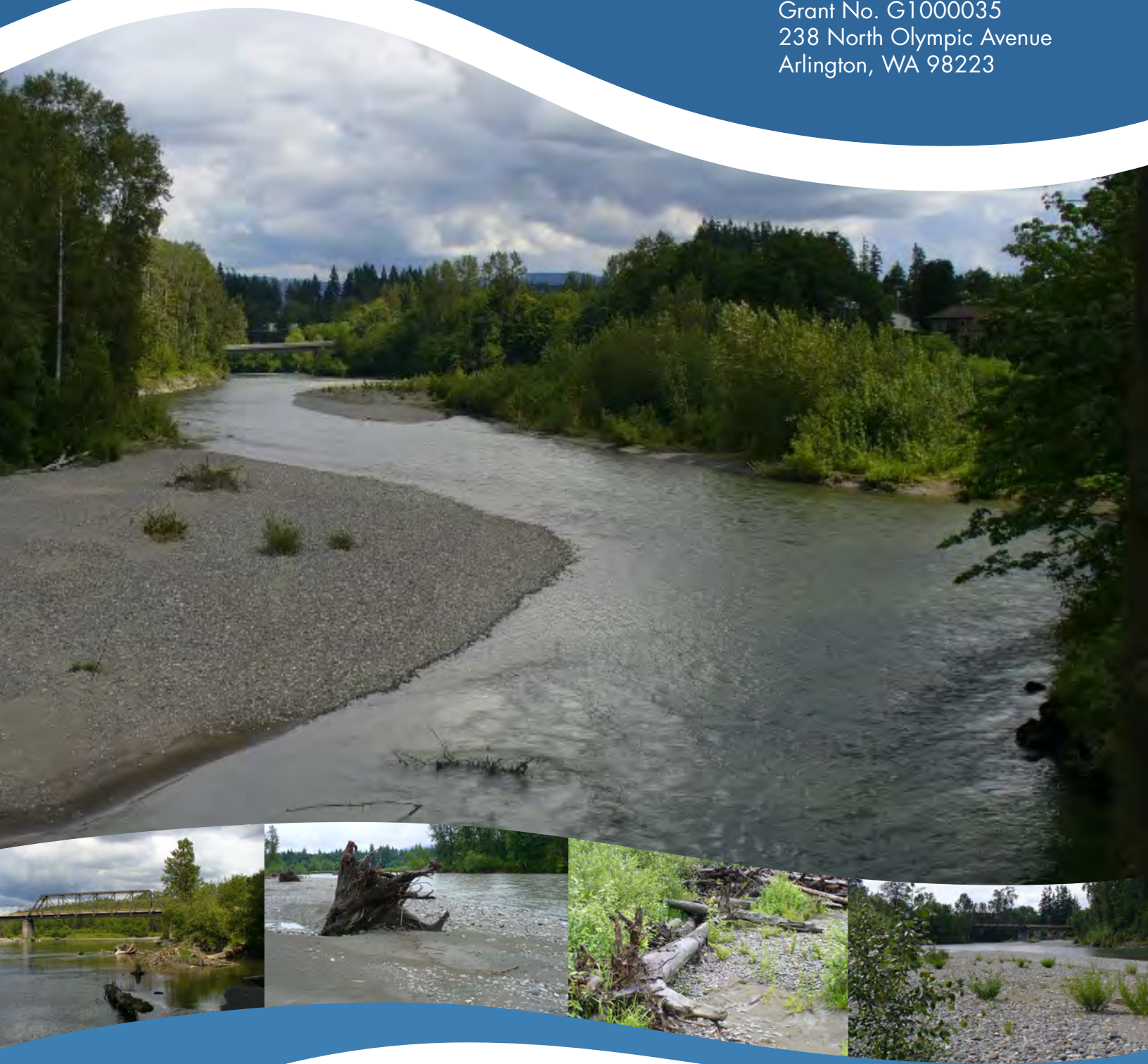
FINAL

Shoreline Analysis Report for City of Arlington's Shoreline: South Fork and Mainstem Stillaguamish River and Portage Creek

Prepared for:

City of Arlington
Grant No. G1000035
238 North Olympic Avenue
Arlington, WA 98223



The Watershed Company

January 2011

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1 INTRODUCTION

1.1 Background and Purpose

The City of Arlington (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 (Appendix A) and an information request letter was distributed to potential interested parties and agencies that may have relevant information (Appendix B). 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 and mainstem Stillaguamish River within City limits and the UGA is a regulated Shoreline and is considered a Shoreline of Statewide Significance (≥ 1,000 cubic feet per second). Additionally, Portage Creek is also considered a shoreline stream. Associated wetlands, floodway, and contiguous floodplains are also considered within shoreline jurisdiction. A detailed discussion of the entire jurisdiction assessment and determination process can be reviewed in full in Appendix C of this report. No other streams, lakes, or wetlands within the City of Arlington are considered part of shoreline jurisdiction.

1.3 Study Area

The City of Arlington is located in Snohomish County, Washington. The City is surrounded by areas of unincorporated Snohomish County and borders the City of Marysville along portions of the southern and western city limits. The City encompasses approximately 9.22 square miles. The study area for this report includes all land currently within the City's proposed shoreline jurisdiction (Appendix C), 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 198.43 acres (0.31 square mile), and encompasses approximately 1.86 miles of shoreline.

2 Current Regulatory Framework Summary

2.1 City of Arlington

The Shoreline Management Act of 1971 brought about many changes for local jurisdictions, including the City of Arlington. 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). Although the City's Comprehensive Plan contains only a handful of specific shoreline policies, many of the goals and policies scattered through the Comprehensive Plan recognize and encourage protection or enhancement of, and access to, the City's shorelines. Regulations applicable to critical areas which are located within shoreline jurisdiction were last updated in 2003 consistent with Growth Management Act requirements for use of "best available science" (City of Arlington Municipal Code, Section 20.88). Those regulations specify buffers for the Stillaguamish River and Portage Creek of 150 feet (20.88.440) and wetland buffers of up to 150 feet (20.88.830).

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 Arlington 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 Arlington's 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. The Stillaguamish River is a designated navigable waterbody from Puget Sound to the City of Arlington. Portage Creek is not a designated navigable waterbody. Accordingly, proposals to construct new or modify existing over-water structures (including bridges), to excavate or fill, or to "alter or modify the course, location, condition, or capacity of" navigable waters must be reviewed and approved by the Corps.

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 Arlington's 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 Arlington's shoreline jurisdiction, however, it generally means that WDFW must review and approve most activities in both the Stillaguamish River and Portage Creek. 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. A list of inventory elements and the various data sources that were utilized for each element are provided in Appendix A. Figures depicting the various inventory pieces listed in Table 1 are provided in Appendix D.

Table 1. Shoreline Inventory Elements and Information Sources.

Inventory Element	Information Gathered	Data Sources
Land Use Patterns	• Zoning, current land use, and future land use	• City • County
Surface Water and Outfalls	• Streams, stormwater facilities and pipes	• City
Sanitary Sewer System	• Force Mains and Gravity sewer lines	• City of Arlington • City of Marysville • County

Inventory Element	Information Gathered	Data Sources
Impervious Surfaces	• General impervious surface from 2001 aerial photo interpretation at 30-m resolution • Commercial and multi-family buildings, streets	• City • USGS
Public Access Areas	• Parks and open spaces	• City • County
Soils	• Soil types	• USDA NRCS (SSURGO)
Floodplains & Wetlands	• Floodplains • Wetlands	• City • County • FEMA • WDFW
Aquifer Recharge Areas	• Floodplain and outwash deposits	• WDNR
Geologic Hazards	• Seismic Hazard Areas • Liquifaction • Lahars • Landslides	• WDNR
WDFW Priority Habitats & Species	• Priority fish, priority wildlife, priority habitats	• WDFW
Vegetation	• Terrestrial vegetation type and land cover	• NOAA CCAP
Water quality impairment	• 303(d) waters and regulated sites	• Ecology
Topography	• LIDAR	• Puget Sound LIDAR Consortium

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 within City limits or the UGA as follows and as illustrated on Figure 15 in Appendix D.

- South Fork Stillaguamish River – City (includes small section of mainstem)
- South Fork Stillaguamish River – UGA
- Portage Creek

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	Public Access (Park & Open Space)	Channel Migration and Flooding	Geologic Hazards	Critical Areas
Stillaguamish River – City	• 30.25 acres • 2,885 linear feet of shoreline	**Zoning Type:** • Public/Semi-Public Use Land (51%) • Old Town Business District 3 (41%) • Low/Moderate Density Residential (7%) • High Density Residential (1%) **Current Land Uses (approx. # of parcels):** • Executive, Legislative & Judicial Functions (1) • Four Family Residence (Four Plex) (1) • Manufactured Home (Owned Site) (1) • Mobile Home Park 1 – 20 Units (1) • Parks – General Recreation (1) • Religious Activities (Churches, Synagogues, etc.) (1) • Rivers, Streams, or Creeks (4) • Single Family Residence Condominium Detached (4) • Single Family Residence – Detached (16) • Three Single Family Residences (1) • Trails (Centennial, et al) (1) • Two Family Residence (Duplex) (2) • Undeveloped (Vacant) Land (10)	• 28% impervious surfaces • 1 acre of forest • <1 acre of non-forest vegetation	• South Fork of Stillaguamish on 303(d) list for dissolved oxygen	• Haller Park	**Channel Migration Zone:** • North Fork Stillaguamish River – .06 mile • South Fork Stillaguamish River – .58 mile • Stillaguamish River – .77 mile • Floodway – 18.18 acres • Floodplain – 21.27 acres	**Site Class (Ground Shake)** • Class D (Stiff Soil) – 16.29 acres • Class E (Soft Soil) – 13.97 acres **Lahar Hazard:** • 28.78 acres **Liquefaction Susceptibility:** • High – 12.06 acres • Low to Moderate – 1.91 acres • Very Low – 16.29 acres	• 2.01 acres of wetlands
South Fork Stillaguamish River – UGA	• 159.78 acres • 6,849 linear feet of shoreline	**Zoning Type:** • Low/Moderate Density Residential (96%)[1] • High Density Residential (2%) • Suburban Residential (1%) • Moderate Density Residential (<1%) • Public/Semi-Public Use Land (<1%) **Current Land Uses (approx. # of parcels):** • Nursery, Primary & Secondary School (1) • Open Space Agriculture RCW 84.34 (1) • Single Family Residence – Detached (4) • Undeveloped (Vacant) Land (6)	• <1% impervious surfaces • 15 acres of forest • 79 acres of non-forest vegetation	• South Fork of Stillaguamish on 303(d) list for dissolved oxygen	• Country Charm Recreation and Conservation Area (future)	**Channel Migration Zone:** • South Fork Stillaguamish River - 2.09 miles • Floodway – 89.16 acres • Floodplain – 149.75 acres	**Site Class (Ground Shake):** • Class C (Dense Soil and Rock) - .6 acres • Class D (Stiff Soil) – 2.74 acres • Class E (Soft Soil) – 156.44 acres **Lahar Hazard**: • 116.95 acres **Liquefaction Susceptibility:** • High – 156.43 acres • Very Low – 3.34 acres	• 102.24 acres of wetlands
Portage Creek	• 8.40 acres • 74 linear feet of shoreline	**Zoning Type:** • Highway Commercial (79%) • Low/Moderate Density Residential (21%) **Current Land Uses (approx. # of parcels) :** • Open Space Agriculture RCW 84.34 (1) • Undeveloped (Vacant) Land (1)	• 6% impervious surfaces • 2 acres of non-forest vegetation	• Portage Creek on 303(d) list for turbidity		**Channel Migration Zone:** • NA • Floodway – NA • Floodplain – 8.15 acres	**Site Class (Ground Shake):** • Class E (Soft Soil) – 8.4 acres **Lahar Hazard:** • 8.37 acres **Liquefaction Susceptibility:** • High – 7.65 acres • Low to Moderate – .74	• 1.77 acres of wetlands

[1]~140 acres of Country Charm has a proposed Comprehensive Plan change from Residential to Public/Semi-Public use

3.3 Data Gaps

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

Table 3. Data Gaps.

Inventory Element	Comments
Shoreline armoring	Armoring is known to exist at the abutments of the SR9, SR530, and Centennial Trail (formerly railroad) bridges. There is armoring associated with protection of the Williams pipeline that transects the Country Charm Conservation Area (CCCA). There are remnants of past armoring along the CCCA that are not expected to be maintained in the future due to their location within a buffer easement. Haller Park also has a short section of heavily armored shoreline adjacent to the historic boat launch.
Overwater coverage	Overwater coverage is known to include the SR9, SR530, and Centennial Trail (formerly railroad) bridges
Impervious Surfaces	Existing 30m impervious surface data is coarse relative to the area of shoreline jurisdiction.
Vegetation	Existing 30m vegetation data is coarse relative to the area of shoreline jurisdiction.

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 presence/absence in shoreline jurisdiction of other environmental conditions for which data is available is expected to be more relevant to decision making.

4 Analysis of Ecological Functions and Ecosystem Wide Processes

4.1 Geographic and Ecosystem Context (WRIA 5)

The City of Arlington 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 (Exhibit 1). 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. 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 River Mile 18 at Arlington. The North Fork Stillaguamish drains 284 square miles and the South Fork 255, with the remainder drained by the Mainstem or its tributaries (Williams et. al. 1975). Major tributaries include 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 they pass by and near the City of Arlington, the Stillaguamish and both of its forks flow in relatively low-gradient channels bounded primarily by agricultural, parkland, and cottonwood-forested floodplain areas with higher bluffs bordering the more developed areas within the City.

The Stillaguamish River is a groundwater driven base flow system. Snowmelt contributes to the flows throughout various times of the year, with some late summer snowmelt coming from White Horse and Three Fingers Mountains snowfields to Boulder and Squire Creeks.

In the Pacific Northwest, climate change is expected to result in: modest increases in annual average precipitation, with most of the increase coming in the winter months; less spring snowpack as more winter precipitation falls as rain rather than snow; earlier melting of snowpack due to warmer spring temperatures. Therefore, as a result of climate change, the Stillaguamish River system can be expected to have higher flows in the winter, lower flows in late spring, and lower, warmer flows in the summer.

The South Fork and a very short section of the Mainstem of the Stillaguamish River flow east to west along the northern boundary of the City (see Appendix D, Figure 1) and are included in the City's Shoreline jurisdiction. Though in close proximity, the North Fork does not flow through or border the City and hence it is not included in, nor does it contribute to, the City's Shoreline jurisdiction. A section of Mainstem tributary Portage Creek is also a Shoreline stream and flows through the City, however it contributes relatively little area to the City's Shoreline jurisdiction since nearly all of its stream length within the City is upstream of the SMP stream limit (20 cfs mean annual flow). Only a short section of Portage Creek passing through a newly-annexed area along the east side of Interstate 5 near Island Crossing and a separate small jurisdictional buffer area in the City's UGA at the SMP stream limit contribute to the City's area of Shoreline jurisdiction (see Appendix D, Figure 1a and Figure 1, Inset C). The City and its UGA include 9,191 feet of South Fork shoreline frontage (south bank only), 543 feet of

Mainstem shoreline frontage (south bank only), and 74 feet of Portage Creek shoreline frontage (both banks) for a total of 9,808 lineal feet of shoreline rivers and streams. 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 198.43 acres is within the shoreline jurisdiction of the City.

No dams or reservoirs occur along either fork of the Stillaguamish River or the mainstem, so flows in the basin are essentially unregulated. While diking of the lower Mainstem of the river is prevalent throughout the Stillaguamish Flood Control District, entirely west of Interstate 5, no diking is known to occur within the City's shoreline jurisdiction. Some diking does occur in unincorporated Snohomish County along the south bank of the Mainstem just downstream (west) of the City (e.g. the Dike Road).

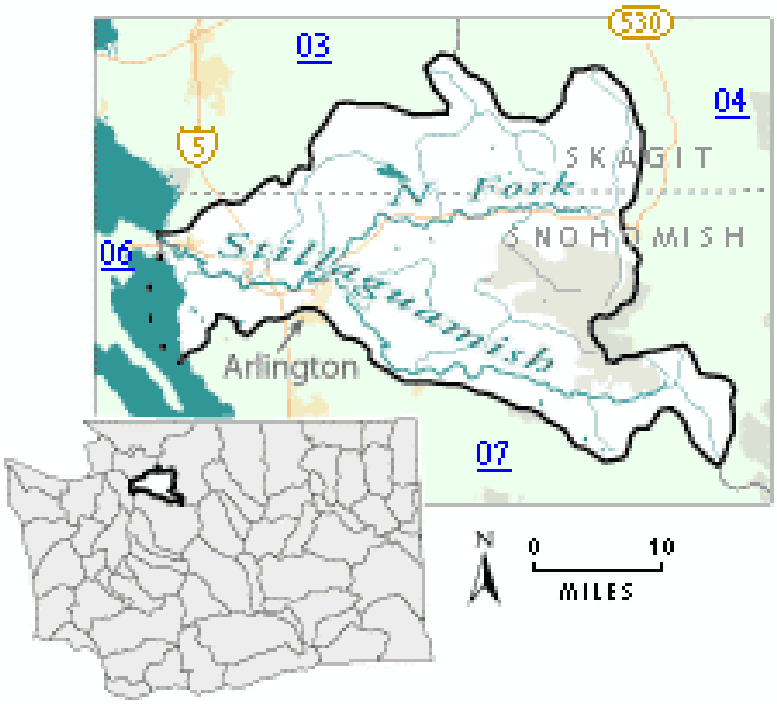

Exhibit 1. City of Arlington Setting in WRIA 5 (Department of Ecology)

4.2 Major Land Use Changes and Current Shoreline Condition

The City of Arlington is situated at the forks of the Stillaguamish River. Coast Salish people from pre-historic times, primarily of the Stillaguamish Tribe, stopped to camp at the forks as they passed up and down the river following the abundant fish runs and otherwise using the river as a primary travel corridor. The Stillaguamish called the place *Skabalko*.

