that extend beyond the ordinary high water mark through portions of the City and the UGA. However, neither system has a designated floodway within or adjacent to the City boundary (see Figure 10). Figure 10 depicts the current GIS layer for FEMA Zone A (100-year floodplain) for both the Pilchuck River and South Fork Stillaguamish River. However, Snohomish County Surface Water Management recently prepared a Letter of Map Revision (LOMR) for the Pilchuck River within the City of Granite Falls (see Supplemental Figure D). This LOMR depicts an extended floodplain along the Pilchuck River. Regardless, the proposed shoreline jurisdiction does not include the area of expanded floodplain beyond the minimum 200-foot shoreline jurisdiction (Figure 1).

No associated wetlands are mapped along the jurisdictional boundary of either river system and thus expansion of shoreline jurisdiction beyond the minimum 200-foot jurisdiction is not anticipated. Any future determination of wetland conditions within the shoreline jurisdiction may potentially increase the jurisdictional area beyond the current proposed limits.

1.3 Study Area

The City of Granite Falls is located in Snohomish County, Washington. The City is surrounded by areas of unincorporated Snohomish. The City encompasses approximately 1.7 square miles. The study area for this report includes all land currently within the City's proposed shoreline jurisdiction, as well as relevant discussion of the contributing watershed. The total area subject to the City's updated SMP, not including aquatic area, is approximately 26 acres, and encompasses nearly one mile of shoreline.

2 CURRENT REGULATORY FRAMEWORK SUMMARY

2.1 City of Granite Falls

The Shoreline Management Act of 1971 brought about many changes for local jurisdictions, including the City of Granite Falls. The legislative findings and policy intent of the SMA states:

> "There is, therefore, a clear and urgent demand for a planned, rational, and concerted effort, jointly performed by federal, state, and local governments, to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines (RCW 90.58.020)."

While protecting shoreline resources by regulating development, the SMA is also intended to provide balance by encouraging water-dependent or water-oriented uses while also conserving or enhancing shoreline ecological functions and values. SMPs will be based on state guidelines, but should be tailored to the specific conditions and needs of the local community.

The City has incorporated by reference the Snohomish County Shoreline Management Master Program (as amended in 2006). The City's Comprehensive Plan contains a few policies that apply directly to shorelines; generally, these policies encourage protection of the habitat and water quality associated with the City's shorelines. These policies include:

- NFP7- Preserve and enhance the Pilchuck and South Stillaguamish Rivers as wildlife and vegetation habitats.
- NFP8- Work with other jurisdictions on regional environmental issues such as surface and ground water quality and the maintenance/enhancement of the Stillaguamish and Pilchuck Rivers.
- NFP14- Encourage new development to be compatible with sensitive links in ecological systems such as streams and rivers, aquifers, wetlands, hillsides, and woodlands.

Regulations applicable to critical areas which are located within shoreline jurisdiction were last updated in 2005 consistent with Growth Management Act requirements for use of "best available science." Those regulations specify buffers for the South Fork Stillaguamish River and the Pilchuck River of 150 feet and wetland buffers of up to 100 feet. Floodplain development is also regulated under the City's flood damage prevention regulations (GFMC 19.07.035).

Most of the uses, developments, and activities regulated under the Critical Areas Regulations are also subject to the City's Comprehensive Plan, the City of Granite Falls Municipal Code, the International Building Code, and various other provisions of City, state and federal laws. Any applicant must comply with all applicable laws prior to commencing any use, development, or activity. The City will ensure consistency between the SMP and other City codes, plans and programs by reviewing each for consistency during periodic updates of the City's Comprehensive Plan as required by State statute.

2.2 State and Federal Regulations

State and federal regulations most pertinent to development in the City's shorelines include the federal Endangered Species Act, the federal Clean Water Act, the State Shoreline Management Act, and the State Hydraulic Code. Other relevant federal laws include the National Environmental Policy Act, Anadromous Fish Conservation Act, Clean Air Act, Coastal Zone Management Act, and the Migratory Bird Treaty Act. State laws which address shoreline issues include the Growth Management Act, State Environmental Policy Act, State Clean Water Act (RCW 90.48), tribal agreements and case law, Watershed Planning Act, Water Resources Act, Salmon Recovery Act, and the Water Quality Protection Act. A variety of agencies (e.g., U.S. Army Corps of Engineers, National Marine Fisheries Service, U.S. Fish and Wildlife Service, FEMA, Washington Department of Ecology, Washington Department of Fish and Wildlife) are involved in implementing these regulations, but review by these agencies of shoreline development in most cases would be triggered by in- or over-water work, discharges of fill or pollutants into the water, or substantial land clearing. Depending on the nature of the proposed development, state and federal regulations can play an important role in the design and implementation of a shoreline project, ensuring that impacts to shoreline functions and values are avoided, minimized, and/or mitigated. With the comprehensive SMP update, the City will strive to ensure that Granite Falls' SMP regulations are consistent with other State and Federal requirements and explore ways to streamline the shoreline permitting process. A summary of some of the key regulations and agency responsibilities follows.

Section 10: Section 10 of the federal Rivers and Harbors Appropriation Act of 1899 provides the U.S. Army Corps of Engineers (Corps) with authority to regulate activities that may affect navigation of "navigable" waters. Neither the South Fork Stillaguamish River nor the Pilchuck River is a designated navigable waterbody in the City of Granite Falls. Accordingly, proposals do not need to be reviewed and approved for a Section 10 permit.

Section 404: Section 404 of the federal Clean Water Act provides the Corps, under the oversight of the U.S. Environmental Protection Agency, with authority to regulate "discharge of dredged or fill material into waters of the United States, including wetlands" (http://www.epa.gov/owow/wetlands/pdf/ reg_authority_pr.pdf). The extent

of the Corps' authority and the definition of fill have been the subject of considerable legal activity. As applicable to the City of Granite Falls' shoreline jurisdiction, however, it generally means that the Corps must review and approve most activities in streams and wetlands. These activities may include wetland fills, stream and wetland restoration, and culvert installation or replacement, among others. Similar to SEPA requirements, the Corps is interested in avoidance, minimization, restoration, and compensation of impacts.

Federal Endangered Species Act (ESA): Section 9 of the ESA prohibits "take" of listed species. Take has been defined in Section 3 as: "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." The take prohibitions of the ESA apply to everyone, so any action of the City that results in a take of listed fish or wildlife would be a violation of the ESA and exposes the City to risk of lawsuit. Per Section 7 of the ESA, activities with potential to affect federally listed or proposed species and that either require federal approval, receive federal funding, or occur on federal land must be reviewed by the National Marine Fisheries Service (NOAA Fisheries) and/or U.S. Fish and Wildlife Service (USFWS) via a process called "consultation."

Section 401 Water Quality Certification: Section 401 of the federal Clean Water Act allows states to review, condition, and approve or deny certain federal permitted actions that result in discharges to state waters, including wetlands. In Washington, the Department of Ecology is the state agency responsible for conducting that review, with their primary review criteria of ensuring that state water quality standards are met. Actions within streams or wetlands within the shoreline zone that require a Section 404 permit (see above) will also need to be reviewed by Ecology.

Hydraulic Code: Chapter 77.55 RCW (the Hydraulic Code) gives the Washington Department of Fish and Wildlife (WDFW) the authority to review, condition, and approve or deny "any construction activity that will use, divert, obstruct, or change the bed or flow of state waters." As applicable to the City of Granite Falls' shoreline jurisdiction, however, it generally means that WDFW must review and approve most activities in both the South Fork Stillaguamish River and the Pilchuck River. These activities may include bank stabilization, stream alteration, and culvert installation or replacement, among others. WDFW can condition projects to avoid, minimize, restore, and compensate adverse impacts.