Exploration of the future Arlington area by setters of European descent began around 1851 with a prospector visit followed in 1856 by a U.S. Army trail from present day Snohomish crossing the river just below the forks. A rough wagon road closely following the old trail brought pioneers coming from the Marysville area in the mid-1880s; others came by canoe. A store was opened at the forks in the spring of 1887 by Nels K. Tvete and Nils C. Johnson joined by the White House Hotel owned by loggers Lee Rogers and Al Dinsmore about 4 months later.

In the Spring of 1890, two rival towns were actually platted within one month of each other in what is present-day Arlington. Arlington was platted in March of that year and Haller City in April. Haller City, including the store and hotel, was located on the riverbank with Arlington on higher ground to the south. It was Haller City which contained the much of City's present-day Shoreline areas since it was located along the river with Arlington farther inland.

Rivalry between the two towns continued for a several years, with Arlington apparently having a distinct advantage with respect to the location of a critical railroad depot. Haller City's location along the river bank was not as suitable for a depot, so it was built on higher ground farther from the River, in Arlington. By year's end, Arlington also had an express office, a warehouse, telegraph, and a post office while Haller City had a blacksmith, hay dealers, shoemakers, stage line, meat market, livery, hotel, and vet surgeon. By 1895, however, a number of businessmen in Haller City conceded that it would be better to be up in Arlington. Leading were Tvete and Johnson who moved their original general store by ox team up to a lot on 4th Street in Arlington, and others followed. Eventually, all that was left in Haller City were the shingles mills and housing.

The two towns were incorporated into one in 1903 (taking the name of Arlington), with Division Street serving as a reminder that there were once two towns. In 2003, the City celebrated its hundredth year, applying for and being accepted as a Tree City as part of its anniversary events. See link:

http://www.historylink.org/index.cfm?DisplayPage=output.cfm&file_id=8416

Prior to European settlement, most of the drainage basin of the Stillaguamish was forested, with conifers the dominant tree type.

Logging was the first economic driver for the area, while farming and particularly dairy farming soon followed. 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 are the DeForest Creek slide (1984) on Deer Creek, which was estimated to contribute 50 percent of the sediment load of the North Fork Stillaguamish (the slide contributed 1.6 million cubic yards of sediment to Deer creek between 1984 and 1991), and 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).

4.3 Analysis of Ecological Functions and Processes

Ecological processes and functions of the City of Arlington's 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
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 reaches based on land use and shoreline condition. 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 and Mainstem Stillaguamish River – City

The South Fork and Mainstem Stillaguamish River – City assessment unit consists of lands within shoreline jurisdiction generally located along the south bank of the South Fork downstream (west) of the SR 530 bridge (Exhibit 2) and continuing along that bank past the confluence with the North Fork and along the Mainstem to just downstream (west) of the SR 9 bridge (see Appendix D, Figure 1a). This assessment unit includes lands within the City limits as well as the City UGA.

In addition, this assessment unit includes a separate small jurisdictional area north of 211th Place NE, near the City limits (see Appendix D, Figure 1, Inset B). This area consists of a wetland located within the 100-year floodplain.

This assessment unit includes approximately 2,885 linear feet of shoreline and 30.25 acres of total jurisdiction (see Appendix D, Figure 15).

Exhibit 2. Photo looking upstream toward the Hwy 530 bridge crossing.

Table 4. Function Summary of the South Fork and Mainstem Stillaguamish River – City

Shoreline Processes and Functions within Assessment Unit	Alterations and Assessment of Functions
Hydrologic	
Storing water and sediment	LOW/MODERATE: Within this unit, the river is constrained on the south (City) side by relatively high banks of somewhat erosion-resistant materials at the boundary of the channel migration zone. The shoreline jurisdictional areas within this unit are highly developed, with the SR530 bridge over the South Fork roughly bounding the east end and the SR 9 bridge over the Mainstem roughly bounding the west end. Existing development includes residential development, the Cascade District Courthouse (Snohomish County), park lands (Haller Park), and the City's sewage treatment plant. It can be expected that steps would be taken to protect these improvements should the river channels show signs of migrating towards them. However, the thalweg (line of deepest water) of the South Fork channel has moved northward, away from the City side, in recent years and an extensive gravel bar has formed. Formation of this bar indicates higher functionality with respect to sediment storage, though functionality with respect to the storage of water on that side remains low. This bar has been colonized extensively by primarily sapling cottonwood trees which have in turn helped to capture and accumulate woody debris. The north (County) side of the South Fork channel is characterized by a 6-8-foot-high cut-bank, formed as the channel moves northward. Its adjacent flood plain areas, between the forks of the river, consist of low-lying, depositional cottonwood forest and ball field areas (Twin Rivers Park, see Exhibit 2) that are frequently flooded during high-flow events. As such, they have a high level of functionality with respect to the storage of both water and sediment. The cottonwood forest area appears to provide good wildlife habitat and some wood is recruited as the channel moves. The short distance between the confluence of the north and south forks and the Highway 9 bridge on the north (County) side is constrained by a training dike.
Transport of water and sediment	LOW/MODERATE: A long-standing floodplain constriction in the form of the heavily-armored Centennial Trail (formerly railroad) bridge crossing of the mainstem exactly at the confluence of the North and South Forks has likely altered the flow regime and the sediment transport capacity through this reach.

Shoreline Processes and Functions within Assessment Unit	Alterations and Assessment of Functions
Attenuating flow energy	LOW/MODERATE: Riparian forests on the north (County) side between the forks at their confluence may help attenuate energy, as well as the vegetated bar forming on the south side. Also, logs rack up on the Centennial Trail bridge abutments on the north side. The SR 530, SR 9, and Centennial Trail embankments all interfere with and diminish connections between the river channel and its floodplain on the north (County) side. There are bank armored conditions both upstream and downstream of this unit that have impacted the ability of this short unit to attenuate flow energy.
Developing pools, riffles, and gravel bars	MODERATE: A good and apparently permanent pool exists on the South Fork near the SR 530 crossing and appears to be maintained by existing, very large natural boulders at that location, possibly including some bedrock. Deep water also appears to be maintained at the confluence, with riffle areas and gravel bars along the South Fork above and in the Mainstem below it. 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, although some wood has accumulated on the gravel bar areas. City staff reports that the channel thalweg along the South Fork has been shifting to the north at a rate of about 10' per year over the past decade.
Removing excess nutrients and toxic compounds	LOW: On the south (City) side, the steeper bank and lack of a broad floodplain results in incomplete biofiltration functions, though the existing vegetated bar provides some function. Further, developed upland shoreline areas are more often a source of nutrients and toxic compounds than a sink, due to urban residential runoff (pesticides, fertilizers, herbicides) and road runoff (hydrocarbons, metals). There are three stormwater outlets along this reach, located at 1) Talcott Street (east end, near SR 530 crossing of the South Fork), 2) Broadway (west central), and 3) the Centennial trail crossing (near the west end). The outfall from the City's sewage treatment facility also occurs to the Mainstem at the lower end of this reach. The partially-forested floodplain areas on the north (County) side of the South Fork along this same reach likely provide considerably better biofiltration function.
Recruitment of LWD and other organic matter	MODERATE: Some wood tends to accumulate as jams on the vegetated gravel bar that has formed on the south (City) side of the South Fork along this unit, though the more mature riparian forests on the opposing north bank have a higher potential to capture and retain such wood during the larger flow events. Some LWD has reportedly been removed from this unit due to safety concerns associated with high recreational use.
Vegetation	
Temperature regulation	MODERATE: High, fairly-well-vegetated banks along the south side of the river channel, except at Haller Park, provide moderately good shading conditions, in turn benefiting temperature.

Shoreline Processes and Functions within Assessment Unit	Alterations and Assessment of Functions
Water quality improvement	LOW/MODERATE: Biofiltration potential is lower on the south (City) side due to the narrow, steep bank. However, cottonwood saplings are becoming established on the gravel bar and the majority of the bank, even though it is steep, is heavily vegetated and so provides some level of treatment. Biofiltration function is higher on the opposing north (County) side as described above. Wide floodplain areas that are densely vegetated with trees, shrubs, grasses, emergent vegetation, and other riparian vegetation, as occurs on the north but not the south side, offer a superior level of biofiltration.
Slowing riverbank erosion; bank stabilization	MODERATE: Despite bounding an urban area, the south (City) bank is moderately well vegetated. That condition, along with fairly erosion-resistant soils, slows the rate of bank erosion. In addition, the deepest part of the channel appears to be moving away from and a bar is forming along the City side.
Attenuating flow energy	MODERATE: Some vegetation in the form of primarily cottonwood saplings is present on the forming bar along the south bank as well as more mature vegetation along the upper banks. Some log jams have also formed on the bar, with accumulated wood appearing to have been trapped by the sapling trees. As stated above, it has been reported that some Large Wood has been removed from the system due to safety concerns.
Sediment removal	MODERATE: As stated above, the formation of a fairly extensive bar along the south (City) side of the river is an indication of sediment removal. Both coarse- and fine-grained sediments are represented. Young vegetation which has colonized the bar helps to retain additional sediment.
Provision of LWD and other organic matter	LOW/MODERATE: Vegetation along the upper bank is of the size that could provide recruitment of some LWD, though trees tend to be deciduous short-lived alder and cottonwood. A lack of channel migration on the south, City side limits recruitment to windfalls or trees recruited through attrition (mortality).
Removing excess nutrients and toxic compounds	LOW/MODERATE: A high, relatively steep riverbank and the nature of the soils tend to limit hyporheic activity adjoining the south (City) side of the river, though hyporheic activity is anticipated within the forming bar. Upper bank soils are primarily glacial till, which are typically fairly impermeable. However, the City reports that the surficial geology supports infiltration as an effective component of stormwater management in the predominantly residential area adjoining the river. Existing springs observed on the face of the slope are not hyporheic themselves, but may indicate that soils are permeable enough to support some hyporheic activity on that side. In contrast, the active floodplain depositional area on the north side of the channel, situated as it is between the North and South Forks at the confluence, is expected to have an unusually high level of hyporheic function and activity, including a high natural potential for hyporheic removal of excess nutrients and toxic compounds. However, the conversion from trees to farm land and now park land over some of this riparian zone may have reduced hyporheic function somewhat.

Shoreline Processes and Functions within Assessment Unit	Alterations and Assessment of Functions
Water storage and maintenance of base flows	LOW: As above, the existing soils on the south (City) side beyond the gravel bar are not likely conducive to significant hyporheic flow or function, limiting the potential for water storage and base-flow maintenance. The 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/ MODERATE: Except on the gravel bar, the steeper bank on the south (City) would severely limit the ability of plants to be watered from the hyporheic zone. However hyporheic supply of water to vegetation on the flood plain to the north of the channel is expected.
Sediment storage	LOW/MODERATE: The soils on the south (City) side of this unit beyond the gravel bar are fairly impermeable and so there is relatively little hyporheic activity or function. Sediments are stored within the bar itself. Such hyporheic sediment storage likely occurs beyond the opposing north (County) bank.
Habitat	
Physical space and conditions for life history	MODERATE: Habitat in and along the South Fork of the Stillaguamish River adjoining Arlington has been reduced in quality, quantity, and complexity compared to its original condition. Though the channel has not been directly altered, the vegetative community has been reduced in scale with invasive species introduction and less accumulated downed wood and snags, resulting in fewer places for various wildlife species to find cover or suitable nesting and rearing sites. The reduction of dense riparian vegetation is a limiting factor for terrestrial species' (birds, mammals, amphibians) use of the shoreline, since cover, food, nesting sites, travel corridors, etc. are more restricted. Within the channel itself, fewer log jams and less wood overall similarly results in less available protective cover, and diminishes pool quality and the creation of pool/riffle sequences as well.
Food production and delivery	MODERATE: 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 and Mainstem Stillaguamish River – City assessment unit, the overall shoreline ecological function is considered LOW/MODERATE.

4.3.2 South Fork Stillaguamish River – UGA

The South Fork Stillaguamish River – UGA unit primarily consists of the shoreline area within the City's UGA which is to be added in the future. This shoreline area consists of those areas of City lands within shoreline jurisdiction generally located along the south bank of the South Fork upstream (east) of the SR 530 bridge and continuing along that bank approximately 1.6 miles to the established UGA boundary (see Appendix D, Figure 1). This unit is composed predominantly of cottonwood forest and recently-farmed floodplain areas. Uses going forward are anticipated to be a combination of forested riparian conservation buffers along the river, stream and wetland restoration, and some recreational areas, including inland ball fields.

In addition, this assessment unit includes a separate smaller jurisdictional area north of Tveit Road (see Appendix D, Figure 1, Inset A). This area consists of a wetland located within the 100-year floodplain.

This unit includes approximately 6,849 linear feet of shoreline and 159.78 acres of total jurisdiction (see Appendix D, Figure 15).

Exhibit 3. Photo looking upstream along the Country Charm property

Table 5. Function Summary of the South Fork Stillaguamish River – UGA

Shoreline Processes and Functions within Assessment Unit	Alterations and Assessment of Functions
Hydrologic	
Storing water and sediment	HIGH: This unit consists predominantly of low-lying cottonwood forest and recently-farmed pasture and crop lands in alluvial floodplain areas that are frequently flooded during high-flow events. Therefore, it has a high level of functionality with respect to hyporheic functions, including the storage of water and sediment. Existing cottonwood forest areas appear to provide good wildlife habitat.
Transport of water and sediment	HIGH: The floodplain has ample width and is relatively unconstrained throughout this unit, allowing for the fairly unrestricted movement of water and sediment.
Attenuating flow energy	MODERATE/HIGH: Existing forest areas and accumulated wood associated with bars toward the upper end, along with expanded flood flows across the flood plain, allow for effective attenuation of flow energy. Increases in forested flood plain area would further increase roughness and energy attenuation.
Developing pools, riffles, and gravel bars	MODERATE/HIGH: This 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 and well-formed pools also occur, but are somewhat transient due to the shifting sand changeable nature of the channel itself. There is one persistent log jam about mid-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.
Recruitment of LWD and other organic matter	HIGH: The riparian vegetation present along the river combined with a broad, shallow, somewhat braided channel form is conducive to the recruitment of logs and other vegetative materials, forming moderate jams in places. 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 is well-vegetated along this unit and such vegetated buffers generally tend to improve shading conditions, the broad, braided, and shallow nature of the river channel through this area, especially the upstream portions, leave 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.

Shoreline Processes and Functions within Assessment Unit	Alterations and Assessment of Functions
Slowing riverbank erosion; bank stabilization	MODERATE: Recently-farmed areas have a relatively thin band of forest separating them from the river channel. Cottonwood forests of varying degrees of maturity are growing on some of the maturing gravel bar areas towards the upstream end of the unit. All in all, these forests are not mature or pervasive enough to slow erosion and channel migration to a high degree. Some of the downstream sections of this unit have been artificially armored with angular boulders (rip-rap) to protect the former farmland. The opposite (non-City) bank along the downstream portion of this unit is also highly constricted to protect Highway 530 from flooding and channel migration.
Attenuating flow energy	MODERATE/HIGH: The combination of existing areas of forest at various stages of maturity and other areas off shrubby vegetation effectively attenuate flow energy. In addition to vegetation, accumulated wood and a braided, shallow, complex channel form with a broad, active flood plain also serve to dissipate flow energy. Roughness is expected to increase as forested areas across the flood plain expand and mature.
Sediment removal	HIGH: As evidenced by the prevalence of gravel bars throughout this unit, this reach is a depositional zone. Forested, shrubby, and grassy areas throughout the floodplain are effective at filtering and retaining fine sediments, which are prevalent due to the Gold Basin slide and other sediment sources in the upper South Fork basin.
Provision of LWD and other organic matter	MODERATE: Though the channel is changeable and somewhat prone to migration along this unit, the moderate abundance and size of trees present limits the recruitment of LWD. However, significant amounts of wood originating from farther upstream tend to accumulate in the channel, on the bars, and along the vegetated flood plain.
Removing excess nutrients and toxic compounds	HIGH: the active floodplain depositional area and active, changeable, and complex array of channels and gravel bars along this unit is expected to provide it with an unusually high level of hyporheic activity and function, including a high natural potential for hyporheic removal of excess nutrients and toxic compounds. Though the historic conversion from trees to farm land over some of this riparian zone may have reduced hyporheic function somewhat, upcoming land use changes allowing wider forested buffer areas may largely restore it.
Water storage and maintenance of base flows	HIGH: The wide flood plain of alluvial soils, recent and ongoing gravel deposition, and the confluence with Eagle Creek would all tend to elevate hyporheic function and activity throughout this unit at an exceptionally high level. Specifically, the areas in the unit are expected to have a high level of function with respect to water storage and base-flow maintenance.
Support of vegetation	HIGH: Due to the broad, low flood plain and expected permeable soils, hyporheic supply of water to vegetation across the flood plain is expected to be high. However, some of the vegetation supported by such flow has been altered along this reach, having been converted to crop land and pasture.

Shoreline Processes and Functions within Assessment Unit	Alterations and Assessment of Functions
Sediment storage	HIGH: As mentioned, Gold Basin and other active slide areas in the upper basin result in a high level of fine sediment supply in the South Fork during moderate and high flow events. These sediments tend to be effectively captured and stored within the hyporheic zone as well as on the surface in this unit.
Habitat	
Physical space and conditions for life history	MODERATE/HIGH: Good habitat for a variety of wildlife species is presently provided along the forested banks of the South Fork in this unit, and habitat quality and quantity are expected to improve going forward as some of the now-agricultural land is transitioned to conservation (and some to recreation), resulting in wider forested buffers. Of note, bald eagles perch in riverside trees and forage for salmon along this reach and continuing upstream towards River Meadows County Park, and deer use the riparian forests as well. Black bear, skunk, bobcat and coyotes are occasionally sighted along the gravel bars. Expansion and maturation of the vegetative community going forward will help provide accumulated downed wood and snags, resulting in more places for various wildlife species to find cover or suitable nesting and rearing sites. 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. Within the river channel, moderately abundant wood and an overall complex channel form provides protective cover and leads to the creation and enhancement of pool/riffle sequences as well.
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, including tree, shrub, and grassland/emergent layers, accentuates its value as a source of food for a variety of wildlife throughout the seasons. Riparian vegetation is also a source of insects and other organic matter that drops 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 UGA assessment unit, the overall shoreline ecological function is considered MODERATE/HIGH.

4.3.3 Portage Creek

The Portage Creek assessment unit consists of those areas of City lands located in the Island Crossing Annexation Area within shoreline jurisdiction along both banks of Portage Creek. The Island Crossing Annexation Area is a roughly triangular area which lies between Interstate 5 on the west and Smokey Point Boulevard on the east and extends northward to north of SR 530 (see Appendix D, Figure 1a).

In addition, the Portage Creek assessment unit includes a separate small jurisdictional area southwest of Cemetery Road in the City's UGA near the upstream SMP stream limit, although the SMP portion of the stream itself is entirely outside of the City as well as its UGA near that location (see Appendix D, Figure 1, Inset C).

The Portage Creek assessment unit includes approximately 74 linear feet of shoreline (all in the Island Crossing Annexation Area) and 8.4 acres of total jurisdiction (see Appendix D, Figure 15).

Exhibit 4. View of downstream section along Portage Creek with reed canarygrass and new plantings adjacent to the stream

Table 6. Function Summary of Portage Creek

Shoreline Processes and Functions within Assessment Unit	Alterations and Assessment of Functions
Hydrologic	
Storing water and sediment	MODERATE/HIGH: Within the assessment unit, Portage Creek flows within the floodplain of the Mainstem Stillaguamish River and so functions to store water and sediment originating from its own drainage area upstream as well as, occasionally, water and sediment overflowing from the river.
Transport of water and sediment	LOW/MODERATE: The very low gradient of the stream channel across the flat river floodplain is not particularly efficient at transporting either water or sediment, and the prevalence of reed canary grass in and along it has further impaired its transport capabilities over time. It serves more as a water storage and sediment depositional area.
Attenuating flow energy	MODERATE/HIGH: Given the flat, low-gradient, setting, there is little energy to attenuate. Even flood flows are relatively low velocity. However, aquatic emergent, and grassy vegetation tends to add roughness and capture fine sediments.
Developing pools, riffles, and gravel bars	LOW/MODERATE: This section of Portage Creek is low-gradient with a fine-grained substrate and consists primarily of pool and run habitat with virtually no riffle or gravel bar areas. Large woody debris to form, maintain, and accentuate pools within the channel is scarce due to a long history of agriculture use of the adjoining areas. Few trees are in close enough proximity to the channel for recruitment. The fine-grained texture of the substrate and surrounding floodplain soils limits the presence of riffles and bars.
Removing excess nutrients and toxic compounds	MODERATE: Though the floodplain setting is conducive to a high level of biofiltration function, the agricultural use of that same floodplain would tend to elevate the levels of nutrients and toxic compounds to be removed, straining biofiltration capacity. Furthermore, Portage Creek carries urban runoff since it passes through developed areas of the City upstream and includes those developed urban areas in its drainage basin.
Recruitment of LWD and other organic matter	LOW/MODERATE: Little LWD is available for recruitment, though other sources of organic materials from shrubs, grasses, and emergent vegetation provide ample organic materials to support a decomposition-based food chain and nutrients to support primary productivity. Some young trees were planted as a restoration project around 2004 and may contribute to recruitment in time.
Vegetation	
Temperature regulation	LOW/MODERATE: The existing streambanks through the short annexation area are moderately well vegetated with shrubby deciduous trees including willow and alder and therefore a moderate amount of shading to the channel is provided. There is considerable room for improvement, however. Well-vegetated banks and buffers improve shading conditions, in turn benefiting both temperature and dissolved oxygen.

Shoreline Processes and Functions within Assessment Unit	Alterations and Assessment of Functions
Water quality improvement	MODERATE: Wide floodplain areas that are densely vegetated with trees, shrubs, grasses, emergent vegetation, and other riparian vegetation offer an effective level of biofiltration. However, as stated above, chemicals and nutrients from both agricultural and urban runoff sources can reach the stream and strain biofiltration capacity. Dissolved oxygen impacts have been documented immediately downstream of this location.
Slowing riverbank erosion; bank stabilization	MODERATE/HIGH: Given the low-gradient, low-energy nature of Portage Creek on the Stillaguamish floodplain, existing vegetation appears adequate to minimize erosion and stabilize banks.
Attenuating flow energy	LOW/MODERATE: As mentioned above, existing vegetation is adequate to attenuate flow energy, given the low-energy, low-velocity setting.
Sediment removal	HIGH/MODERATE: Areas of shrubby, emergent, and grassy vegetation throughout the floodplain are effective at filtering and retaining fine sediments.
Provision of LWD and other organic matter	LOW/MODERATE: As stated above, little LWD is available for recruitment. Sources of other organic materials, from shrubs, grasses, and emergent vegetation, provide ample organic materials to support a decomposition-based food chain and nutrients to support primary productivity.
Removing excess nutrients and toxic compounds	LOW/MODERATE: The soils along the stream in this portion of the overall Stillaguamish flood plain are largely finer-grained and not as conducive to hyporheic flow as a coarser substrate nearer the river and more recently laid down would be, limiting the natural potential for hyporheic removal of excess nutrients and toxic compounds. Basically, the hyporheic zone is already mostly full with respect to the storage of fine sediments and associated pollutants. The conversion from flood plain forest to agricultural land in much of the riparian zone has likely reduced hyporheic function.
Water storage and maintenance of base flows	LOW/MODERATE: As above, the existing soils in this “older” part of the floodplain are likely less permeable and therefore less likely to pass significant hyporheic flows, limiting the potential for water storage and base-flow maintenance.
Support of vegetation	MODERATE/HIGH: Floodplain water tables would be fairly near to the surface and finer-grained “river silt” soils would be effective at wicking the water upward far enough to be used by vegetation growing at the surface. Beyond the immediate streambanks, the vegetation supported by such flow has been altered significantly in much of this reach, having been converted to farm land within the unit and roadways bordering it, including Smokey Point Boulevard and the wide and elevated Interstate 5 roadway fill prism.
Sediment storage	LOW/MODERATE: As stated above, the soils along the stream in this portion of the overall Stillaguamish flood plain are largely finer-grained and not as conducive to hyporheic flow as a coarser substrate nearer the river and more recently laid down would be, thereby limiting the ability of the hyporheic zone to store additional sediment. Basically, the hyporheic zone is already mostly full with respect to the storage of fine sediments.

Shoreline Processes and Functions within Assessment Unit	Alterations and Assessment of Functions
Habitat	
Physical space and conditions for life history	MODERATE: Terrestrial wildlife habitat in and along Portage Creek in the vicinity of this unit has been reduced in quality, quantity, and complexity compared to its original condition due to conversion of floodplain forests to farmland and encroachment of major roadways, first old SR 99 followed by Interstate 5. The vegetative community has been reduced in scale, with less accumulated downed wood and snags, resulting in fewer places for various wildlife species to find cover or suitable nesting and rearing sites. The reduction of dense riparian vegetation is a limiting factor for terrestrial species' (birds, mammals, amphibians) use of the shoreline, since cover, food, nesting sites, travel corridors, etc. are more restricted. However, the slow-moving, open-water and emergent areas along the creek near and within this unit likely provide good waterfowl habitat. Portage Creek is a primary producer of coho salmon in the Stillaguamish basin with primary spawning habitat occurring in non-shoreline headwater tributary reaches on both sides of the City's eastern boundary. The SMP unit under consideration provides upstream passage for adults and downstream passage for smolts as well as long-term rearing habitat for juveniles. Reliable, perennial, and relatively high-volume groundwater flows originate from sources (springs) in the County's Portage Creek Wildlife Area bordering the City. These sources provide flows of relatively cool water sufficient to support productive juvenile rearing habitat for these fish along the lower, floodplain creek sections, including within the Portage Creek SMP unit. However, within the channel itself, lower levels of LWD recruitment overall result in less available protective cover.
Food production and delivery	MODERATE: Food production for terrestrial wildlife from upland areas originates largely from native seed- and fruit-bearing vegetation. Riparian vegetation is also a source of insects and other organic matter that drops 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 Arlington's Portage Creek assessment unit, the overall shoreline ecological function is considered MODERATE.

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.

The areas along the Stillaguamish River and Portage Creek included in shoreline jurisdiction all would require a 150' ESA stream buffer under the current Critical Areas Regulation (CAR). The CAR does allow buffer averaging and some uses of the outer buffer for naturally designed stormwater management systems.

4.4.1 South Fork and Mainstem Stillaguamish River – City

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 highly impacted areas where the vegetation has been cleared. The forested areas consist primarily of deciduous trees, including alder, big leaf maple, and cottonwood. Invasive species, including Himalayan blackberry and Japanese knotweed are also present in this reach. Primary restoration opportunities would be the planting of native coniferous species to expedite the improvement of riparian function.

The areas are protected by City's critical areas regulations, which require a 150-foot buffer for new development along the Mainstem and South Fork of the Stillaguamish River. There are existing, ongoing uses that do not meet the buffer requirements, as they occurred prior to the adoption of those regulations. During redevelopment of those areas landowners would be required to restore or allow the restoration of buffer areas, depending on the impacts of the proposed development.

4.4.2 South Fork Stillaguamish River – UGA

The restoration opportunities in the UGA reach are many. There are opportunities to incorporate small stream, wall-based channel, wetland, riparian, log jam, wildlife habitat, riparian and flood plain connectivity.

The Country Charm Recreation and Conservation area included a 150-foot buffer deed of right and stewardship plan required by the Salmon Funding Recovery Board as a condition of grant funding. The stewardship plan also addresses other uses identified in the Country Charm Recreation and Conservation Area. There are also several private landowners of wetland areas in the UGA that may allow restoration.

Protection of these areas is a responsibility of Snohomish County until annexed in to the City of Arlington. The area would be protected by both the Shoreline Master Program and critical areas regulations, whichever would be the most protective, depending on the requested development activity. The development of the updated Arlington SMP would include a similar combination of protections provided by the two regulatory mechanisms.

4.4.3 Portage Creek

Portage Creek area restoration would primarily be riparian, but there are opportunities for in-stream fish habitat, off-channel habitat, and wetland restoration. Protection of this area is provided by the current critical areas regulations and would require a 150-foot buffer. New development would require the dedication of a Critical Area Protection Easement to be filed with Snohomish County.

South Slough has been identified as a high-priority area for floodplain and side-channel reconnection for the recovery of Stillaguamish Chinook. The slough functions have been impacted by agricultural uses as well as hydrological impacts from the construction of Interstate 5 and State Route 530. Restoration opportunities would include riparian projects and off-channel flood refuge and flood storage functions.

4.5 Special Topic: Flooding and Channel Migration

The South Fork flows in a moderately broad valley bounded by a succession of terraces. Flooding is prevalent in the valley bottom, with a floodway that encompasses a quarter mile or more in places. Extensive gravel bars indicate this is a depositional reach, and combined with the lack of confinement, this likely contributes to the potential for channel migration across the valley bottom. The Mainstem Stillaguamish flows in an even broader valley, in places approaching two miles in width. Most of the valley bottom is subject to flooding, with a relatively broad strip of floodway bordering the active river channel.

Immediately upstream of Arlington Jurisdiction Highway 530 acts similar to a training dike with a combination of barbs and armoring preventing channel migration. The river is also controlled immediately below the confluence where the mainstem begins. The north bank is controlled by the Schloman Road training dike, while the south bank armoring at Haller Park ties in to the Johnson levee that is contiguous downstream with the Dike Road levee maintained by Snohomish County. The armoring at Haller Park also protects the City Water Reclamation Plant effluent pipe.

Opportunity for channel migration in the Country Charm Conservation Area is limited with the presence and easement for the Williams Pipeline and Puget Sound Energy High tension electrical lines.

4.5.1 South Fork and Mainstem Stillaguamish River – City

In the South Fork and Mainstem Stillaguamish– City unit, the floodplain of the South Fork merges with that of the North Fork. As with the UGA unit upstream, the potential for flooding, as well as channel migration, is limited in this unit by a terrace on the river's left bank. No development occurs in the lowland below this terrace.

4.5.2 South Fork Stillaguamish River – UGA

In the South Fork Stillaguamish – UGA Unit, channel migration is limited by a terrace on either side of the river. On the rivers left bank, the terrace forms a point near the terminus of E Gilman Avenue. The scarp just north or E. Gilman Avenue defines the floodplain limit on the South Fork, and likely the limit of channel migration as well. On the opposite bank, Jordan Road circles around an embayment of sorts in the right bank terrace. Land in the area prone to flooding and potential channel migration area is presently lacking in structures, limiting the hazard potential in this reach. The upland area within Country Charm is less subject to channel migration as shown in the geologic map below (Exhibit 5).

Exhibit 5. Map showing the hard point of glacial till within the Country Charm upland area

4.5.3 Portage Creek

Portage Creek originates on terraces south and east of the City, dropping to the valley floor of the Mainstem Stillaguamish as it enters the Portage Creek Wildlife Reserve. The floodplain of Portage Creek and the Mainstem Stillaguamish converge in this valley bottom area where the two segments of the Portage Creek assessment unit occur. Channel migration potential of the lower portion of Portage Creek is likely to be low, due to the low gradient of the channel and resulting lack of stream power.

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 (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 Population Target

The 2025 population target for the entire City, as allocated through the Snohomish County Tomorrow process, is 30,538. The City's current 2010 population is approximately 16,786.

5.3 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 7). Likely or appropriate environment designations are listed for each reach.

Table 7. Likely Changes in Land Use and Implications for Shoreline Management.

Reaches	Likely Changes in Land Use	Implications for Shoreline Management
Stillaguamish River – City	Historically, land use in this reach was connected to timber-related industries. Currently, 51% of this reach is zoned Parks/Semi-Public (P/SP). The P/SP district is intended to accommodate public and semi-public uses, such as schools, government services and facilities, public utilities, community facilities, parks, etcetera, on publicly owned land. 41% of this reach is zoned Old Town Business District 3 (OTBD-3). The OTBD zones are designed to accommodate a mix of a wide variety of commercial activities and high density residential uses in a pedestrian-oriented environment. 7% of the reach is zoned Low	The more developed portions of this reach could receive an Arlington-specific shoreline environment designation, such as "Historic Shoreline Business District." Residential areas could be designated as Shoreline Residential. Lands currently zoned Parks/Semi-Public could be designated Urban Conservancy. Wetlands in this reach could be designated as Natural.

Reaches	Likely Changes in Land Use	Implications for Shoreline Management
	to Moderate Density Residential (RLMD). RLMD-zoned areas are designed primarily to accommodate detached single-family residential development and recreational, quasi-public, and public uses that customarily serve residential development in areas served by public sewer and water facilities. Some types of two-family residences are allowed in this district on larger lots. 1% of this reach is zoned High Density Residential (RHD). RHD-zones areas are designed primarily to accommodate higher density multi-family developments and recreational, quasi-public, and public uses that customarily serve residential development in areas served by public sewer and water facilities. Only 2 or 3 small lots in this reach remain undeveloped. While the return of timber-related industry is unlikely, a canoe or kayak facility is a potential future use. The potential for future subdivisions of over four lots is very low. However, there are two lots where an old farm house and a trailer park are currently located, which may be converted into a commercial business providing some public access to the shoreline. Haller Park is due for upgrades to improve public access, including repair of the existing boat launch.	
Stillaguamish River – UGA	Currently, 96% of this reach is zoned Low to Moderate Density Residential (RLMD). RLMD-zoned areas are designed primarily to accommodate detached single-family residential development and recreational, quasi-public, and public uses that customarily serve residential development in areas served by public sewer and water facilities. Some types of two-family residences are allowed in this district on larger lots. However, the majority of this area, including the Country Charm Recreation and Conservation Area, is proposed to have the zoning changed from RLMD to Public/Semi-Public (P/SP). The P/SP district is intended to accommodate public and semi-public uses, such as schools, government services and facilities, public utilities, community facilities, parks, etc. on publicly owned land. 2% of this reach is currently zoned High Density Residential (RHD), However, approximately 15 acres of upland that was not purchased by the City for the County Charm Recreation and Conservation area has been pre-zoned RHD. RHD-zones areas are designed primarily to accommodate higher density multi-family	Most of this reach could be designated as Urban Conservancy. Additionally, the 150-foot shoreline buffer at the Country Charm Recreation and Conservation Area could receive a parallel Natural designation. Wetlands in this reach could be designated as Natural.