3 ELEMENTS OF THE SHORELINE INVENTORY & SPECIFIC CONDITIONS

3.1 Introduction

Development of a shoreline inventory is intended to record the existing or baseline conditions upon which the development of shoreline master program provisions will be examined to ensure the adopted regulations provide no net loss of shoreline ecological functions. At a minimum, local jurisdictions shall gather the inventory elements listed in the Guidelines, to the extent information is relevant and readily available. Table 1 lists those relevant inventory elements for which data is available for the City's shorelines. Areas of data gaps are listed in Section 3.3. The table also describes the information collected for each of the required inventory elements. Figures depicting the various inventory pieces listed in Table 1 are provided in Appendix A.

Table 1. Shoreline Inventory Elements and Information Sources.

Inventory Element	Information Gathered	Data Sources	Map Location
Land Use Patterns	• Zoning, current land use, and future land use, transportation	• City • County	• Figures 2, A, and B
Utilities	• Streams, stormwater facilities and pipes • Sanitary Sewer Force Mains and Gravity sewer lines	• City	• Figures 3 and 4
Impervious Surfaces	• General impervious surface from 2001 aerial photo interpretation at 30-m resolution • Commercial and multi-family buildings, streets	• City • USGS	• Figure 5
Public Access Areas	• Parks and open spaces	• City • County	• Figure 12
Soils	• Soil types	• USDA NRCS (SSURGO)	• Figure 7
Floodplains & Wetlands	• Floodplains • Wetlands	• City • County • FEMA • WDFW	• Figures 8, 10, and D
Geologic Hazards	• Seismic Hazard Areas • Liquifaction • Landslides	• City • WDNR	• Figure C
WDFW Priority Habitats & Species	• Priority fish, priority wildlife, priority habitats	• WDFW	• Figure 9

Inventory Element	Information Gathered	Data Sources	Map Location
Vegetation	• Terrestrial vegetation type and land cover	• NOAA CCAP	• Figure 6
Water quality impairment	• 303(d) waters and regulated sites	• Ecology	• Figure 11
Topography	• LIDAR	• Puget Sound LIDAR Consortium	• Figure 8
Channel migration zone	• Snohomish County "Rivers subject to channel migration"	• Snohomish County	• Map 8A (Snohomish County SMP)
Shoreline armoring	• Aerial imagery	• Google	• NA
Archeological and historical sites	• Historical and archeological sites	• DAHP	• NA[1]
Opportunity areas	• Hazardous sites	• Ecology	• NA[2]

[1] The Granite Falls Bridge over the South Fork Stillaguamish River was built in 1934 and identified in the Snohomish County Cultural Resource Inventory as significant as a Depression era bridge.

[2] No known hazard sites were found within the shoreline jurisdictional area.

3.2 Assessment Unit Conditions

In order to break down the shoreline into manageable units and to help evaluate differences between discrete shoreline areas, the City's shorelines have been divided into assessment units based on biological character, dominant land use, and location as follows and as illustrated on Figure 1 in Appendix A.

1. South Fork Stillaguamish River
2. Pilchuck River

Table 2 expands upon the relevant above required inventory elements, providing specific detail and data for each of the assessment units.

Table 2. Summary of Inventory by Assessment Unit.

Assessment Unit	Dimensions	Land Use Patterns	Land Cover	Water Quality[1]	Public Access (Park & Open Space)	Priority Habitats and Species
South Fork Stillaguamish River	• 8.18 acres • 1,616 linear feet of shoreline	**Zoning Type:** • Low Density Residential (100%) **Current Land Uses:** • 1 parcel • 100% Undeveloped (Vacant) Land • Potential for subdivision into 26 residential units	• 1% impervious surfaces (Mountain Loop Highway) • 8.09 acres of forest (99%)	• Dissolved Oxygen – Cat 4 • Temperature – Cat 4 • Fecal Coliform – Cat 2 • pH – Cat 1 • Ammonia – Cat 1	• None currently	• Bull trout, coho and pink salmon, steelhead trout
Pilchuck River	• 17.59 acres • 3,594 linear feet of shoreline	**Zoning Type:** • Rural Residential 2.3 acre dwelling unit (100%) **Current Land Uses:** • 56 parcels • 20% Residential (13 lots are at least semi-developed)[2] • 1.6% Well • 77% Undeveloped (Vacant) Land • 1% Other Undeveloped Land • No potential for subdivision	• 3.4% impervious surfaces • 15 acres of forest (85%) • 1.4 acres of non-forest vegetation	• Not listed	• None currently	• Bull trout, chinook, chum, coho and pink salmon, steelhead trout • Harlequin Duck 6.34 acres

[1] Sources of water quality contamination are likely a combination of point and non-point sources, but are not currently identified.

[2] A mixture of various levels of residential uses is present along the Pilchuck River. Approximately 5 lots are developed with permanent single-family residences. Remaining lots are developed with semi-permanent (mobile) structures. Several other lots without residential structures do have accessory structures (i.e. gazebos, sheds, small garages). Of the lots developed with single-family residences, only 3 appear to be within 150 feet of the River (setbacks vary between approximately 20, 30, and 80 feet).

Assessment Unit	Soils	Transportation	Hazards	Overwater Structures
South Fork Stillaguamish River	• Skykomish gravelly loam (~90%) • Elwell-Olomount rock outcrop (~5%)	• Mountain Loop Highway	• None identified	• Mountain Loop Highway- 0.03 acres
Pilchuck River	• Pilchuck loamy sand (~35 %) • Sumas silt loam (~30%) • Menzel silt loam (~12%) • Sultan silt loam (~9%) • Tokul-Ogarty- Rock outcrop complex (~8%); • Puyallup fine sandy loam (~6%)	• Paradise Lane	• High Seismic Hazard Area (100% of unit)	• None identified

3.3 Data Gaps

GIS information was not located or is incomplete for the following parameters:

Table 3. Data Gaps.

Inventory Element	Comments
Channel migration zone	Not available in GIS format. With the exception of the easternmost portion of the South Fork Stillaguamish unit, Snohomish County identified both river units within the city's shoreline jurisdiction as "rivers subject to migration." Ecology is currently evaluating CMZ, including mapping, for several jurisdictions around Puget Sound, including Granite Falls. This information is expected in late 2011 or 2012.
Shoreline armoring	Shoreline armoring is apparent from aerial imagery on at least two properties along the Pilchuck River.
Building footprints	New or recent development along the Pilchuck River is not documented in GIS. This information would help the assessment of existing building setbacks and the effectiveness of critical area regulations. Based on aerial photography, existing setbacks range from 25 to 200 ft along the Pilchuck River.
Floodway/Floodplain	The floodway and floodplain area are in the process of being reevaluated. The most recent mapping of the floodplain provided by the Letter of Map Revision is not presently available in a digitized format (See Supplemental Map D).
High seismic hazard areas	The Granite Falls Comprehensive Plan identified the entire jurisdictional shoreline area along the Pilchuck River as a high seismic hazard area.
Opportunity areas	Identification of more detailed opportunity areas will be developed during the Restoration Planning process.
Archeological and historical sites	Not available in GIS format. The Granite Falls Bridge over the South Fork Stillaguamish River was built in 1934 and identified in the Snohomish County Cultural Resource Inventory as significant as a Depression era bridge.

Although more information about each of the above items might help develop a fuller picture of shoreline conditions and processes, it is not expected that the absence of these items in the GIS database would have significant impacts on the selection of environment designations or the development of the SMP. The other environmental conditions for which data is available is expected to be sufficient for present decision making.

4 ANALYSIS OF ECOLOGICAL FUNCTIONS AND ECOSYSTEM WIDE PROCESSES

4.1 Geographic and Ecosystem Context

The City of Granite Falls is located in Snohomish County in the Puget Sound Region, and contains freshwater shorelines associated with Washington State's Water Resource Inventory Area (WRIA) 5 - Stillaguamish and WRIA 7 – Snohomish (Exhibit 1). The South Fork Stillaguamish River flows east to west along the northern boundary of the City (see Appendix A, Figure 1) and meets the North Fork Stillaguamish River in the City of Arlington. The Pilchuck River flows east to west along the southwestern border the City, from which it heads south into the Snohomish River in the City of Snohomish. The City of Granite Falls includes 1,616 feet of South Fork Stillaguamish shoreline frontage (south bank only) and 3,594 feet of the Pilchuck River for a total of 5,210 lineal feet of river. Including areas within 200 feet of the OHWM of these waterbodies as well as additional included areas related to floodplains, floodways, and associated wetlands, a total area of 25.76 acres is within the shoreline jurisdiction of the City.