Reaches	Likely Changes in Land Use	Implications for Shoreline Management
	developments and recreational, quasi-public, and public uses that customarily serve residential development in areas served by public sewer and water facilities. When the rezoning process occurs, the City will consider an alternative zoning which may provide enhanced public access. 1% of the reach is zoned Suburban Residential (SR), which is designed primarily to accommodate detached single-family residential development and recreational, quasi-public, and public uses that customarily serve residential development in areas served by public sewer and water facilities. Some types of two-family residences are allowed in this district on larger lots. 1% of the reach is zoned Moderate Density Residential (RMD), which is designed primarily to accommodate detached or attached single-family residential uses at medium densities and recreational, quasi-public, and public uses that customarily serve residential development in areas served by public sewer and water facilities. Some types of two-family residences are allowed in this district on larger lots. Less than 1% of this reach is currently zoned P/SP.	
Portage Creek	79% of this reach is zoned Highway Commercial (HC). The HC zone is designed to accommodate the widest range of commercial activities. Uses allowed here include those allowed in other commercial districts, but also those that require highway access or that should be separated from residential uses. 21% of this reach is zoned Low to Moderate Density Residential (RLMD). RLMD-zoned areas are designed primarily to accommodate detached single-family residential development and recreational, quasi-public, and public uses that customarily serve residential development in areas served by public sewer and water facilities. Some types of two-family residences are allowed in this district on larger lots. Land in this reach is currently used for private farm operations. Possible future uses for the creek buffer in this area include public viewing, stormwater management, and increased landscaping.	Wetlands in this reach could be designated as Natural or Urban Conservancy depending upon future use of the area (i.e. trails and access).

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

6.2.1 Haller Park

This 2.5-acre park is located on the Stillaguamish River. It is a popular spot to view eagles or fish along the riverbank.

The park features:

- Beach access
- View of the Stillaguamish River
- Restrooms
- Picnic shelter
- Picnic tables
- Benches
- Swinging benches
- Children's play area (ages 2-12)

- Asphalt and concrete paths
- Horse Shoe pits
- Public fishing (existing boat launch is in need of repair)
- Off-street parking

The park is used during the 4th of July Festival and hosts the Great Stilly Duck Dash, the Pedal Paddle Puff Triathlon, Kiwanis Auction, and Fireman's Pancake Breakfast.
Swimming is not allowed at this park.

Haller Park is due for public access upgrades, including the repair of the existing boat launch.

6.2.2 Twin Rivers Park

This 50-acre park is owned by Snohomish County and maintained by the City of Arlington.

This park features:

- Beach access
- Public fishing access at the confluence of the North and South forks of the Stillaguamish River
- Large Cottonwood forest
- County-maintained trail
- Restrooms
- 3 softball fields
- 3 adult soccer fields
- 4 youth soccer fields
- Picnic tables
- Off-street parking
- Arlington Rotary Disc Golf Course

6.3 Future City Parks and Open Space

6.3.1 Country Charm Recreation and Conservation Area

On February 1, 2010 the Arlington City Council authorized the purchase 150 acres of lowlands adjacent to the Stillaguamish River to establish the Country Charm Recreation & Conservation Area. The purchase will cost the City $4 million plus interest over 30 years. The city received a $274,000 Washington State

Salmon Recovery Grant to help with the $800,000 down payment. The property was sold to the City by Hank and Betty Graafstra, who started Country Charm Dairy on the property in 1969. They operated the dairy for 37 years and sold milk, ice cream and other products directly from the dairy. It is a rare occasion for a small city to get a huge area of green space for a long list of uses.

In the future, the City plans to develop the Country Charm Recreation and Conservation area with nature trails, an off-leash pet area, a campground, sports fields, fishing pond, community garden and other recreational facilities. Any permanent facilities will be constructed with flooding in mind, since the lowland property is prone to flooding during major storm events when the Stillaguamish River leaves its banks.

6.3.2 City Riverfront

The City Riverfront started as Haller City around 1890 with the immigrants pursing mineral mining and timber. The confluence of the North and South Fork Stillaguamish had long been used by the Stillaguamish Tribe of Indians as a village and rendezvous site. Early development included shake mills, hotels and mercantile. The City of Arlington was incorporated in 1903 which included those portions of the earlier Haller City along the waterfront. In 2004 the City developed an economic strategy that included the redevelopment of the riverfront area from a residential neighborhood to recreational and commercial uses. There are many residents and travelers of all ages seeking access to the river as part of the Pacific Northwest experience. The commercial uses would provide retail sales income for the City and provide needed services to visitors accessing the Mountain Loop Highway. The redevelopment would allow improvements to the buffer areas along the river and implementation of low impact designs for stormwater and energy use.

6.4 Public Access Implications

Haller Park and Twin Rivers Park currently provide shoreline public access to the Stillaguamish River. The County Charm Conservation and Recreation Area will provide additional public access when developed.

In the future, the City would like to develop a water trail linking various public access points that could be used by recreational boaters. This would maintain the historical connection to pioneer families, who were transported along local rivers by the Stillaguamish Tribe in their shovelnose canoes.

Additionally, the City is also planning a comprehensive trail system that would allow pedestrian traffic to have easy access to area commercial and recreational opportunities.

Portage Creek does not currently have public access or recreation sites within the City's shoreline jurisdiction. The area of Portage Creek in shoreline jurisdiction is currently private farmland, with no physical access to the shoreline, though some viewing opportunities are available from the adjacent roadway. Enhanced public access is expected to be provided at some point in the future.

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 in and 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

- Consider whether regulations could be more stringent in shoreline jurisdiction.

Aquaculture

- Consider whether aquaculture should be allowed.

Boating Facilities

- The City should develop provisions that address boating facilities, particularly if any are under consideration for the Country Charm Recreation and Conservation Area. Consider the future use of the existing boat launch at Haller Park.

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.

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 (or future Recreation and Conservation Department) and any other public agencies that may own park land to identify issues related to park development. Park lands provide many 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

- 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.

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.

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

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

List of Data Sources

Preliminary List of Information Sources by Topic

Multi-Topic General Reference Materials/GIS Sources

City of Arlington GIS datasets [computer file]. (2006-2010). Arlington, Washington: City of Arlington, GIS/Engineering Division. Available from GIS/Engineering Division, City of Arlington [2010].

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APPENDIX B

Information Request Letter and Distribution List

City letterhead

Date

Name of Person
Address
Address

RE: City of Arlington Shoreline Inventory and Assessment, request for existing information: Stillaguamish River and Portage Creek

Dear Stakeholders:

The City of Arlington is in the early stages of examining its Stillaguamish River and Portage Creek Shorelines for the purposes of updating its Shoreline Master Program per requirements of the Washington State Department of Ecology. We have recently hired a consultant to assist with Shoreline characterization, analysis, and regulatory review. The products of the inventory/analysis include a map portfolio and a report characterizing ecological functions and ecosystem-wide processes, among other things.

The City is requesting your help in obtaining all relevant existing physical and biological information regarding these waterbodies; their associated riparian and wetland areas; and other relevant watershed or basin information. We are interested in any and all inventories, assessments, water quality analyses, and/or fish and wildlife distribution and habitat information. A map identifying the City's Shorelines is attached.

We are hoping to assemble our inventory by February 28, 2010 in order to complete the necessary characterization and analysis, and resultant recommendations, in a timely manner. A response would be appreciated by November 30, 2009. If possible, please provide hard copies or electronic files of any studies instead of a list of citations; contact the City if a copy fee is required. If you believe that another individual within your organization would be a more appropriate contact for this solicitation, please forward this letter to that individual, and notify us of the change in contact.

If you have any questions, would like to remain on the City's mailing list for future notifications related to this project, or need additional information, please feel free to contact me at (360) 403-3440 or bblake@ci.arlingtonwa.gov.

Sincerely,

Bill Blake
City of Arlington Planning Department

Encl.

Distribution List for City of Arlington Shoreline Master Program Inventory

Adjacent Cities

Adopt-A-Stream
600 128th St. SE
Everett WA 98208

American Rivers
Northwest Regional Office
4005 20th Avenue West, Suite 221
Seattle, WA 98199

Cascade Bicycle Club
PO Box 15165
Seattle, WA 98115

Cascade Land Conservancy
615 Second Avenue, Suite 525
Seattle WA 98104

Futurewise
Attn: Dean Patterson
814 Second Ave, Suite 500
Seattle, WA 98104

National Marine Fisheries Service
Attn: Tom Sibley
7600 Sand Point Way NE
Seattle, WA 98115

Puget Sound Partnership
P.O. Box 40900
Olympia, Washington 98504-0900

Rainier Audubon Society
Nancy Hertzel, President
PO Box 778
Auburn, WA 98071

Shared Strategy for Puget Sound
1411 4th Avenue, Suite 1015
Seattle, WA 98101

Snohomish County

The Snohomish Tribe of Indians
11014 19th Ave. SE, Suite 8, PMB #101
Everett, WA 98208

Stilly Snohomish Fisheries Enhancement Task Force
PO Box 5006
Everett, WA 98206

Trout Unlimited
South King County Chapter #115
P.O. Box 3434
Federal Way, WA 98003

Tulalip Tribes Natural Resources Department
Attn: Terry Williams
7515 Totem Beach Road
Tulalip, WA 98271

U.S. Army Corps of Engineers
Seattle District
P.O. Box 3755
Seattle, WA 98124-3755

U.S. EPA Region 10
1200 6th Avenue
Seattle, WA 98101

U.S. Fish and Wildlife Service
510 Desmond Drive, Suite 102
Lacey, WA 98503-1263

University of Washington
Center for Water and Watershed Studies
Box 352100
Seattle WA 98195-2100

Washington Department of Ecology
Attn: Barry Wenger
1440 10th St., Suite 102
Bellingham, WA 98225

Washington Department of Fish and Wildlife
Attn: Doug Hennick
16018 Mill Creek Boulevard
Mill Creek, WA 98012-1296

Washington Department of Natural Resources
Sandy Swope Moody
Natural Heritage Program
PO Box 47014
Olympia WA 98504-7014
(360) 902-1667

Washington Department of Natural Resources
Attn: Hugo Flores
Aquatic Resources Division
PO Box 47027
Olympia, WA 98504-7027

Wild Fish Conservancy
P.O. Box 402
Duvall WA 98019

WA Department of Fish and Wildlife
Attn: Katie Knight, SMP Reviewer
600 Capitol Way
Olympia WA 98501

APPENDIX C

Assessment of Shoreline Jurisdiction

4 December 2009

Bill Blake
City of Arlington
238 North Olympic Avenue
Arlington, WA 98223

Re: City of Arlington Shoreline Jurisdiction Options

Dear Bill:

The Watershed Company has developed the attached proposed maps of shoreline jurisdiction, illustrating the minimum jurisdiction option and the additional full floodplain and wetland buffers options. Under the City's current Shoreline Master Program (SMP), the South Fork Stillaguamish River and a small portion of the mainstem Stillaguamish River are regulated as shorelines. Existing shoreline jurisdiction includes the shorelands extending 200 feet from the ordinary high water mark and identified associated wetlands. As part of the update to the City's Shoreline Master Program, the City also plans to include and evaluate a portion of Portage Creek and additional areas within the City's Urban Growth Area (UGA). The UGA also includes portions of additional floodplain, floodway, and associated wetlands.

MINIMUM JURISDICTION

The first step in updating the map of shoreline jurisdiction was to review the precise shoreline, floodway, floodplain and associated wetlands definitions found in the WAC and in Washington Department of Ecology's (Ecology) rules and guidance documents. Portions of these definitions that apply to the City of Arlington revolve around the flow thresholds for waterbodies meeting shoreline criteria, the two State floodway definitions, and when to consider critical areas (wetlands) as "associated" with the shoreline. The final illustration of the minimum shoreline jurisdiction is provided on the *Minimum Shoreline Jurisdiction* exhibit.

Lakes

The minimum size limit for lakes to be designated as shoreline is 20 acres. No waterbodies within the City boundary exceed 20 acres.

Streams and Rivers

Washington Department of Ecology's Digital Atlas was consulted to verify the upstream limits of stream and river shoreline jurisdiction based on USGS's recent study of the 20 cubic feet per second (cfs) cut-off. Based on this information, Portage Creek has a mean annual

flow greater than 20 cfs beginning east of Interstate 5. The mainstem of the Stillaguamish River, along with the North and South Forks of the Stillaguamish River, are each considered a Shoreline of Statewide Significance since their mean annual flow exceeds 1,000 cfs.

No other waterbodies were indicated as having flows sufficient to meet shoreline criteria.

Shorelands

Floodplains/Floodways

The mapping of floodplains and floodways uses the latest information developed by Snohomish County and is in the final stages of review by FEMA. Portage Creek and the Stillaguamish River have floodplains that extend beyond the ordinary high water mark through portions of the City and the UGA (see Step 1 of the *Shoreline Jurisdiction Assembly* exhibit). However, Portage Creek does not have a designated floodway. At a minimum, the shoreline jurisdiction is extended to include any floodways (see Step 2 of the *Shoreline Jurisdiction Assembly* exhibit). In addition, shoreline jurisdiction is extended to any portions of the floodplain that extend up to 200 feet inland from the floodway edge (see Step 3 of the *Shoreline Jurisdiction Assembly* exhibit). We will continue to monitor progress of the floodplain/floodway mapping until final adoption by FEMA, and will update jurisdiction maps as needed during the SMP update process.

Associated Wetlands

Existing wetland inventory information (see Step 4 of *the Shoreline Jurisdiction Assembly* exhibit), essentially what has been identified by Snohomish County, Washington Department of Fish and Wildlife's Priority Habitats and Species maps as part of the National Wetland Inventory, and data provided by the City of Arlington, was reviewed to identify associated wetlands (see Step 5 of *the Shoreline Jurisdiction Assembly* exhibit). Ecology guidance states that the entire wetland is associated if any part of it lies within the area 200 feet from the OHWM (or floodway in riverine environments) of a state shoreline. Further guidance states that wetlands that are hydraulically connected to a Shoreline also would be considered associated, as well as wetlands within the 100-year floodplain. Wetlands that are separated by an obvious topographic break from the shoreline are not associated, provided they are outside the shoreland zone and provided that the break is not an artificial feature such as a berm or road.

Associated wetlands are identified in several areas along the jurisdictional boundary of both the mainstem and South Fork of the Stillaguamish River. Currently, wetland inventory information is lacking for areas along Portage Creek and the slough connection from the Stillaguamish River. As more information becomes available, additional associated wetlands may be mapped in this area.

OTHER JURISDICTION OPTIONS

The information above describes assembly of the minimum shoreline jurisdiction. The City may further elect to expand jurisdiction to include 1) all or part of the 100-year floodplain, or 2) buffers of associated wetlands that would otherwise encompass areas outside of shoreline jurisdiction.

The 100-year floodplain option was assembled by combining the *Minimum Shoreline Jurisdiction* exhibit with additional floodplain areas shown on Step 1 of the *Shoreline Jurisdiction Assembly* exhibit. The resulting optional jurisdiction is illustrated on the *Shoreline Jurisdiction Option 1* exhibit.

The wetland buffers option was assembled by combining the *Minimum Shoreline Jurisdiction* exhibit with buffers assigned to wetlands illustrated on Step 3 of the *Shoreline Jurisdiction Assembly* exhibit. Known wetlands within the City and its UGA have not been rated using Ecology's latest wetland rating system as required by the City's critical areas regulations. According to the critical area regulations, possible buffers range from 10 to 150 feet. For illustration purposes only, these wetlands were assigned a 100-foot buffer (see *Shoreline Jurisdiction Option 2* exhibit).

Given the existing development in the area, and the anticipated inclusion of the City's existing critical areas regulations wetland buffers into the SMP, it does not appear that inclusion of the buffers in shoreline jurisdiction would provide meaningful additional protection to the wetland and may unnecessarily increase the permit burden on the property owner.

Please call if you have any questions.

Sincerely,

Dan Nickel
Environmental Engineer

Enclosures

DRAFT

STILLAGUAMISH RIVER

PORTAGE CREEK

Area of interest in red

MINIMUM SHORELINE JURISDICTION

City of Arlington Shoreline Master Program

0 1,500 3,000

Feet

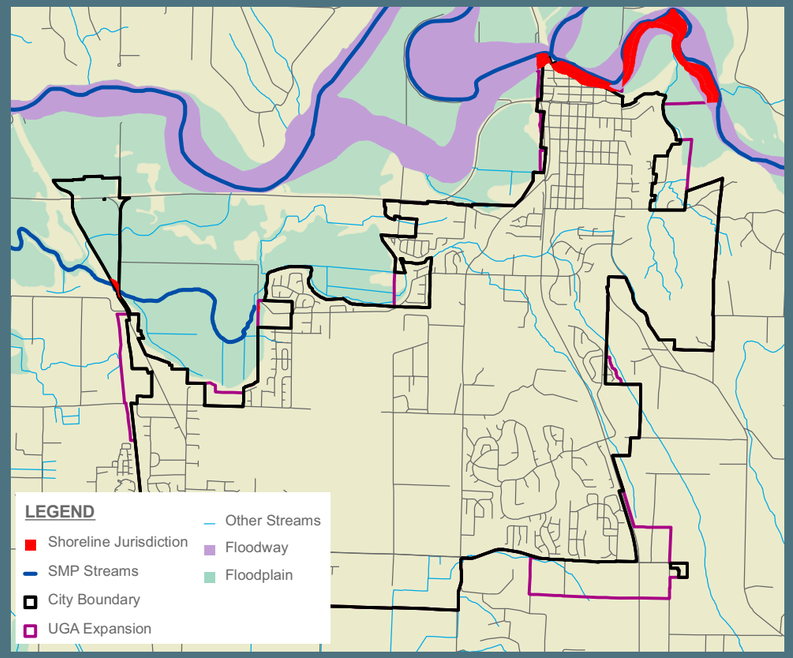
- Shoreline Jurisdiction
- SMP Streams
- Other Streams
- UGA Expansion
- Future Planning Area
- City Boundary

Shoreline jurisdiction boundaries depicted on this map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm/verify information shown on this map.