The Stillaguamish River Basin includes more than 4,618 miles of streams and rivers [Stillaguamish Technical Advisory Group (STAG) 2000] and drains an area of 684 square miles, making it the fifth largest basin draining to Puget Sound. It extends from the Cascade Mountains along the eastern boundary to Port Susan (Puget Sound) near Stanwood in the west. Elevations within the watershed range from sea level at Stanwood to 6,854 feet at the summit of Three Fingers. Flows within the Stillaguamish are supported by both snow and rain events, with a substantial baseflow from groundwater. Unlike most eastside Puget Sound river basins, the Stillaguamish Basin does not extend all the way to the Cascade Crest, but is rather bordered to the east and surrounded by two other Puget Sound basins, the Snohomish and Skagit.

WRIA 5 can be divided into three separate sub-watersheds or basins for categorization and discussion purposes: the North Fork, the South Fork, and the Mainstem below the confluence of the two forks near the City of Arlington. The North Fork Stillaguamish drains 284 square miles and the South Fork drains 255 square miles, with the remainder drained by the Mainstem or its tributaries (Williams et. al. 1975). Major tributaries include the Church, Portage, and Pilchuck Creeks for the mainstem, Jim and Canyon Creeks for the South Fork, and the Boulder River and Deer, French, and Squire Creeks for the North Fork. As the South Fork Stillaguamish passes Granite Falls, it has a defined channel bounded primarily by low density residential land and mixed forest floodplain areas on bluffs. The City's namesake, Granite Falls, drops 40 ft over an approximately 300 ft run just downstream from the Mountain Loop Highway.

No dams or reservoirs occur along the South Fork Stillaguamish River, so flows in the basin are essentially unregulated. According to the Stillaguamish Watershed Chinook Salmon Recovery Plan (2005), the Department of Ecology anticipates setting instream flows on the South Fork Stillaguamish at Granite Falls. Diking of the lower mainstem of the river is prevalent throughout the Stillaguamish Flood Control District; however, no diking occurs within the City's shoreline jurisdiction.

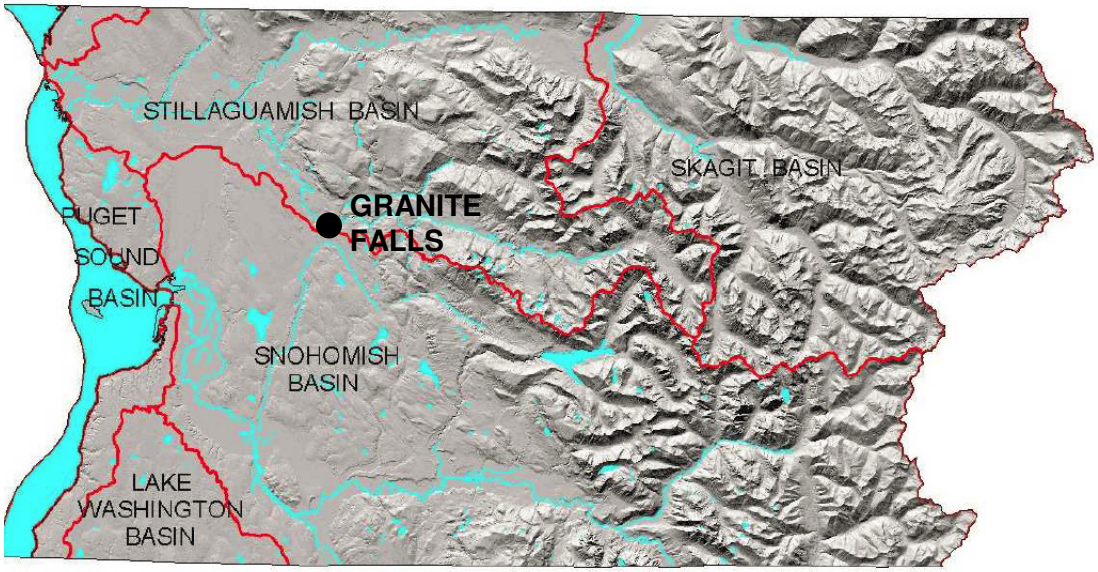

Exhibit 1. City of Granite Falls setting in the Stillaguamish Watershed (WRIA 5) and the Snohomish Watershed (WRIA 7) (Snohomish County Relief Map).

On the south side of the City, the Pilchuck River is part of the Snohomish River watershed- WRIA 7, which covers approximately 1,856 square miles, making it the second largest watershed in the state of Washington. The Pilchuck River Basin covers 132 square miles, stretching from the peaks of Mount Pilchuck to the East to its confluence with the Snohomish River in the city of Snohomish. Surface flows are generated from both snow and rain events with base flow primarily fed by groundwater as there are few if any snowfields in the sub basin by the end of June (Savery and Hook 2003). Granite Falls is located along the Middle Pilchuck sub-basin, which runs from 28th Place NE to the City of Snohomish dam, a run of the river dam used for water supply, located approximately 6 miles upstream from Granite Falls. The city of Snohomish can withdraw up to 10-20% of summer baseflow from the Middle Pilchuck sub-basin (Pentec and NW GIS 1999).

Land use in the Middle Pilchuck sub-basin is primarily rural residential and forestry (both in public and private ownership) (Savery and Hook 2003). The headwaters of the Pilchuck River drain the southern face of Mt. Pilchuck, at an elevation of 3,805 feet. Forestry is the sole land use upstream in the Upper Pilchuck sub-basin (Savery and Hook 2003).

4.2 Major Land Use Changes and Current Shoreline Condition

The City of Granite Falls is situated on a small plateau, bordered to the north by the South Fork Stillaguamish River and to the south by the Pilchuck River. The Coast Salish people used the area as a portage between the two rivers (Oakley 2008). The first European settler established a claim in the area in 1883, and Granite Falls was incorporated in 1903. After the discovery of gold and silver in the nearby Monte Cristo area, the Wayside mine, two miles from Granite Falls, brought miners to the area (Oakley 2008). Logging also became an important industry, and by 1906, the town had ten shingle mills and one sawmill. Miller Shingle Mill was built in 1946, and grew to be the largest specialty mill in the country and a major employer in the area today (Oakley 2008).

Granite Falls has long been a recreational outpost. The 55-mile Mountain Loop Highway, completed in 1936, linked Granite Falls to the City of Darrington, and paved the way for further recreation and making the City is known as the "Gateway to the Mountain Loop" (Oakley 2008).

Prior to European settlement, most of the drainage basin of the Stillaguamish and Pilchuck Rivers was forested, with conifers the dominant tree type. Mining and logging were the first economic drivers for the area. By 1940, most, if not all, of the anadromous zone riparian areas (those portions of the drainage system available for use by anadromous fish) had been cleared of large conifers. Much of this land was converted to agricultural or urban use, and not reforested. This deforestation reduces the amount of large woody debris (LWD) available to the stream, and LWD is an important component for both stream stability and fish habitat (STAG 2000). Along with the deforestation of the riparian areas, most of the logjams in the river were removed between 1877 and 1893 to facilitate rafting of logs to downstream mills. Splash-damming was also used to transport logs downstream, causing the complete destruction of riparian and in-stream structure and habitat in affected areas (STAG 2000).

Sediment loads in the Stillaguamish are predominately generated by landslide or other mass-wasting events in the upper watersheds (STAG 2000). Large, deep-seated landslides contribute most of this sediment. Of note is the Gold Basin slide, which contributes up to 60 percent of the sediment in the South Fork Stillaguamish (STAG 2000). In total, 1,080 landslides have been inventoried in the Stillaguamish basin; 75 percent of these associated with clear cuts and road-building activities (Perkins and Collins 1997).

The Snohomish River Basin Salmon Conservation Plan (2005) cites low base flows and high sediment load as major concerns in the Middle Pilchuck sub-basin. Savery and Hook (2003) conducted a survey of the Pilchuck River from its mouth to 0.5 miles below Granite Falls. They found that bank armoring and a shortage of large wood along the river banks had resulted in the simplification of channel habitat, and they recommended focusing enhancement efforts on removing channel hardening, adding large wood to create habitat complexity and sort sediment, and planting riparian vegetation to provide a source of large wood to the river in future years (Savery and Hook 2003). In recent years, the Stilly-Snohomish Fisheries Enhancement Task Force has completed several projects to restore riparian vegetation and improve the habitat complexity in the Stillaguamish and Pilchuck Rivers. One project in the Granite Falls area installed large wood structures along 300 ft of streambank and planted over 1,450 native plants along the shoreline. Similar riparian restoration projects have been conducted along the Pilchuck River in Lake Stevens and Machias areas. In the South Fork Stillaguamish basin, the Stilly- Snohomish Fisheries Enhancement Task Force has teamed with Snohomish County to control invasive knotweed and replant riparian areas with native vegetation.

4.3 Analysis of Ecological Functions and Processes

Ecological processes and functions of the City of Granite Falls' shoreline are summarized in Tables 3 through 5. These tables are organized around the Department of Ecology's list of processes and functions for freshwater streams. The list includes the evaluation of four major processes: 1) hydrologic; 2) vegetation; 3) hyporheic; and 4) habitat. These are further broken down into the following functions which are in turn used to evaluate reach performance:

Stream Functions
1. Hydrologic Functions
• Storing water and sediment
• Transport of water and sediment
• Attenuating flow energy
• Developing pools, riffles, and gravel bars
• Removing excess nutrients and toxic compounds
• Recruitment of LWD and other organic material
2. Vegetative Functions
• Temperature regulation
• Water quality improvement
• Slowing riverbank erosion; bank stabilization
• Attenuating flow energy
• Sediment removal
• Provision of LWD and other organic matter

Stream Functions
3. Hyporheic Functions
• Removing excess nutrients and toxic compounds
• Water storage and maintenance of base flows
• Support of vegetation
• Sediment storage
4. Habitat Functions
• Physical space and conditions for life history
• Food production and delivery

Assessment of each function is based upon both quantitative data results derived from the GIS inventory information described in Chapter 3; a qualitative assessment based on aerial photography, field inventory (where possible); and existing assessment information. As described in Chapter 3, the shoreline has been divided into the two different shorelines. Given their small size, sub-reaches are not necessary. In the ensuing tables, each reach has been given an overall "rating" for ecological functions based on the available and relevant GIS information and the corresponding quantitative and qualitative evaluation. Rating was completed using a "low" to "high" function scale. The level categories are:

- Low
- Low/Moderate
- Moderate
- Moderate/High
- High

4.3.1 South Fork Stillaguamish River

The South Fork Stillaguamish River assessment unit consists of lands within shoreline jurisdiction located along the south bank of the South Fork Stillaguamish from the Mountain Loop Highway east to the City limits (see Appendix A, Figure 1). This assessment unit includes lands entirely within the City limits (approximately 1,616 linear feet of shoreline and 8.18 acres of total jurisdiction).

The City's shoreline area occurs along a high energy reach of the South Fork Stillaguamish, just above Granite Falls (waterfall). The shoreline area is zoned for residential development, but it is presently undeveloped and in one parcel. It has steep forested banks, with a mix of forested and cleared areas on the ridge top.

The area just east of the Mountain Loop Highway Bridge is composed of rock outcroppings, and the soils over the remainder of the unit are Skykomish gravelly loam. The Snohomish County Master Program identifies the eastern portion of the City's shoreline area along the South Fork Stillaguamish as a "channel subject to migration," but the lateral extent of the channel migration zone was not defined. Ecology is currently evaluating the CMZ, including mapping, for several jurisdictions around Puget Sound, including Granite Falls. This information is expected in late 2011 or 2012.

Due to the steep banks within this shoreline unit, land in the area prone to flooding and potential channel migration area along the South Fork Stillaguamish is presently lacking in structures, limiting the flood hazard potential in this reach. In general, the geomorphic (i.e. steep banks) and well vegetated condition along this section of the South Fork Stillaguamish River tends to drive the evaluation of ecological functions described in Table 4. Therefore, tentative solutions to address improperly functioning conditions are generally not applicable as they are typically a result of landscape processes rather than anthropogenic modifications.

Table 4 provides an overall assessment of ecological functions.

Exhibit 2. Aerial view of South Fork Stillaguamish River in the City of Granite Falls (Bing 2010)

Table 4. Function Summary of the South Fork Stillaguamish River

Shoreline Processes and Functions within Assessment Unit	Alterations and Assessment of Functions
Hydrologic	
Storing water and sediment	LOW: Within this unit, the river is constrained on the south (City) side by relatively high banks of moderately erosion-prone materials. Conditions on the north bank (County jurisdiction) are similar. The Mountain Loop Highway bridge over the South Fork roughly bounds the east end of the reach, and the other shoreline jurisdictional areas within this unit are presently undeveloped. In the event that the river channel migration threatens the bridge structure, it can be expected that steps would be taken to protect its integrity. The river gradient is relatively steep in this reach, and it exhibits high energy as it approaches the City's namesake, Granite Falls. A small gravel bar along the south side of the channel provides some temporary sediment storage, although the high energy within this reach lends itself to sediment transport rather than storage.
Transport of water and sediment	MODERATE/HIGH: The river gradient and relatively constricted nature of this reach contributes to high energy, and correspondingly high transport of water and sediment.
Attenuating flow energy	LOW: Both banks along this reach of river are well vegetated with mixed conifer and deciduous forest, but the steep banks and minimal large woody debris allow for little floodplain interactions and flood energy attenuation, except perhaps at the highest flows. The large pool at the bottom of the unit likely attenuates some stream energy.
Developing pools, riffles, and gravel bars	MODERATE: A large pool exists downstream from a rapid just west of the Mountain Loop Highway bridge. The pool appears to be maintained by very large natural boulders and bedrock. Through the rest of the reach, smaller riffle-pool sequences exist and likely change position over time when high-flow events reconfigure the river channel bottom. Relatively little wood has accumulated within the active, low-flow portions of the channel along this reach to maintain pool features or provide habitat associated with them. Some wood has accumulated on the small gravel bars.
Removing excess nutrients and toxic compounds	LOW: The area upstream from Granite Falls is primarily undeveloped and under public ownership; however, the position of this unit just downstream from a mining operation near the river likely provides the opportunity to improve water quality. The steep banks and lack of a broad floodplain in this reach results in minimal biofiltration functions, though the existing vegetated banks provides some function. The areas with relatively intact forested upland areas in this reach likely have high-functioning nutrient filtration processes, limiting the quantity of nutrient and toxic compounds entering the river within the reach. However, road runoff from the Mountain Loop Highway bridge likely introduces contaminants to the river at the lower end of the reach.