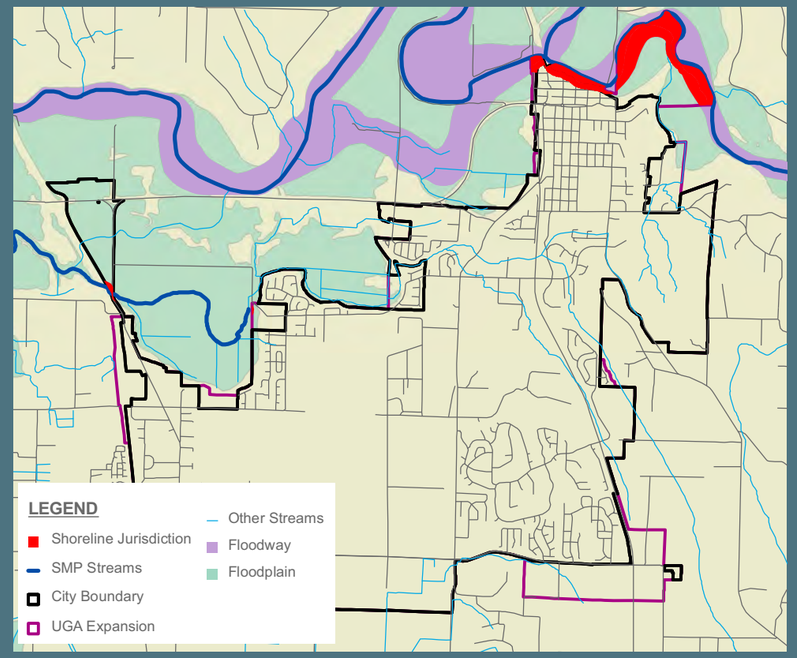
THE WATERSHED COMPANY

December 4, 2009
Data: Snohomish County
City of Arlington

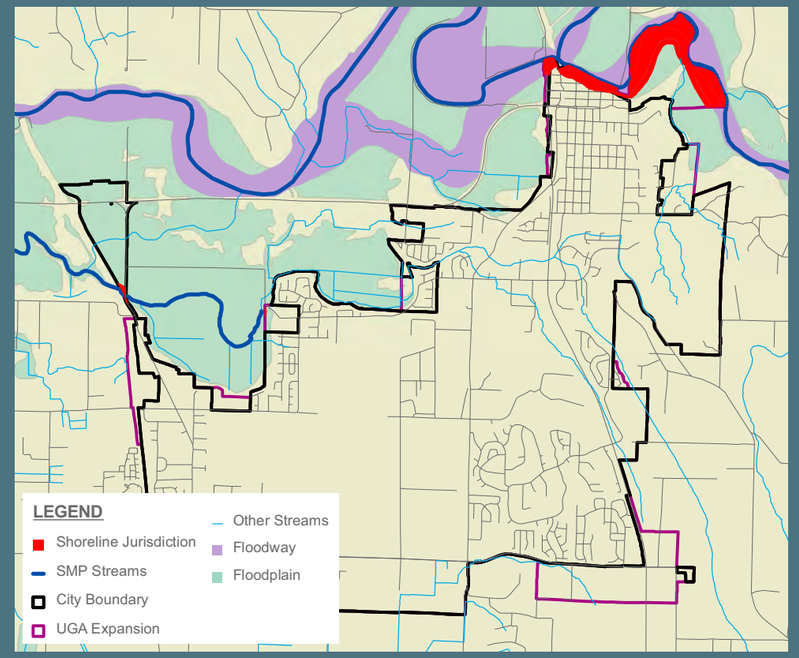
1. River Channels, 200' OHWM, Floodway, Floodplain



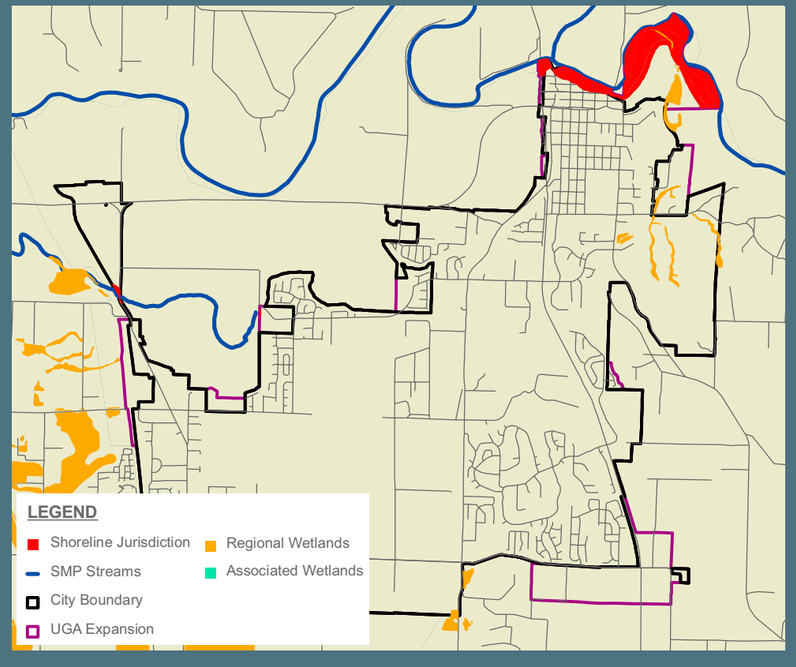
2. SMP Jurisdiction, including Floodway



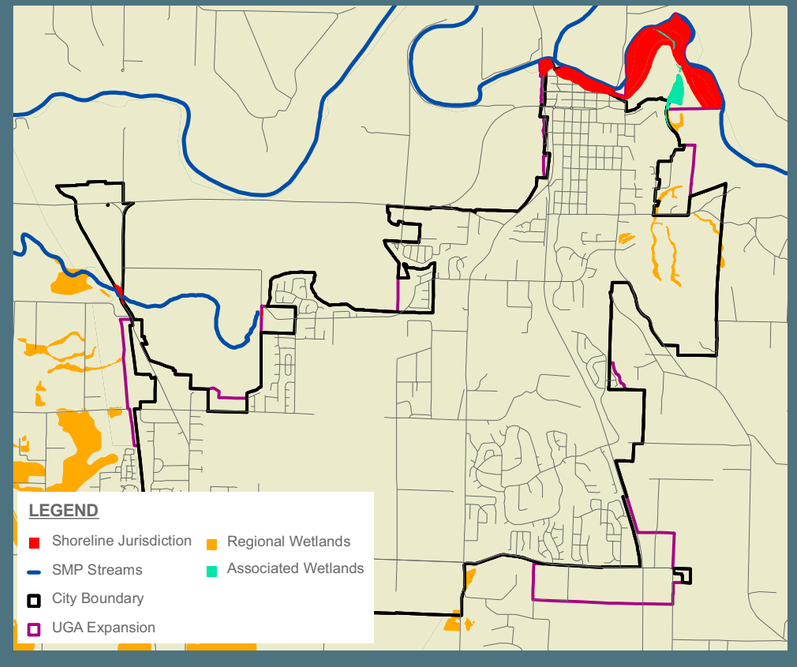
3. SMP Jurisdiction, including 200' Contiguous Floodplain



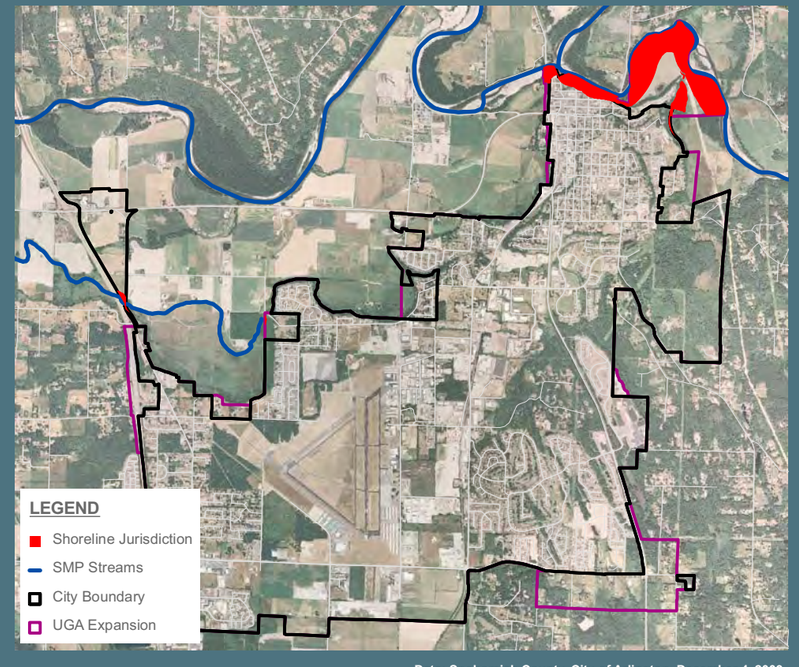
4. Regional Wetlands



5. Associated Wetlands



6. Shoreline Jurisdiction



Data: Snohomish County, City of Arlington. December 4, 2009.

DRAFT

SHORELINE JURISDICTION ASSEMBLY

City of Arlington Shoreline Master Program

0 0.5 1
Miles

Shoreline jurisdiction boundaries depicted on this map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm/verify information shown on this map.

THE WATERSHED COMPANY

DRAFT

STILLAGUAMISH RIVER

PORTAGE CREEK

Area of interest in red

SHORELINE JURISDICTION OPTION 1

City of Arlington Shoreline Master Program

0 1,500 3,000

Feet

- Shoreline Jurisdiction
- SMP Streams
- Other Streams
- UGA Expansion
- Future Planning Area
- City Boundary

Shoreline jurisdiction boundaries depicted on this map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm/verify information shown on this map.

THE WATERSHED COMPANY

December 4, 2009
Data: Snohomish County
City of Arlington

DRAFT

STILLAGUAMISH RIVER

PORTAGE CREEK

AREA OF ADDITIONAL ANALYSIS

Area of interest in red

MINIMUM SHORELINE JURISDICTION OPTION 2

City of Arlington Shoreline Master Program

0 190,000 380,000

Feet

LEGEND

- Shoreline Jurisdiction
- SMP Streams
- Other Streams
- Roads
- UGA Expansion
- City Boundary

Shoreline jurisdiction boundaries depicted on this map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm/verify information shown on this map.

THE WATERSHED COMPANY

February, 2010
Data: Snohomish County
City of Arlington

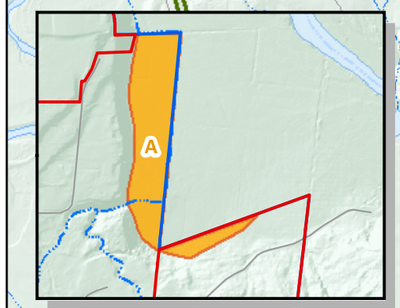
APPENDIX D

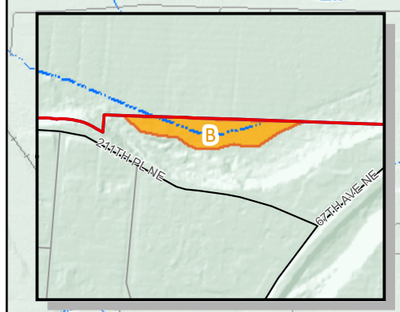
Inventory and Analysis Map Folio

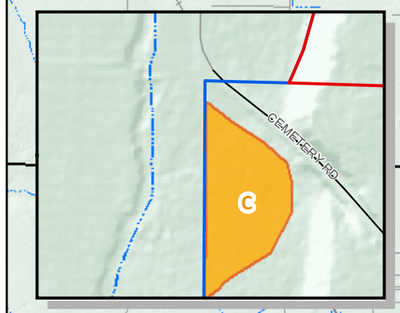
City of Arlington
Shoreline Master Plan

Figure 1
Proposed Jurisdiction

Inset Maps:
Shoreline Jurisdiction Areas







Detailed Island Crossing and Old Town maps are shown in figures labeled 'Figure [figure #]a'.

Legend

- Proposed Jurisdiction
- South Slough
  Area of additional analysis
- City Limits
- City UGA
- Local roads
- Airport
- Rail line
- Streams
- Rivers
- Ponds

DRAFT

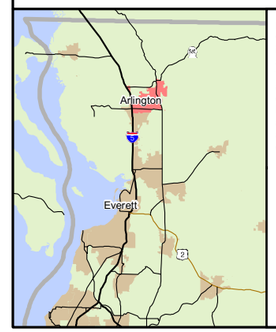
Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Topography provided by Puget Sound LiDAR Consortium, downloaded summer 2009.

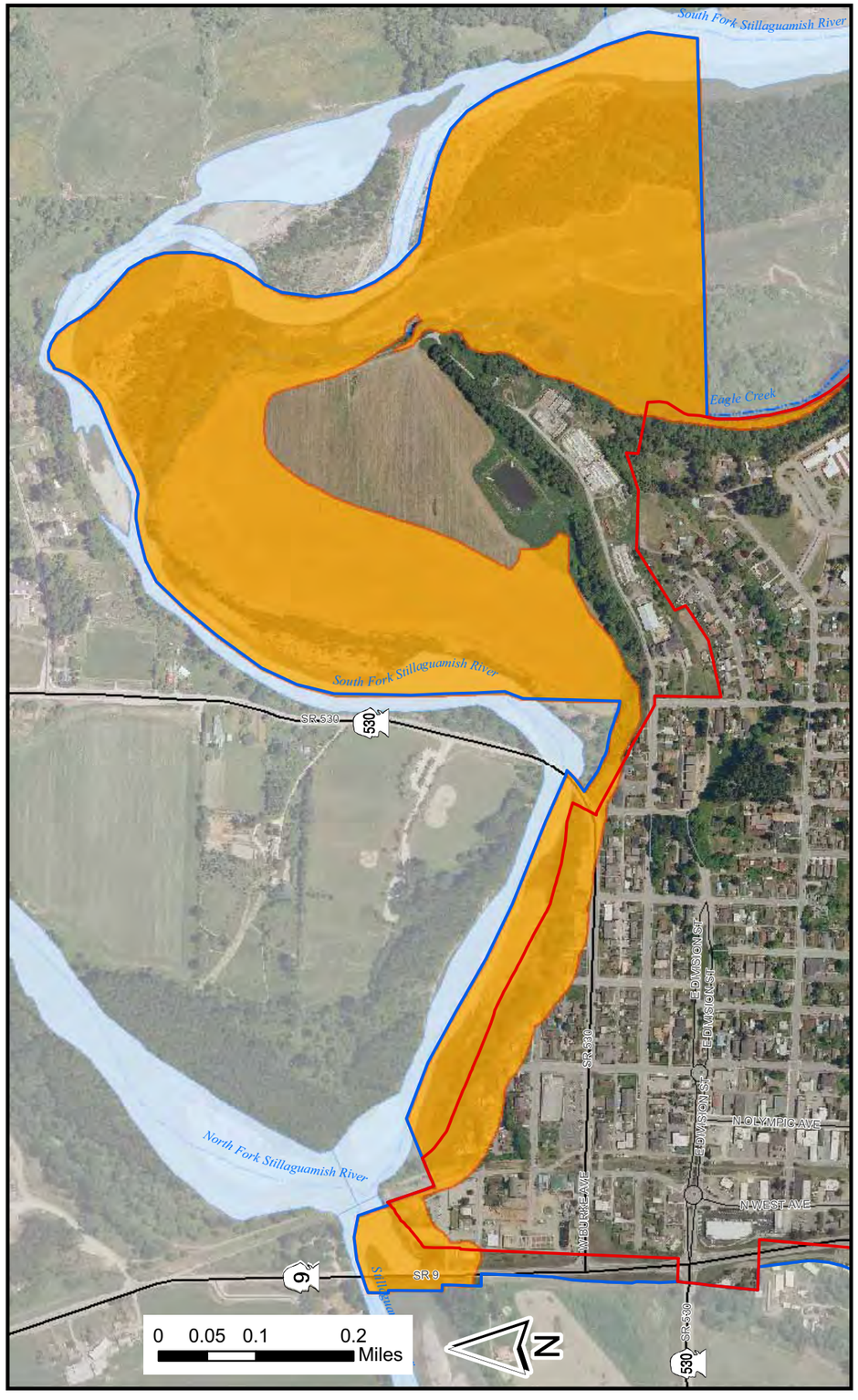
Date:
04/29/2010

File:
Figure1_11x17_10.mxd

Cartographer:
kdk



CITY OF ARLINGTON



City of Arlington
Shoreline Master Plan

Figure 1a
Proposed Jurisdiction: Old Town and Island Crossing

Legend

- Proposed Jurisdiction
- South Slough
  Area of additional analysis
- City Limits
- City UGA
- Local roads
- Streams
- Rivers
- Ponds

DRAFT

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Aerials taken in June 2009.