Shoreline Processes and Functions within Assessment Unit	Alterations and Assessment of Functions
Recruitment of LWD and other organic matter	MODERATE: Some wood tends to accumulate as jams on the small gravel bars along this unit, and the riparian forests on both banks have the potential to contribute, capture, and retain such wood during the larger flow events. The extent to which LWD has been removed from this unit is presently unknown.
Vegetation	
Temperature regulation	MODERATE: High, well-vegetated banks along the south side of the river channel provide moderately good shading conditions. However, given the width of the river, shading provides only moderate temperature regulation functions.
Water quality improvement	MODERATE/HIGH: The steep banks and lack of a broad floodplain in this reach results in lower biofiltration functions, though the existing vegetated banks and forested upland areas provide filtration functions. The majority of the bank, even though it is steep, is heavily vegetated and so provides filtration potential.
Slowing riverbank erosion; bank stabilization	MODERATE: The relatively steep south bank of the river is composed of soils with a moderate erosion risk; however, the bank is moderately well vegetated, which improves erosion resistance. Erosion risk is greatest on the south bank on the outer bend of the river just upstream from the Mountain Loop Highway bridge because soils are highly erodible in that area and it is located on a steep bank. Soil erodibility is lower on the north bank, so the erosion risk is likely lower there.
Attenuating flow energy	LOW: As stated above, both banks along this reach of river are well vegetated with mixed conifer and deciduous forest, but the steep banks allow for little floodplain interactions and flood energy attenuation, except perhaps at the highest flows.
Sediment removal	LOW: As stated above, the relatively high energy nature of the reach provides sediment transport rather than long-term sediment storage. Minimal floodplain area exists that could trap fine sediment, and it is likely readily transported during higher flow events.
Provision of LWD and other organic matter	MODERATE/HIGH: Vegetation along both banks is of the size that could provide recruitment of LWD, including both coniferous and deciduous sources. Recruitment is most likely to occur through windfalls or trees recruited through attrition (mortality) rather than through channel migration processes.
Hyporheic	
Removing excess nutrients and toxic compounds	LOW/MODERATE: The high, steep riverbank tends to limit hyporheic activity and correspondingly, the floodplain filtration capacity adjoining the south (City) side of the river. However, the relatively intact forested areas both in the adjacent upland and the riparian zone have high filtration capacity. Upper bank soils are primarily gravelly loam, which are highly permeable. The permeability of the soils will likely promote infiltration rather than surface runoff, which further improves filtration capacity of the area. The small gravel bars that primarily occur on the north side of the river are expected to have moderate hyporheic function and filtration capacity, primarily limited by their small size.

Shoreline Processes and Functions within Assessment Unit	Alterations and Assessment of Functions
Water storage and maintenance of base flows	LOW: As above, the steep slopes on both sides of the river limit the potential for water storage and base-flow maintenance. The small gravel bars likely contribute slightly to water storage capacity. County areas to the north would be expected to have a high level of function with respect to hyporheic water storage.
Support of vegetation	LOW: Given the steeply sloping banks on the south side of the river, it is unlikely that hyporheic flow would support much vegetation.
Sediment storage	LOW: As stated above, the relatively high energy nature of the reach provides sediment transport rather than long-term sediment storage. Sediment storage may occur during the low flow months, but it is readily transported during higher flow events. Some hyporheic sediment storage likely occurs on the small gravel bars, primarily on the opposing north (County) bank.
Habitat	
Physical space and conditions for life history	HIGH: The jurisdictional shoreline area is composed of mixed coniferous and deciduous forests. The forested natural areas within the shoreline area provide nesting and rearing sites for wildlife; however, some forest clearing has likely reduced the accumulated downed wood and snags, resulting in fewer places for wildlife species to find cover or suitable nesting and rearing sites. The availability of dense riparian vegetation is critical factor for terrestrial species' (birds, mammals, amphibians) use of the shoreline because it controls the availability of cover, food, nesting sites, travel corridors, etc. are. Within the channel itself, fewer log jams and less large wood overall results in less available protective cover, reduced pool quality, and the creation of pool/riffle sequences. In this shoreline area, pool and drop sequences are primarily maintained by large boulders and bedrock.
Food production and delivery	MODERATE/HIGH: Food production for terrestrial wildlife from upland areas originates from native seed- and fruit-bearing vegetation. Riparian vegetation is also a source of insects and other organic matter that drop into the water and provide food, either directly or indirectly, for fish and other aquatic life.
Summary	Accounting for the existing hydrologic, vegetative, hyporheic, and habitat conditions within the South Fork Stillaguamish River assessment unit, the overall shoreline ecological function is considered MODERATE.

4.3.2 Pilchuck River

The Pilchuck River shoreline unit consists of the shoreline area generally along the north bank of the Pilchuck River (see Appendix A, Figure 1 and Exhibit 3 below). This unit is zoned for 2.3 acre dwelling unit development, and approximately 20% of the unit is presently developed. This unit extends along 3,594 linear feet of river and 17.59 acres of total jurisdiction.

Exhibit 3. Aerial photo of the Pilchuck River in the City of Granite Falls (Bing 2010)

In contrast to the South Fork Stillaguamish unit, the banks in this unit are relatively low, and the unit has moderately sized gravel bars with cottonwood forest vegetation. An accumulation of large wood has developed at the uppermost section of this unit, which exhibits multiple channels and large gravel bars.

The Snohomish County Shoreline Master Program identified the entire length of the City's shoreline along the Pilchuck River as a "channel subject to migration," but the lateral extent of the channel migration zone was not defined. Ecology is currently evaluating the CMZ, including mapping, for several jurisdictions around Puget Sound, including Granite Falls. This information is expected in late 2011 or 2012.

The recently revised Flood Insurance Rate Map (FEMA 2010) includes the majority of the shoreline jurisdictional area in this unit. The revised floodplain has been expanded and now includes most of the residential properties throughout this reach. Although rip rap or concrete armoring is present on a few properties within this shoreline unit, overall, channel migration is relatively unrestricted.

Use of the immediate shoreline area ranges widely, including permanent single-family residences, mobile home structures, recreational access with associated minor structures (i.e. gazebos and garages), parking pads, and miscellaneous storage.

Table 5 provides an overall assessment of ecological functions.

Table 5. Function Summary of the Pilchuck River

Shoreline Processes and Functions within Assessment Unit	Alterations and Assessment of Functions
Hydrologic	
Storing water and sediment	MODERATE/HIGH: This unit consists predominantly of low-lying residential land and occasional moderately sized gravel bars, with vegetated cover of cottonwood forest ranging from sparse to moderate. An expansive gravel bar complex with forested cottonwood islands and significant large woody debris accumulations on the southeastern end of the reach provides significant water and sediment storage capacity. Other gravel bars along the banks of the reach provide a moderate level of water and sediment storage. Bank armoring is not pervasive within the unit, which allows for the persistence of functioning gravel bars. Further bank armoring would threaten water and sediment storage functions.
Transport of water and sediment	LOW/MODERATE: Transport of water and sediment is low in the uppermost section of the reach, where the broad floodplains, accumulations of large wood, and complex channel form slow flow energy and encourage sediment deposition. Water and sediment transport is higher in the lower portion of the reach, which has a relatively simple channel form.
Attenuating flow energy	MODERATE/HIGH: Existing forest areas and accumulated wood associated with the floodplain complex at the upstream end of the reach allow for effective attenuation of flow energy. Increasing the forested flood plain area throughout the rest of the reach would further increase roughness and energy attenuation.
Developing pools, riffles, and gravel bars	MODERATE/HIGH: Two large, relatively permanent pools occur at the downstream end of the reach and the floodplain complex at the upstream end of the reach includes several large pools. The remainder of the reach is predominantly riffle habitat. The upstream floodplain complex is an area of high deposition for both gravel and large woody debris, with frequent shifting of the active channel. As such, gravel bars and riffles are abundant and well-formed. Deep pools also occur, but are transient due to the shifting nature of the channel itself. There is one large, persistent log jam in the furthest upstream area of the reach.
Removing excess nutrients and toxic compounds	HIGH: The presence of a broad, gravelly channel as well as a broad, active floodplain results in a high level biofiltration functioning.

Shoreline Processes and Functions within Assessment Unit	Alterations and Assessment of Functions
Recruitment of LWD and other organic matter	MODERATE/HIGH: The northeast (City) side of the channel is moderately vegetated, predominantly with cottonwood and other deciduous trees in the upstream half of the reach, while the downstream portion of the reach is sparsely vegetated. The southwest side of the river, which is partially in City jurisdiction, has a well vegetated riparian zone. The braided nature of the channel in the uppermost portion of the reach is highly conducive to the recruitment of logs and other vegetative materials. Channel shifting recruits some wood within the reach and additional wood from farther upstream is deposited here, along with gravel, as a result a reduction in gradient, depths, and velocities.
Vegetation	
Temperature regulation	LOW/MODERATE: Although much of the bank length on the southwest side of the channel is well-vegetated along this unit and such vegetated buffers generally tend to improve shading conditions, the broad, shallow nature of the river channel through this area leaves much of the channel cross section unshaded, allowing for solar warming.
Water quality improvement	HIGH: The presence of a broad, active, fairly well-vegetated floodplain results in a high level biofiltration functioning. Many of the unit's floodplain areas are densely vegetated with trees, shrubs, grasses, and other riparian vegetation, including emergent vegetation in the wetlands. Of concern to water quality is runoff from potential point sources. The storage of old car parts or the general servicing or repair of equipment adjacent to waterbodies may lead to unanticipated negative impacts to water quality that may not be mitigated by the beneficial effects of shoreline vegetation. RECOMMENDATION: Enhancement to the shoreline vegetation community may improve water quality functions for these degraded areas.
Slowing riverbank erosion; bank stabilization	LOW/MODERATE: The well-forested floodplain complex in the uppermost portion of the reach provides the greatest potential to stabilize banks and resist erosion, yet this area is also within a highly braided channel, with a high likelihood of channel migration during large storm events. In the downstream portion of this unit, the river appears to be migrating toward the north (City), indicated by the developing gravel bar on the southern side of the river. Vegetation is relatively sparse along the north side of the river in this downstream area, increasing the likelihood of bank erosion. At least one of the residential parcels in this area has been artificially armored with angular boulders (rip-rap) to protect the bank; however, this armoring may also serve to accelerate flow and erosion potential along the adjacent downstream properties. RECOMMENDATION: Increases in vegetative cover along the north bank, specifically tree and shrub cover, will help establish root structure and thereby stabilize streambanks from excessive erosion.

Shoreline Processes and Functions within Assessment Unit	Alterations and Assessment of Functions
Attenuating flow energy	MODERATE: Flow attenuation is high in the uppermost portion of the reach and low in the residential area in the lower portion of the reach. The combination of existing forested areas at various stages of maturity in the upstream and southwestern side of the channel effectively attenuate flow energy. In addition, accumulated wood and a broad, shallow, channel complex in the upstream portion of the reach helps dissipate flow energy. In contrast, the northeast (City) side of the downstream portion of the area is sparsely vegetated, and the banks of at least one property are armored, which may accelerate flow energy downstream. RECOMMENDATION: Similar to protecting the streambank from excessive erosion, increases in vegetative cover along the north bank, will also help to attenuate flow energy by adding shoreline structure and in the future potential recruitment of LWD. In the near term, addition of anchored LWD may help stabilize banks and attenuate energy, thereby eliminating the need for additional hard armoring (rip rap).
Sediment removal	HIGH: As evidenced by the prevalence of gravel bars throughout this unit, and particularly in the uppermost area, this unit is a depositional zone. Well vegetated gravel bars are effective at filtering and retaining fine sediments.
Provision of LWD and other organic matter	MODERATE/HIGH: The presence of forested vegetation along the braided channel in the uppermost portion of the reach presents a high capacity for the recruitment of LWD. Channel migration in the area just upstream from this reach has the potential to recruit significant amounts of wood that may accumulate in the channel, on the bars, and along the vegetated floodplain within the City's jurisdictional area. Wood recruitment is also likely from the forested area along the southwestern side of the reach.
Hyporheic	
Removing excess nutrients and toxic compounds	MODERATE: The active floodplain depositional area and changeable, complex array of channels in the uppermost portion of this unit, as well as gravel bars along the length of the unit, are expected to provide it with a high level of hyporheic function, including the removal of excess nutrients and toxic compounds. The outfall from the City's sewage treatment facility occurs at the far downstream end of this shoreline unit and likely affects water quality exiting the reach.
Water storage and maintenance of base flows	MODERATE/HIGH: The recent and ongoing gravel deposition in the uppermost portion of the unit indicates a high level of hyporheic function, including water storage capacity. The area on the north (City) side of the downstream portion of the channel has poorly drained soils with a shallow water table, which could provide surface water storage and contribute to the maintenance of base flows.

Shoreline Processes and Functions within Assessment Unit	Alterations and Assessment of Functions
Support of vegetation	HIGH: Due to the broad, low flood plain and permeable soils throughout the upstream portion of the reach and the south side of the channel, hyporheic supply of water to vegetation across the flood plain is expected to be high. Soils on the north (City) side of the channel in the lower portion of the reach have low permeability; however, these poorly drained soils contribute to the forested wetland adjacent near the center of the unit.
Sediment storage	HIGH: Fine sediment tends to be effectively captured and stored within the active floodplain areas, particularly in the uppermost portion of the reach.
Habitat	
Physical space and conditions for life history	MODERATE/HIGH: Good habitat for a variety of wildlife species is presently provided in the upper portion of this unit. Of note, the upper portion of the unit is a priority habitat for Harlequin Ducks. The complex channel structure with extensive accumulations of downed wood in the upper area offers opportunities for various wildlife species to find cover or suitable nesting and rearing sites. Continued channel migration, and the expansion and maturation of the vegetative community going forward will continue to provide diverse habitat opportunities for wildlife. Dense riparian vegetation is a limiting factor for terrestrial species' (birds, mammals, amphibians) use of the shoreline, providing cover, food, nesting sites, travel corridors, etc. The riparian zone in the lower portion of the reach on the north (City) side of the channel is sparsely vegetated, offering only limited wildlife habitat. Within the river channel, wood and an overall complex channel form at the upper and lower ends of the unit provide protective cover and contribute to the maintenance and enhancement of pool/riffle sequences. The middle portion of the reach has relatively little habitat features, and it would benefit from added roughness or complexity. RECOMMENDATION: Increases in vegetative cover, specifically along the immediate shoreline but also throughout the designated buffer, will provide additional physical habitat for terrestrial wildlife. Consideration should be given to providing a continuously vegetated stream corridor for use as a migratory corridor for terrestrial species.
Food production and delivery	MODERATE/HIGH: Food production for terrestrial wildlife from upland areas originates from native seed- and fruit-bearing vegetation. The diversity of existing vegetation in this unit provides a source of food for a variety of wildlife throughout the seasons. Riparian vegetation also provides a source of detritus (organic matter) to the stream, and supports insects that provide food for fish and other aquatic life.
Summary	Accounting for the existing hydrologic, vegetative, hyporheic, and habitat conditions within the Pilchuck River assessment unit, the overall shoreline ecological function is considered MODERATE/HIGH.

4.4 Opportunities and Recommendations for Protection or Restoration

The following discussion identifies opportunities and recommendations for protecting existing functions and processes or restoring impaired functions and processes for each reach. Ecology's *Shoreline Master Program Guidelines* (173-26 WAC) includes the following definition:

> *"Restore," "Restoration" or "ecological restoration" means the reestablishment or upgrading of impaired ecological shoreline processes or functions. This may be accomplished through measures including but not limited to re-vegetation, removal of intrusive shoreline structures and removal or treatment of toxic materials. Restoration does not imply a requirement for returning the shoreline area to aboriginal or pre-European settlement conditions.*

Consistent with Ecology's definition, use of the word "restore," or any variations, in this document is not intended to encompass actions that re-establish historic conditions. Instead, it encompasses a suite of strategies that can be approximately delineated into four categories: creation (of a new resource), restoration (of a converted or substantially degraded resource), enhancement (of an existing degraded resource), and protection (of an existing high-quality resource).

There is a critical distinction between restoration and mitigation. Mitigation will require applicants whose shoreline proposals will have adverse impacts to complete actions to mitigate those impacts or provide compensation in other ways for losses of ecological function. Degraded wetland buffers are required to be restored under the City's CAO. The City can encourage applicants to implement restoration actions that will improve ecological functions relative to the applicant's pre-project condition. As stated in WAC 173-26-201(2)(c):

> *It is intended that local government, through the master program, along with other regulatory and nonregulatory programs, contribute to restoration by planning for and fostering restoration and that such restoration occur through a combination of public and private programs and actions. Local government should identify restoration opportunities through the shoreline inventory process and authorize, coordinate and facilitate appropriate publicly and privately initiated restoration projects within their master programs. The goal of this effort is master programs which include planning elements that, when implemented, serve to improve the overall condition of habitat and resources within the shoreline area of each city and county."*

The opportunities and recommendations identified below present options for "restoration" that would improve ecological functions. For example, enhancement of riparian vegetation, reductions or modifications to shoreline hardening, minimization of in- and over-water structures, and improvements to fish passage would each increase one or more ecological parameters of the City's shoreline. The City or private property owners could implement these options voluntarily or, depending on specific project details, they could be required measures to mitigate adverse impacts of new shoreline projects.