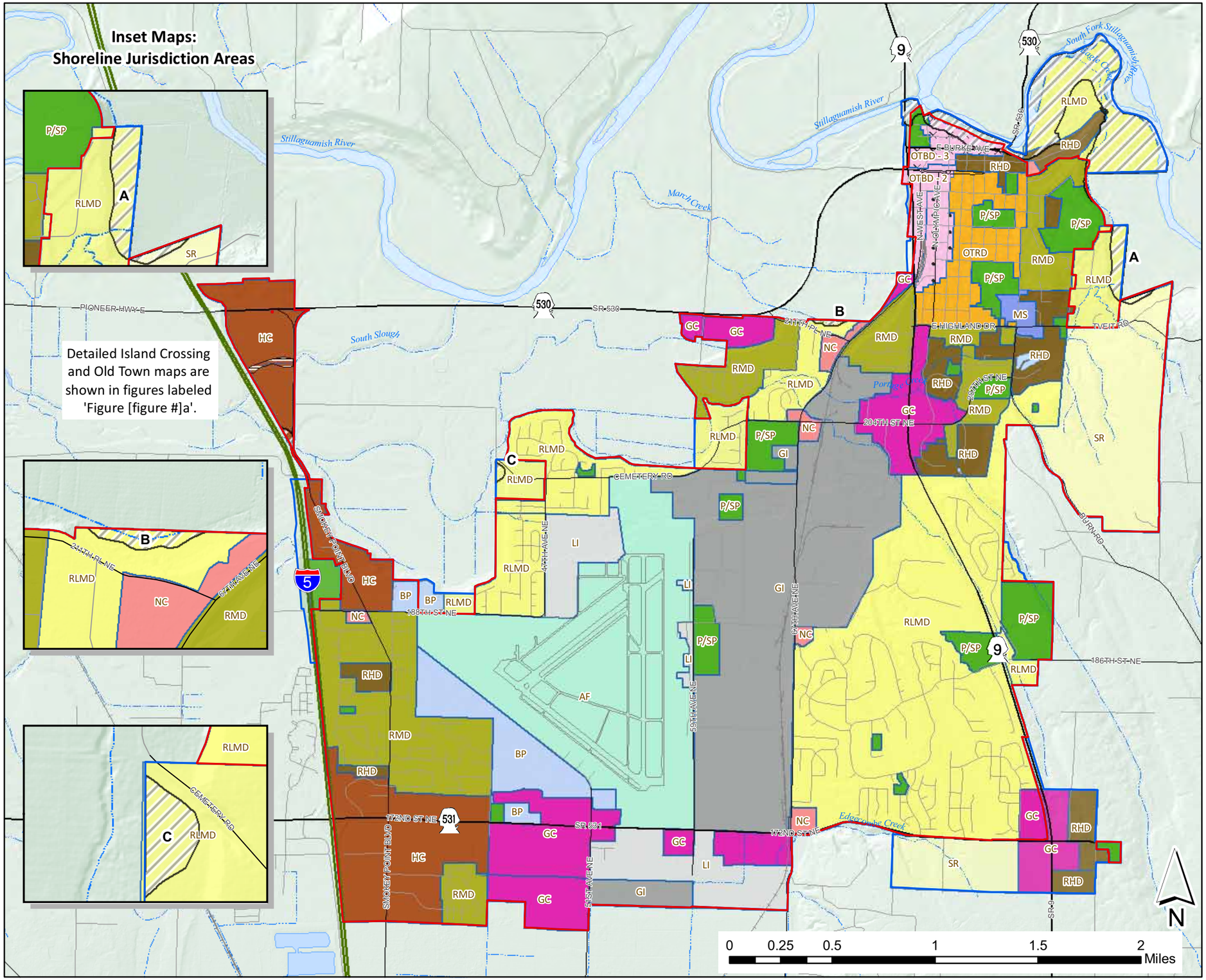
Date:
04/29/2010

File:
Figure1a_11x17_10.mxd

Cartographer:
kdk

CITY OF ARLINGTON

City of Arlington
Shoreline Master Plan
Figure 2
Land Use



Legend

Land Use

- SR — Surburban Residential
- RLMD — Low to Moderate Density Residential
- RMD — Moderate Density Residential
- RHD — High Density Residential
- OTRD — Old Town Residential District
- NC — Neighborhood Commercial
- OTBD-1 — Old Town Business District 1
- OTBD-2 — Old Town Business District 2
- OTBD-3 — Old Town Business District 3
- GC — General Commercial
- HC — Highway Commercial
- BP — Business Park
- LI — Light Industrial
- GI — General Industrial
- P/SP — Public/Semi-Public
- MS — Medical Services
- AF — Aviation Flightline

- Proposed Jurisdiction
- South Slough
- *Area of additional analysis*
- City Limits
- City UGA
- Local roads
- Airport
- Rail line
- Streams
- Rivers
- Ponds

DRAFT

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Topography provided by Puget Sound LiDAR Consortium, downloaded summer 2009.

Date:
04/29/2010

File:
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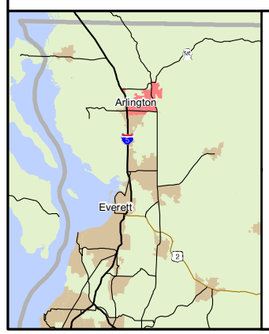
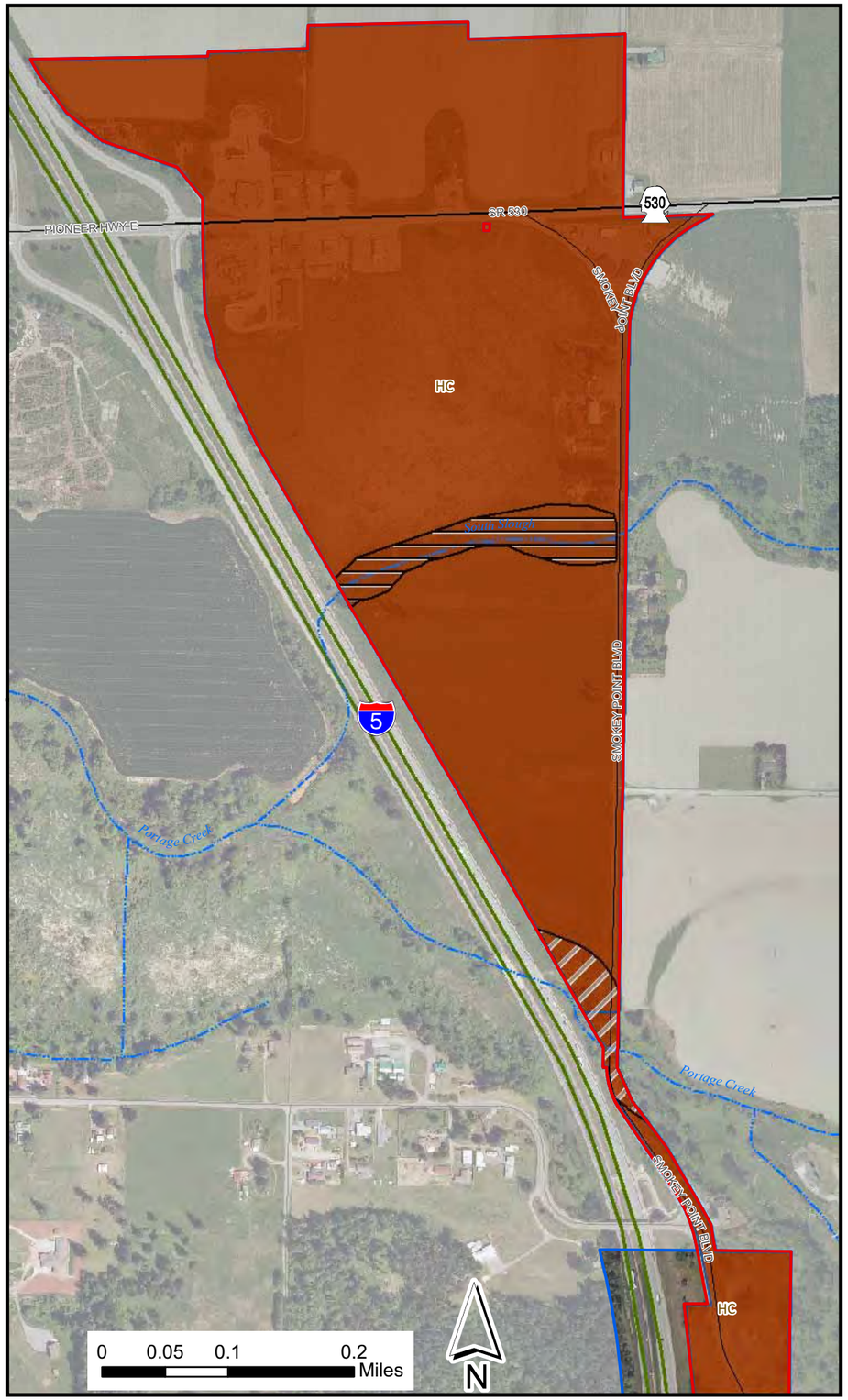
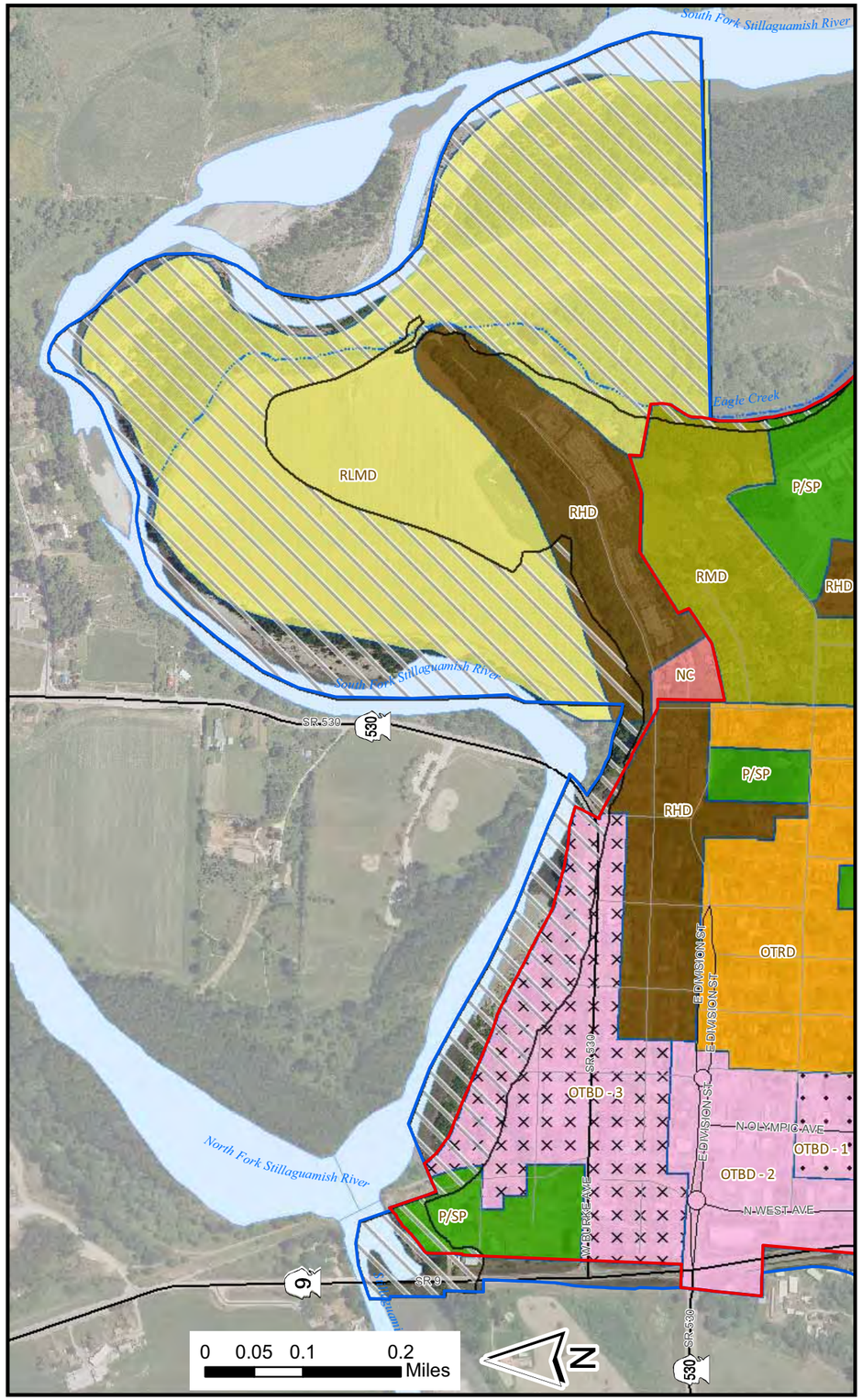
Cartographer:
kdk



CITY OF ARLINGTON





City of Arlington
Shoreline Master Plan

Figure 2a
Land Use:
Old Town and Island Crossing

DRAFT

Legend

Land Use

- SR — Surburban Residential
- RLMD — Low to Moderate Density Residential
- RMD — Moderate Density Residential
- RHD — High Density Residential
- OTRD — Old Town Residential District
- NC — Neighborhood Commercial
- OTBD-1 — Old Town Business District 1
- OTBD-2 — Old Town Business District 2
- OTBD-3 — Old Town Business District 3
- GC — General Commercial
- HC — Highway Commercial
- BP — Business Park
- LI — Light Industrial
- GI — General Industrial
- P/SP — Public/Semi-Public
- MS — Medical Services
- AF — Aviation Flightline

- Proposed Jurisdiction
- South Slough
- *Area of additional analysis*
- City Limits
- City UGA
- Local roads
- Streams
- Rivers
- Ponds

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Aerials taken in June 2009.

Date:
04/29/2010

File:
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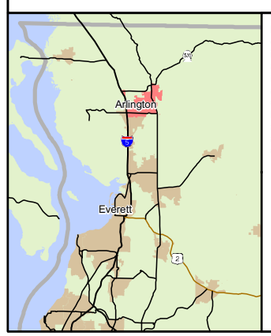
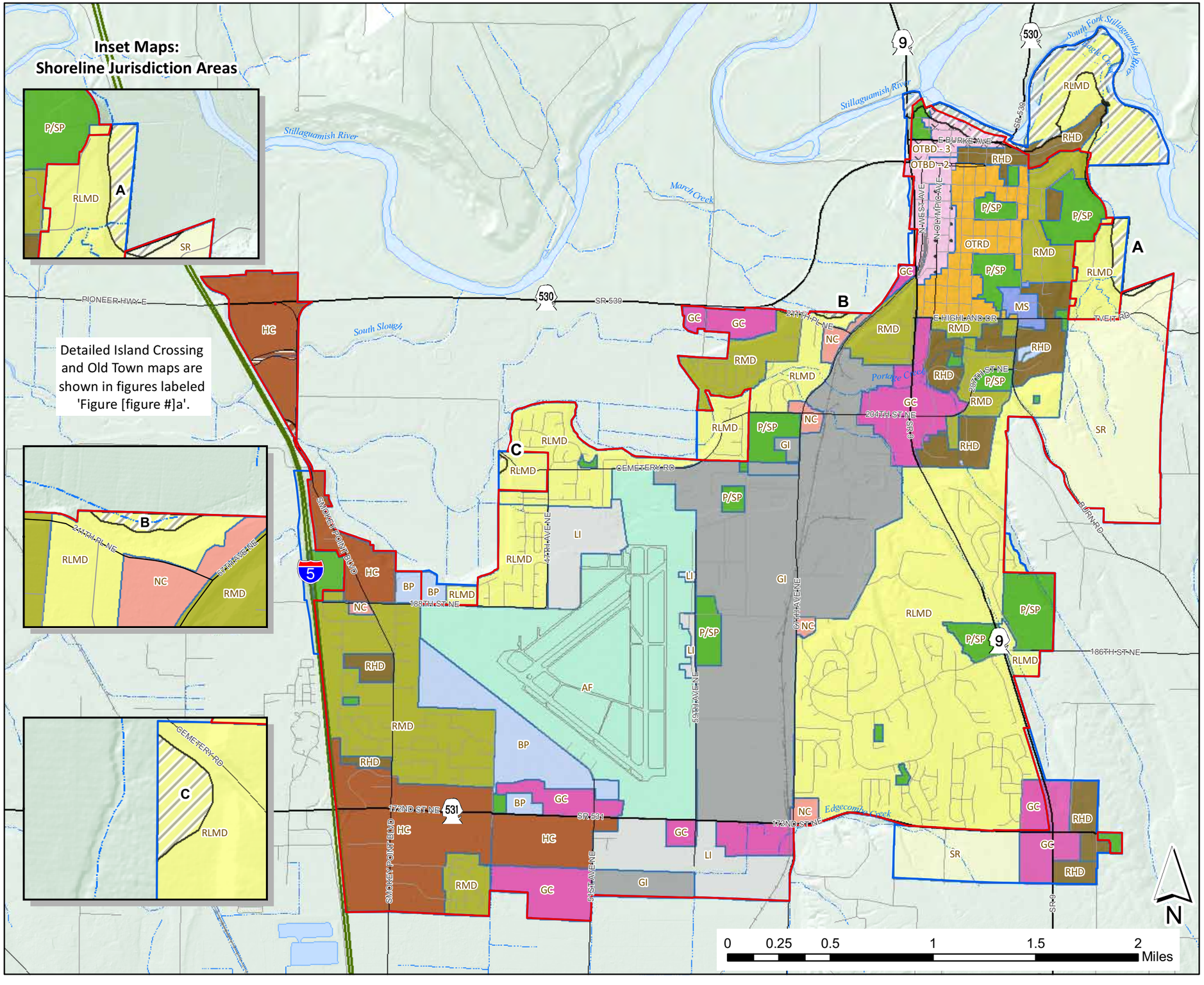
Cartographer:
kdk