4.4.1 South Fork Stillaguamish River

The primary opportunities for restoration and protection in this reach would be riparian forest projects. The area is not large and has a mix of forested areas and impacted areas where the vegetation has been cleared. The forested areas consist of a mix of deciduous and coniferous trees. Primary restoration opportunities would be the planting of native coniferous species to increase riparian density, shading, and future recruitment of large wood to the river. Efforts to restore and protect riparian vegetation on private properties in the Stillaguamish basin are ongoing.

The shoreline areas are protected by the City's critical areas regulations, which require a 150-foot buffer for new development along the South Fork of the Stillaguamish River.

4.4.2 Pilchuck River

Similar to the South Fork Stillaguamish shoreline, the greatest opportunities along the Pilchuck River lie in the restoration and protection of riparian forests. The area is presently composed of forested areas, as well as areas where the vegetation has been cleared. Based on the observations of Savery and Hook (2003), riparian vegetation will play an important role in improving impaired habitat complexity downstream. The restoration of riparian vegetation and edge habitat in the Middle Pilchuck Reach is a high priority, included on the 2008 3-year work plan, for WRIA 7.

The shoreline area is also protected by City's critical areas regulations, which require a 150-foot buffer for new development along the Pilchuck River. Where there are existing, ongoing uses that do not meet the buffer requirements, landowners may be required to restore or allow the restoration of buffer areas during redevelopment, depending on the impacts of the proposed development.

Activities for restoration or enhancement of shoreline functions may result through partnerships with Snohomish County Surface Water Management, Snohomish Conservation District, and the Stilly-Snohomish Fisheries Enhancement Task Force.

5 LAND USE ANALYSIS AND IMPLICATIONS

5.1 Introduction

Land use patterns are an important consideration in SMP analysis because such analysis can identify opportunities for "preferred uses," especially water-dependent, water-related and water-enjoyment uses. Land uses adjacent to the water are also a determinant in assigning environment designations to specific sections of the shoreline. Additionally, an analysis of land use conditions is necessary to determine potential land use changes and their effect on shorelines with respect to SMA objectives. Finally, the existing land uses and proposed environment designation boundaries and provisions must be mutually consistent with the City's comprehensive plan.

Further, as noted previously, rivers with mean annual flow greater than 1,000 cubic feet per second (South Fork Stillaguamish River) are considered Shorelines of Statewide Significance. As such, RCW 90.58.020 establishes a specific order for use preferences as follows:

1. Recognize and protect the statewide interest over local interest;
2. Preserve the natural character of the shoreline;
3. Result in long term over short term benefit;
4. Protect the resources and ecology of the shoreline;
5. Increase public access to publicly owned areas of the shorelines;
6. Increase recreational opportunities for the public in the shoreline;
7. Provide for any other element as defined in RCW 90.58.100 deemed appropriate or necessary.

The SMA requires a "higher level of effort in implementing its objectives on shorelines of statewide significance" (WAC 173-26-251).

As part of SMP development, the shoreline is to be classified into specific shoreline environment designations based upon existing land use patterns, baseline inventory and analysis results, goals stipulated in the City's Comprehensive Plan, and Ecology criteria. Ecology Guidelines include six recommendations for shoreline environment designations (listed below). However, each jurisdiction may use alternate or parallel environment designations, as appropriate, as long as they provide equal or better protection than the standard.

Ecology Recommendations

Natural
Urban Conservancy
Rural Conservancy
Aquatic
High Intensity
Shoreline Residential

5.2 Reach Conditions

This section examines the data gathered in the inventory and describes for each reach the (1) likely future land uses and activities, and (2) implications for shoreline management (Table 6). Likely or appropriate environment designations are listed for each reach.

Table 6. Likely Changes in Land Use and Implications for Shoreline Management.

Reaches	Likely Changes in Land Use	Implications for Shoreline Management
South Fork Stillaguamish River	The City's 2005 Comprehensive Plan identified the future land use zoning for the area within shoreline jurisdiction along the South Fork Stillaguamish as Low Density Residential, which allows single-family housing at a density of 4 dwelling units per acre. Given the present, undeveloped condition of this area, this area has a high potential for subdivision and future development. The unit could potentially be subdivided from a single parcel to approximately 26 residential parcels. Such development would necessitate the development of new roads and public utilities. If development were to occur, the land use changes would be significant.	Shoreline Residential appears to be an appropriate environment designation for this segment given the likely future land use. However, the City could consider either an Urban Conservancy designation or potentially a parallel designation to give additional protection to the existing forested shoreline through this area of river and maintain consistency with the current 150 ft Critical Areas buffer requirements.
Pilchuck River	The land along this reach is presently zoned as 2.3 acre Rural Residential (2.3 RR). The area has been divided into 56 parcels, thirteen of which are presently built out and are not likely to change use. Based on aerial imagery, setbacks for existing residential development range from approximately 25 ft to 200 ft. Water and sewer lines do not extend to these residences, so existing residences rely on well	Shoreline Residential would be an appropriate environment designation for this segment.

Reaches	Likely Changes in Land Use	Implications for Shoreline Management
	water and septic systems. Given the 2.3 RR zoning, further subdivision is not anticipated. New development could occur in the existing 43 vacant parcels. Some redevelopment of existing housing stock may also occur. Parcels in this shoreline unit are within the recently revised floodplain area and are subject to a risk of flooding and any associated development regulations.	

6 PUBLIC ACCESS ANALYSIS AND IMPLICATIONS

6.1 Introduction

Public access includes the ability of the general public to reach, touch, and enjoy the water's edge, to travel on the waters of the state, and to view the water and the shoreline from adjacent locations.

WAC 173-26-221(4)(c) states that:

> *"Local governments should plan for an integrated shoreline area public access system that identifies specific public needs and opportunities to provide public access... This planning should be integrated with other relevant comprehensive plan elements, especially transportation and recreation."*

To support this planning, WAC 173-26-201(3)(c) calls for local governments to inventory existing and potential shoreline public access sites, including public rights-of-way and utility corridors. Because shoreline access includes visual access, important views of the water from shoreline areas were also identified.

Information about public access sites in the City was drawn from site visits; aerial photographs; the City's Comprehensive Plan; City staff and website; and the City's land use and parks maps.

6.2 Existing City Parks and Open Space

The City of Granite Falls has four parks, Jim Holm Park, Jack Webb Park, Galena Park, and Perrigoue Field. These parks provide recreational opportunities for the City's residents, but are located away from the river shorelines of the City.

Just downstream of the Mountain Loop Highway, and on the border of the City's shoreline jurisdiction, a path leads visitors to a viewpoint of Granite Falls and the associated fish ladder.

On the southwest edge of the City, Snohomish County owns 122 acres in the O'Reilly Acres County Park Reserve along the Pilchuck River. The park encompasses dense-forests, streams, beaver ponds, and forested wetlands, surrounded on three sides by clear-cut forests with planned residential development. An old log footbridge across the Pilchuck River once provided access to the site from the northern edge, but it was removed for structural and safety reasons. Future access to the Pilchuck River from O'Reilly Acres Park Reserve will require property acquisition or the construction of a new footbridge. The Granite Falls Comprehensive Plan includes a policy to develop a bike and trail system connecting points of interest including the fish ladder and O'Reilly Acres County Park.

Although outside of the City and UGA, nearby Riverscene Park, just west of Granite Falls and operated by Snohomish County Parks Department, offers easy pedestrian access to the South Fork Stillaguamish. Similarly, to the southeast of Granite Falls, the Lime Kiln trail offers hiker access to Robe Canyon Park and the banks of the South Fork Stillaguamish.

6.3 Public Access Implications

The shoreline area within the City is in private ownership, and public shoreline access to the South Fork Stillaguamish is available nearby. Public shoreline access could be improved within the city, as well as in nearby areas. If the parcel along the South Fork Stillaguamish is subdivided into more than four parcels, dedicated public access will be required under WAC 173-26-221(4)(d)(iii).

7 SHORELINE MANAGEMENT RECOMMENDATIONS

The following are recommended actions for translating inventory and characterization findings into the draft SMP policies, regulations, environment designations, and restoration strategies for areas within shoreline jurisdiction.

7.1 Shoreline Master Program

7.1.1 Shoreline Environment Designation Provisions

- Recommendations for specific shoreline segments are discussed in section 5.2.

- Pre-assign environment designations within the UGA. Coordinate with Snohomish County to identify the differences between County environment designations and the City's future designations.

7.1.2 General Policies and Regulations

Critical Areas

- Consider whether the City's critical areas regulations should be incorporated into the SMP by reference or through direct inclusion.

Flood Hazard Reduction

- Consider how to incorporate the various options developed by FEMA and others during development of the strategy for responding to National Marine Fisheries Service Biological Opinion evaluating FEMA's National Flood Insurance Program.

Public Access

- Work with the City and Snohomish County parks departments to identify potential locations for new public access sites and to identify improvements to increase the quality of existing public access to shorelines adjacent to the City.

Vegetation Conservation

- Build on the existing protections provided in the City's critical areas regulations.

- Retain large woody debris in rivers and streams, and maintain and enhance the long-term recruitment of woody debris from adjacent riparian zones. Prohibit the removal, relocation, or modification of large

woody debris in aquatic habitats and adjacent banks except when the large woody debris poses an immediate threat to public safety or critical facilities. Mitigate the movement or removal of large woody debris complexes clearly posing a threat to infrastructure and critical facilities.

Water Quality, Stormwater, and Nonpoint Pollution

- Include policies and regulations that appropriately incorporate recommendations of the City's and Snohomish County's water quality-related studies, particularly as related to impaired parameters listed by Ecology or outcomes of the NPDES Municipal Stormwater Permit requirements.

- Ensure that regulations allow for placement of any water quality-related structures or facilities in shoreline jurisdiction, including in the Aquatic environment.

- Consider whether special stormwater management provisions may be necessary beyond the standard City requirements contained in the adopted Ecology Stormwater Management Manual for Western Washington. Example is any stormwater system built within the buffer area would have to include natural forested and riverine wetland habitat characteristics.

7.1.3 Shoreline Modification Provisions

Shoreline Stabilization

- Ensure "replacement" and "repair" definitions and standards are consistent with WAC 173-26-231(3)(a). Repair activities should be defined to include a replacement threshold so that applicants and staff will know when "replacement" requirements need to be met.

Fill

- Restoration fills should be encouraged, including improvements to shoreline habitats, material to anchor large woody debris placements, and as needed to implement shoreline restoration.

Shoreline Habitat and Natural Systems Enhancement Projects

- The SMP should include incentives to encourage restoration projects, particularly in areas identified as having lower function. Emphasize that certain fills can be an important component of some restoration projects.

7.1.4 Shoreline Uses

Agriculture

- Not applicable since there is no agriculture within the City or its shoreline jurisdiction. Consider prohibiting.

Aquaculture

- Consider prohibiting this use and removing it from this section. May need to consult with local tribes for confirmation.

Boating Facilities

- Develop appropriate standards for community and public-access related potential future boat ramps, if desired.

Commercial Development

- Encourage low impact development techniques that reduce impervious surface areas and use of ecologically responsible stormwater management.

Forest Practices

- Provide general policies and regulations for forest practices according to the WAC Guidelines.

Industry

- Consider requiring significant vegetated setbacks for new industrial development.

Mining

- Consider prohibiting this use in shoreline jurisdiction.

Piers and Docks

- Not applicable in the river setting. Consider prohibiting.

Recreational Development

- The City's SMP should assure that shoreline recreational development is given priority and is primarily related to access to, enjoyment and use of the water and shorelines.

- Work with the City's recreation coordinator and any other public agencies that may own park land to identify issues related to park development. Park lands can provide opportunities for shoreline restoration and can serve as demonstration projects to the greater public. Policies and regulations related to parks management should provide clear preferences for shoreline restoration consistent with public access

needs and uses. Existing natural parks should be protected and enhanced. Water trail heads would need to avoid high priority restoration sites identified for Salmon recovery.

Residential Development

- Address building setbacks, shoreline armoring, and vegetation conservation for residential properties. The SMP should consider developing regulations that encourage or require shoreline restoration when specific new development or redevelopment activities are proposed. A standard buffer and/or setback should be developed, with an aggressive but practical list of buffer/setback reduction options that would result in a net improvement in shoreline functions. These might include removal of bulkheads, shoreline plantings, landscape chemical reduction or elimination, and removal of other nearshore impervious surfaces, among others.

- Include a policy to educate waterfront homeowners about the use of fertilizers and chemicals and encourage natural lawn care and landscaping methods to reduce chemical output into surrounding shorelines.

- Encourage low impact development techniques that reduce impervious surface areas and use of ecologically responsible stormwater management.

Transportation and Parking

- The City needs to include policies and/or regulations ensuring that circulation system planning will include systems for pedestrian, bicycle, and public transportation where appropriate.

- The City's SMP must include policies and/or regulations so that proposed transportation and parking facilities are planned, located, and designed such that routes will have the least possible adverse effect on unique or fragile shoreline features, will not result in a net loss of shoreline ecological functions, or adversely impact existing or planned water-dependent uses.

Utilities

- Include provisions to address utilities in shoreline jurisdiction. Such provisions should consider short-term and long-term impacts on shoreline functions and processes, particularly in their management of stormwater runoff, shoreline hardening and potential for generating a later need for shoreline hardening, and placement of in-water structures which can affect flows and substrates.

7.2 Restoration Plan

A Restoration Plan document will be prepared as a later phase of the Shoreline Master Program update process, consistent with WAC 173-26-201(2)(f). The Shoreline Restoration Plan must address the following six subjects (WAC 173-26-201(2)(f)(i-vi)) and incorporated findings from this analysis report:

(i) Identify degraded areas, impaired ecological functions, and sites with potential for ecological restoration;

(ii) Establish overall goals and priorities for restoration of degraded areas and impaired ecological functions;

(iii) Identify existing and ongoing projects and programs that are currently being implemented, or are reasonably assured of being implemented (based on an evaluation of funding likely in the foreseeable future), which are designed to contribute to local restoration goals;

(iv) Identify additional projects and programs needed to achieve local restoration goals, and implementation strategies including identifying prospective funding sources for those projects and programs;

(v) Identify timelines and benchmarks for implementing restoration projects and programs and achieving local restoration goals; and

(vi) Provide for mechanisms or strategies to ensure that restoration projects and programs will be implemented according to plans and to appropriately review the effectiveness of the projects and programs in meeting the overall restoration goals.

The Restoration Plan will "include goals, policies and actions for restoration of impaired shoreline ecological functions. These master program provisions should be designed to achieve overall improvements in shoreline ecological functions over time, when compared to the status upon adoption of the master program." The Restoration Plan will mesh potential projects identified in this report with additional projects, regional or City-wide efforts, and programs of the City, watershed groups, and environmental organizations that contribute or could potentially contribute to improved ecological functions of the shoreline.

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List of Acronyms and Abbreviations

CAO .....Critical Areas Ordinance

DAHP.....Washington Department of Archaeology & Historic Preservation

Corps.....U.S. Army Corps of Engineers

Ecology .....Washington Department of Ecology

GMA.....Growth Management Act

HPA.....Hydraulic Project Approval

LWD .....Large Woody Debris

NRCS.....Natural Resources Conservation Service

PHS.....Priority Habitats and Species

SMA.....Shoreline Management Act

SMP .....Shoreline Master Program

USFWS.....U.S. Fish and Wildlife Service

USGS .....U.S. Geological Service

WDFW .....Washington Department of Fish and Wildlife

APPENDIX A

Inventory and Analysis Map Folio