City of Arlington
Shoreline Master Plan
Figure 3
Zoning



Legend

City Zoning

- SR — Surburban Residential
- RLMD — Low to Moderate Density Residential
- RMD — Moderate Density Residential
- RHD — High Density Residential
- OTRD — Old Town Residential District
- NC — Neighborhood Commercial
- OTBD-1 — Old Town Business District 1
- OTBD-2 — Old Town Business District 2
- OTBD-3 — Old Town Business District 3
- GC — General Commercial
- HC — Highway Commercial
- BP — Business Park
- LI — Light Industrial
- GI — General Industrial
- P/SP — Public/Semi-Public
- MS — Medical Services
- AF — Aviation Flightline

- Proposed Jurisdiction
- South Slough — *Area of additional analysis*
- City Limits
- City UGA
- Local roads
- Airport
- Rail line
- Streams
- Rivers
- Ponds

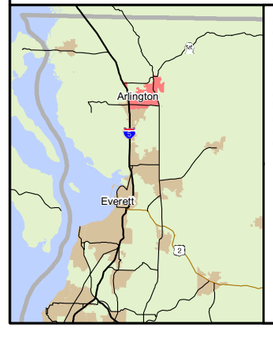
Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

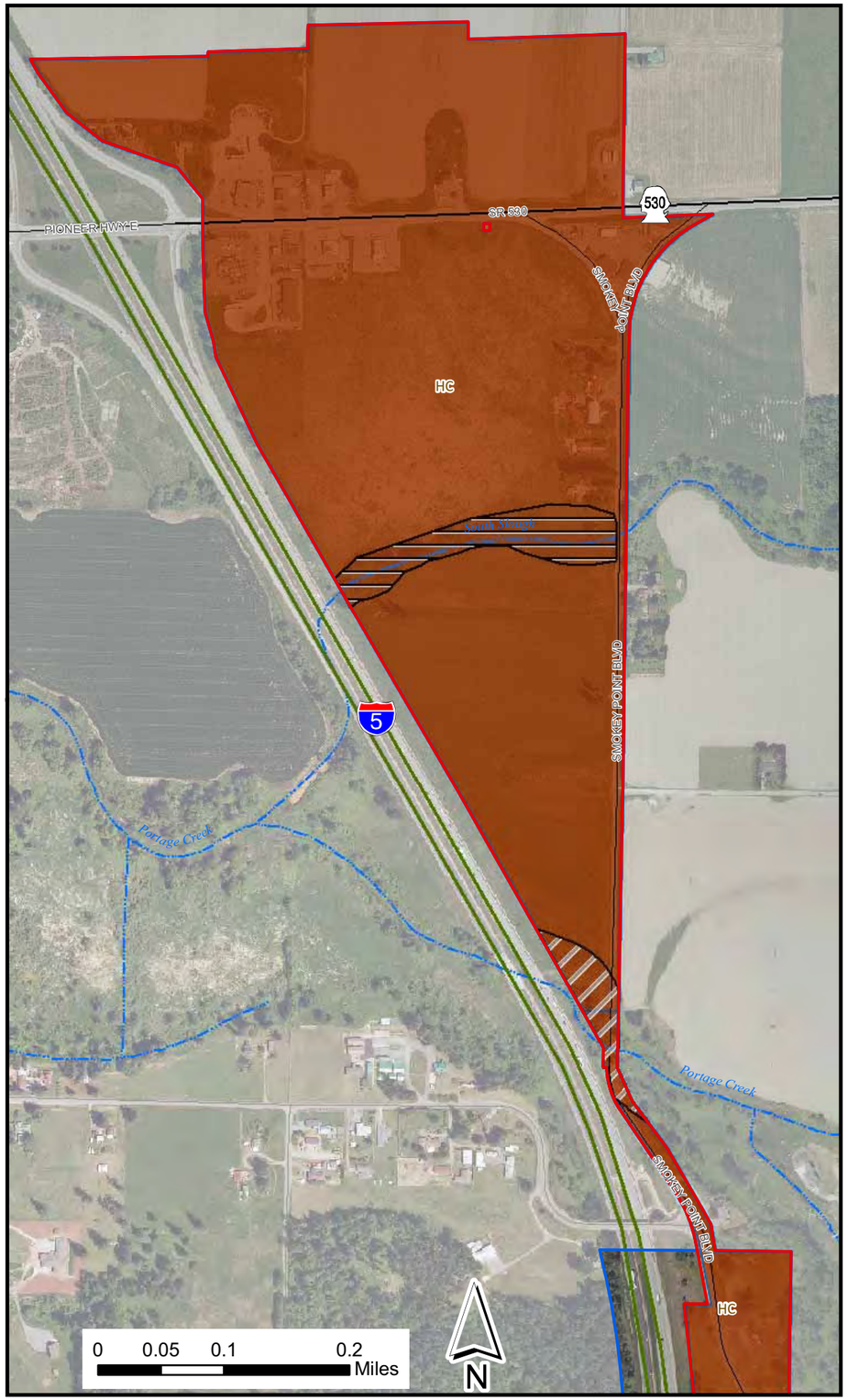
Topography provided by Puget Sound LiDAR Consortium, downloaded summer 2009.

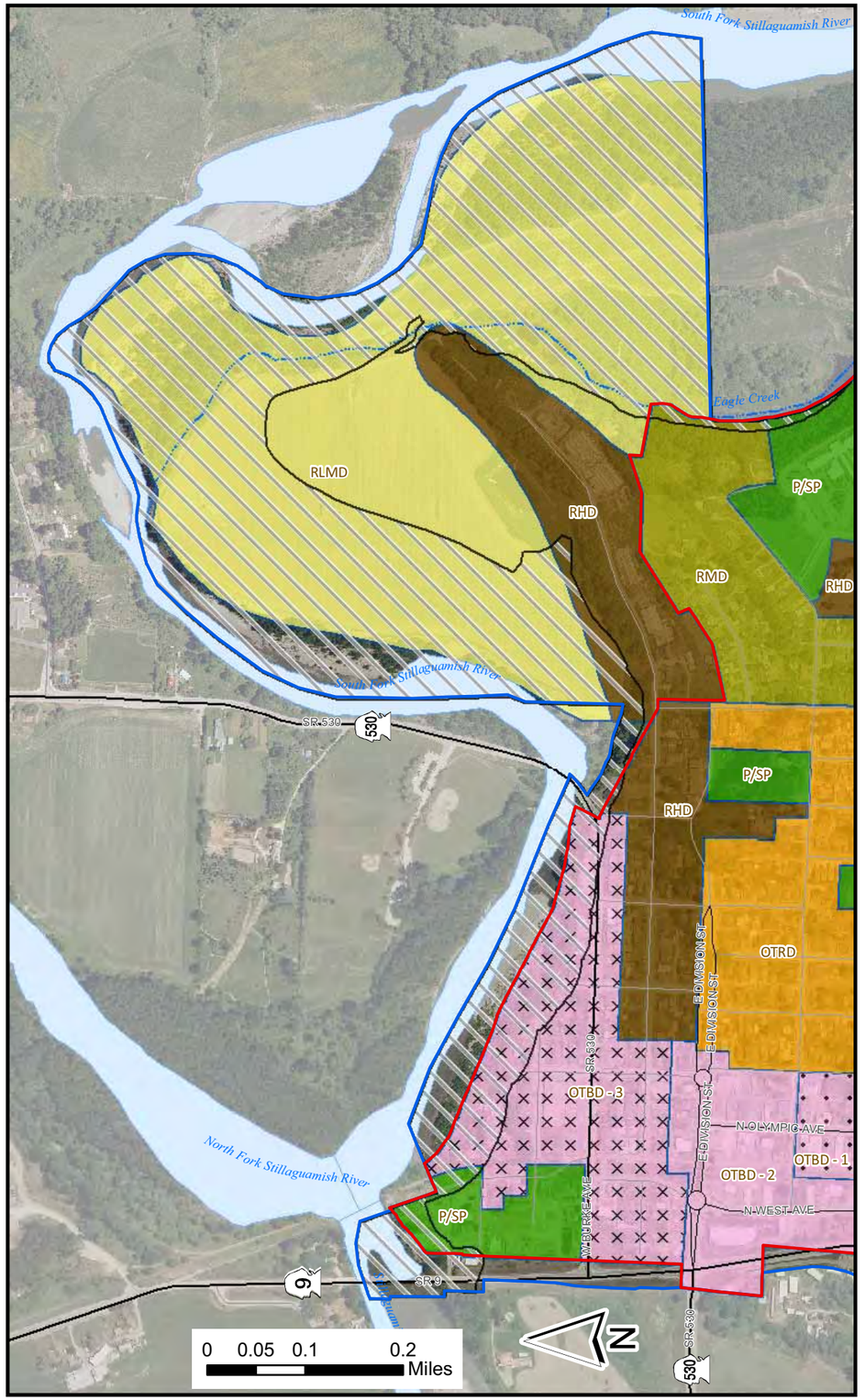
Date:
04/29/2010

File:
Figure3_11x17_10.mxd

Cartographer:
kdk







City of Arlington
Shoreline Master Plan

Figure 3a
Zoning:
Old Town and Island Crossing

Legend

City Zoning

- SR — Surburban Residential
- RLMD — Low to Moderate Density Residential
- RMD — Moderate Density Residential
- RHD — High Density Residential
- OTRD — Old Town Residential District
- NC — Neighborhood Commercial
- OTBD-1 — Old Town Business District 1
- OTBD-2 — Old Town Business District 2
- OTBD-3 — Old Town Business District 3
- GC — General Commercial
- HC — Highway Commercial
- BP — Business Park
- LI — Light Industrial
- GI — General Industrial
- P/SP — Public/Semi-Public
- MS — Medical Services
- AF — Aviation Flightline

- Proposed Jurisdiction
- South Slough
  Area of additional analysis
- City Limits
- City UGA
- Local roads
- Streams
- Rivers
- Ponds

DRAFT

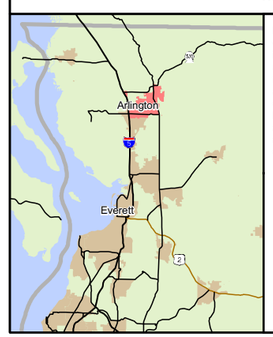
Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Aerials taken in June 2009.

Date:
04/29/2010

File:
Figure3a_11x17_10.mxd

Cartographer:
kdk

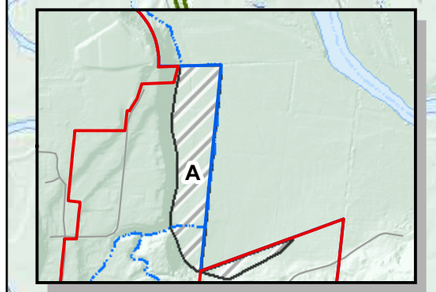


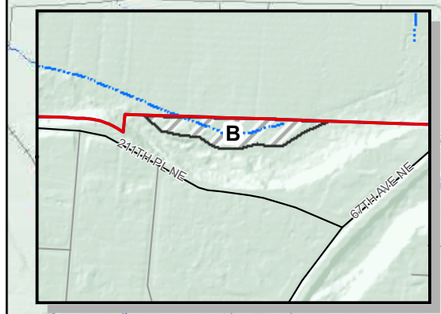
CITY OF ARLINGTON

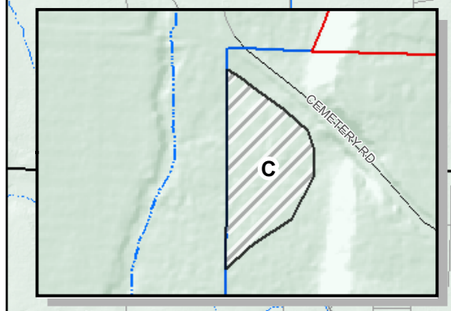
City of Arlington
Shoreline Master Plan

Figure 4
Public Access Areas and Parks

Inset Maps:
Shoreline Jurisdiction Areas







Detailed Island Crossing and Old Town maps are shown in figures labeled 'Figure [figure #]a'.

Haller Park
Twin Rivers Park
Country Charm Park
City Riverfront
Centennial Park
Terrace Park
Legion Park
Lebanon Park
Jensen Park
High Clover Park
Waldo E. Evans Field
Bill Quake Memorial Park and Skate Park
Cal Kinney Field
Boys and Girls Club
Forest Trail Park
York Memorial Park
Woodway Park
Wedgewood Park

Stillaguamish River
March Creek
South Slough
Portage Creek
Edgecombe Creek
South Fork Stillaguamish River
Eagle Creek

PIONEER HWY E
SR 530
E BURKE AVE
E HIGHLAND DR
TVEIT RD
224TH PL NE
204TH ST NE
CEMETERY RD
SMOKEY POINT BLVD
188TH ST NE
172ND ST NE
SR 531
186TH ST NE
BURN RD
SR 9
47TH AVE NE
59TH AVE NE
67TH AVE NE
51ST AVE NE
NW 1ST AVE
OLYMPIC AVE

A
B
C

0 0.25 0.5 1 1.5 2 Miles

N

Legend

- Public Access (Parks)
- Future Public Access
- Proposed Jurisdiction
- South Slough
  Area of additional analysis
- City Limits
- City UGA
- Local roads
- Airport
- Rail line
- Streams
- Rivers
- Ponds

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

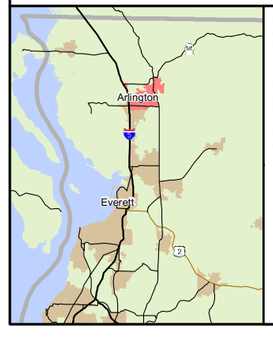
Topography provided by Puget Sound LiDAR Consortium, downloaded summer 2009.

DRAFT

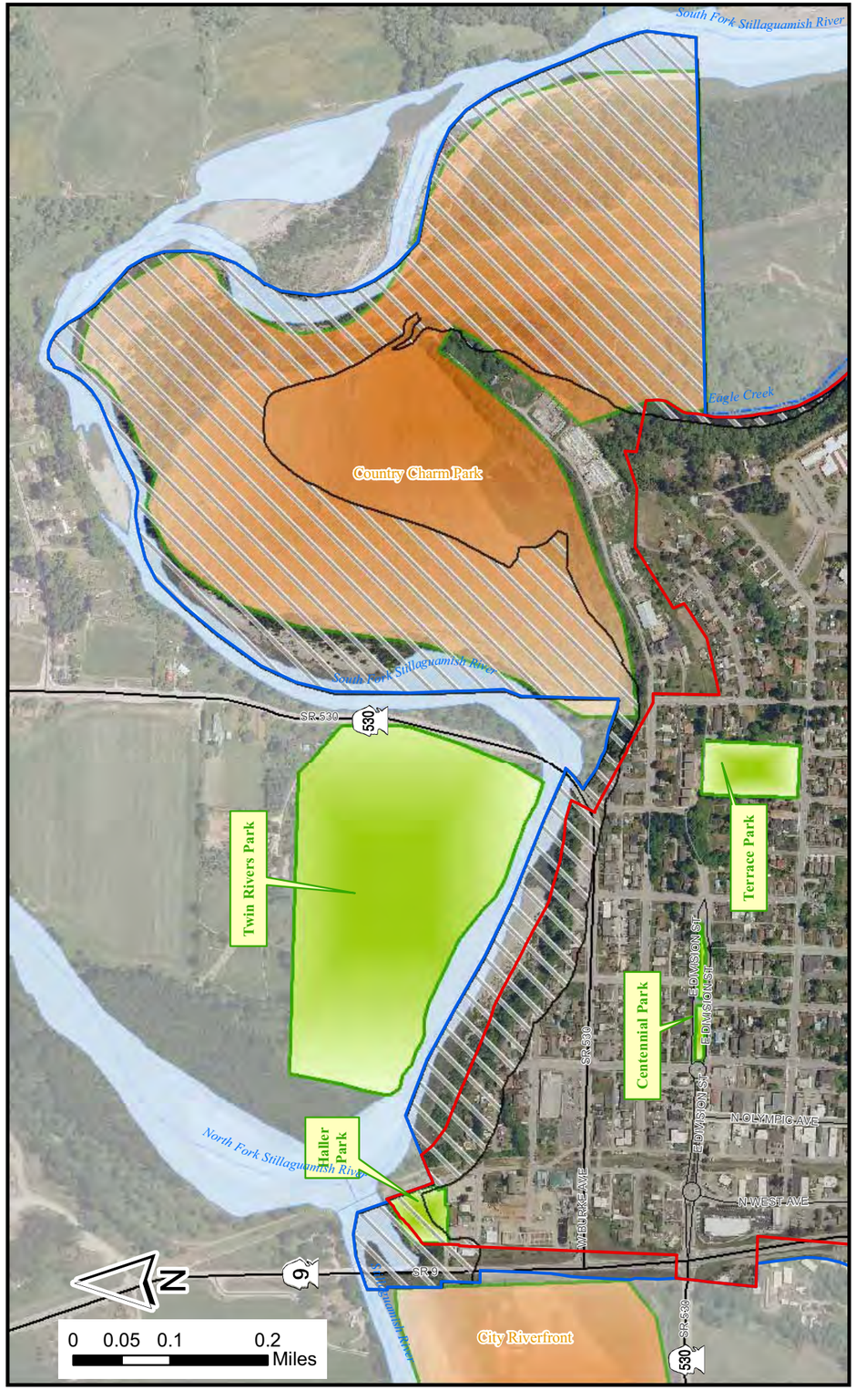
Date:
04/29/2010

File:
Figure4_11x17_10.mxd

Cartographer:
kdk



CITY OF ARLINGTON



City of Arlington
Shoreline Master Plan

Figure 4a
Public Access Areas: Old Town and Island Crossing

Legend

- Public Access (Parks)
- Future Public Access
- Proposed Jurisdiction
- South Slough
  Area of additional analysis
- City Limits
- City UGA
- Local roads
- Streams
- Rivers
- Ponds

DRAFT

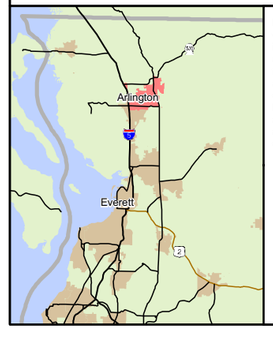
Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Aerials taken in June 2009.

Date:
04/29/2010

File:
Figure4a_11x17_10.mxd

Cartographer:
kdk

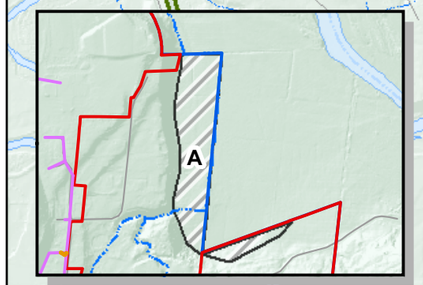


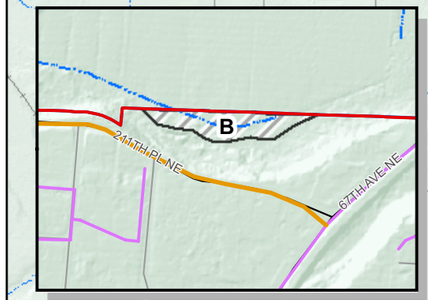
CITY OF ARLINGTON

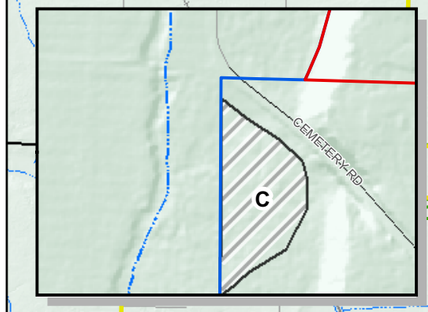
City of Arlington
Shoreline Master Plan

Figure 5
Sanitary Sewer System

Inset Maps:
Shoreline Jurisdiction Areas







City of Arlington's Wastewater and Water Treatment Facilities

Detailed Island Crossing and Old Town maps are shown in figures labeled 'Figure [figure #]a'.

Legend

Arlington Sewer Lines
- Force Main
- Gravity

Marysville Sewer Lines*
- Force Main
- Gravity

Data received from City of Marysville in 2008.

- Proposed Jurisdiction
- South Slough
  Area of additional analysis
- City Limits
- City UGA
- Local roads
- Airport
- Rail line
- Streams
- Rivers
- Ponds

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

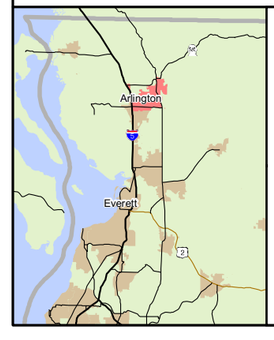
Topography provided by Puget Sound LiDAR Consortium, downloaded summer 2009.

DRAFT

Date:
04/29/2010

File:
Figure5_11x17_10.mxd

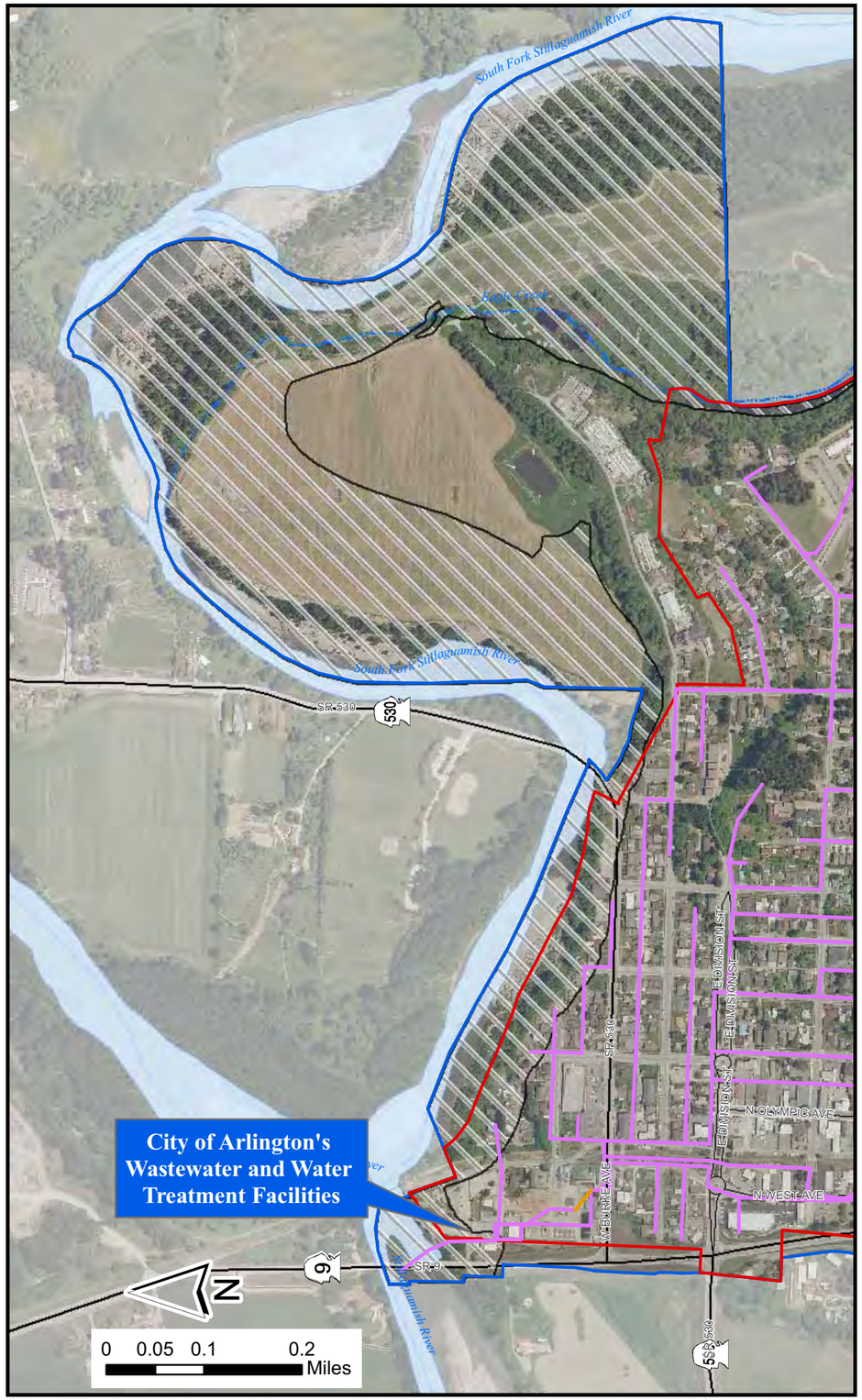
Cartographer:
kdk



CITY OF ARLINGTON

City of Arlington
Shoreline Master Plan

Figure 5a
Sanitary Sewer System: Old Town and Island Crossing



Legend

Arlington Sewer Lines

- Force Main
- Gravity
- Proposed Jurisdiction
- South Slough
  Area of additional analysis

- City Limits
- City UGA
- Local roads
- Streams
- Rivers
- Ponds

DRAFT

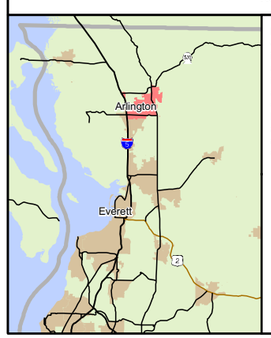
Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Aerials taken in June 2009.

Date:
04/29/2010

File:
Figure5a_11x17_10.mxd

Cartographer:
kdk

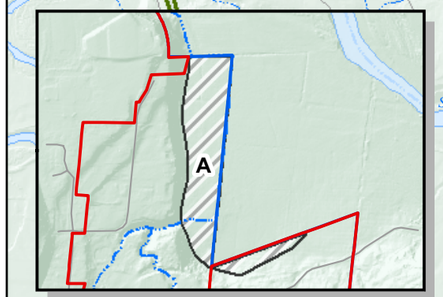


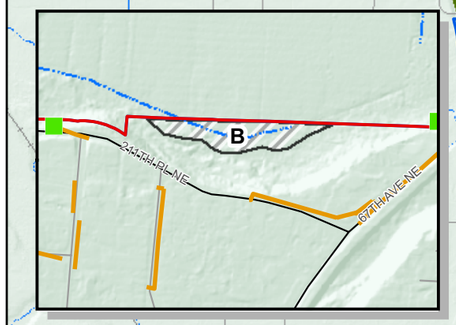
CITY OF ARLINGTON

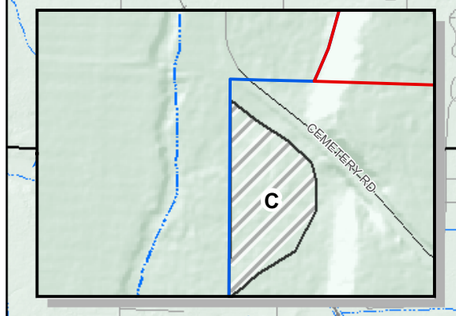
City of Arlington
Shoreline Master Plan

Figure 6
Stormwater System with Outfalls

Inset Maps:
Shoreline Jurisdiction Areas







Detailed Island Crossing and Old Town maps are shown in figures labeled 'Figure [figure #]a'.

Stormwater infrastructure not yet available for Island Crossing

Legend

- Outfalls
- Surface Channels
- Pipe Network
- Proposed Jurisdiction
- South Slough
  Area of additional analysis
- City Limits
- City UGA
- Local roads
- Airport
- Rail line
- Streams
- Rivers
- Ponds

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

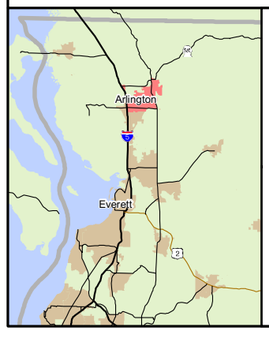
Topography provided by Puget Sound LiDAR Consortium, downloaded summer 2009.

DRAFT

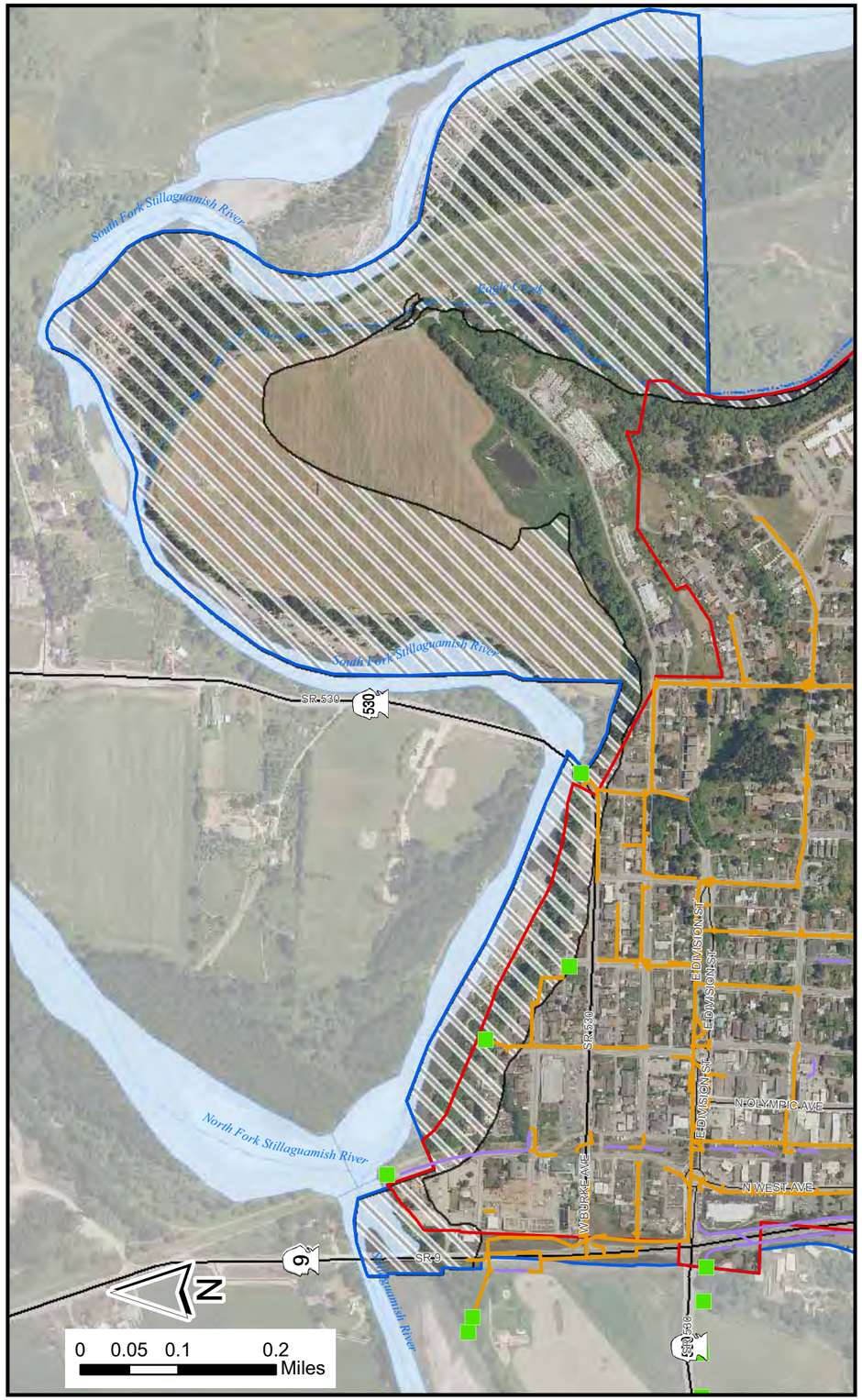
Date:
04/29/2010

File:
Figure6_11x17_10.mxd

Cartographer:
kdk



CITY OF ARLINGTON



City of Arlington
Shoreline Master Plan

Figure 6a
Stormwater System: Old Town and Island Crossing

DRAFT

Legend

- Outfalls
- Surface Channels
- Pipe Network
- Proposed Jurisdiction
- South Slough
  Area of additional analysis
- City Limits
- City UGA
- Local roads
- Streams
- Rivers
- Ponds

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Aerials taken in June 2009.

Date:
04/29/2010

File:
Figure6a_11x17_10.mxd

Cartographer:
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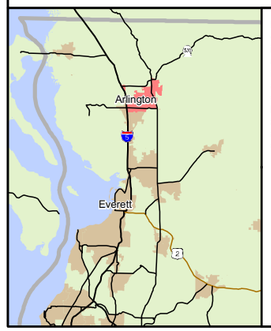
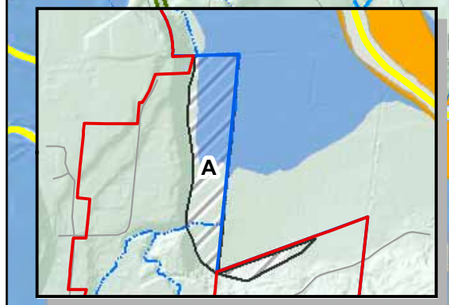


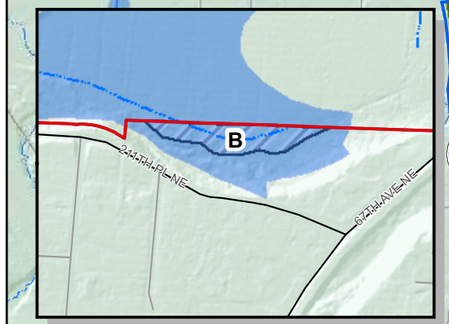
CITY OF ARLINGTON

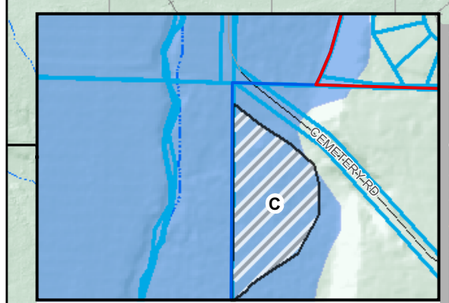
City of Arlington
Shoreline Master Plan

Figure 7
Streams with Floodplain and Floodway

Inset Maps:
Shoreline Jurisdiction Areas







Detailed Island Crossing and Old Town maps are shown in figures labeled 'Figure [figure #]a'.

0 0.25 0.5 1 1.5 2 Miles

N

Legend

- Arlington Mapped Streams
- Channel Subject to Migration*
- FEMA Floodplain
- FEMA Floodway
- Proposed Jurisdiction
- South Slough
  Area of additional analysis

*'Channels subject to migration' recieved from Snohomish County, 2010.
Draft dFIRM floodplain and floodway data provided by FEMA, 2009

- City Limits
- City UGA
- Local roads
- Airport
- Rail line
- Streams
- Rivers
- Ponds

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

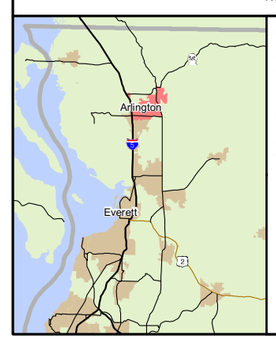
Topography provided by Puget Sound LiDAR Consortium, downloaded summer 2009.

DRAFT

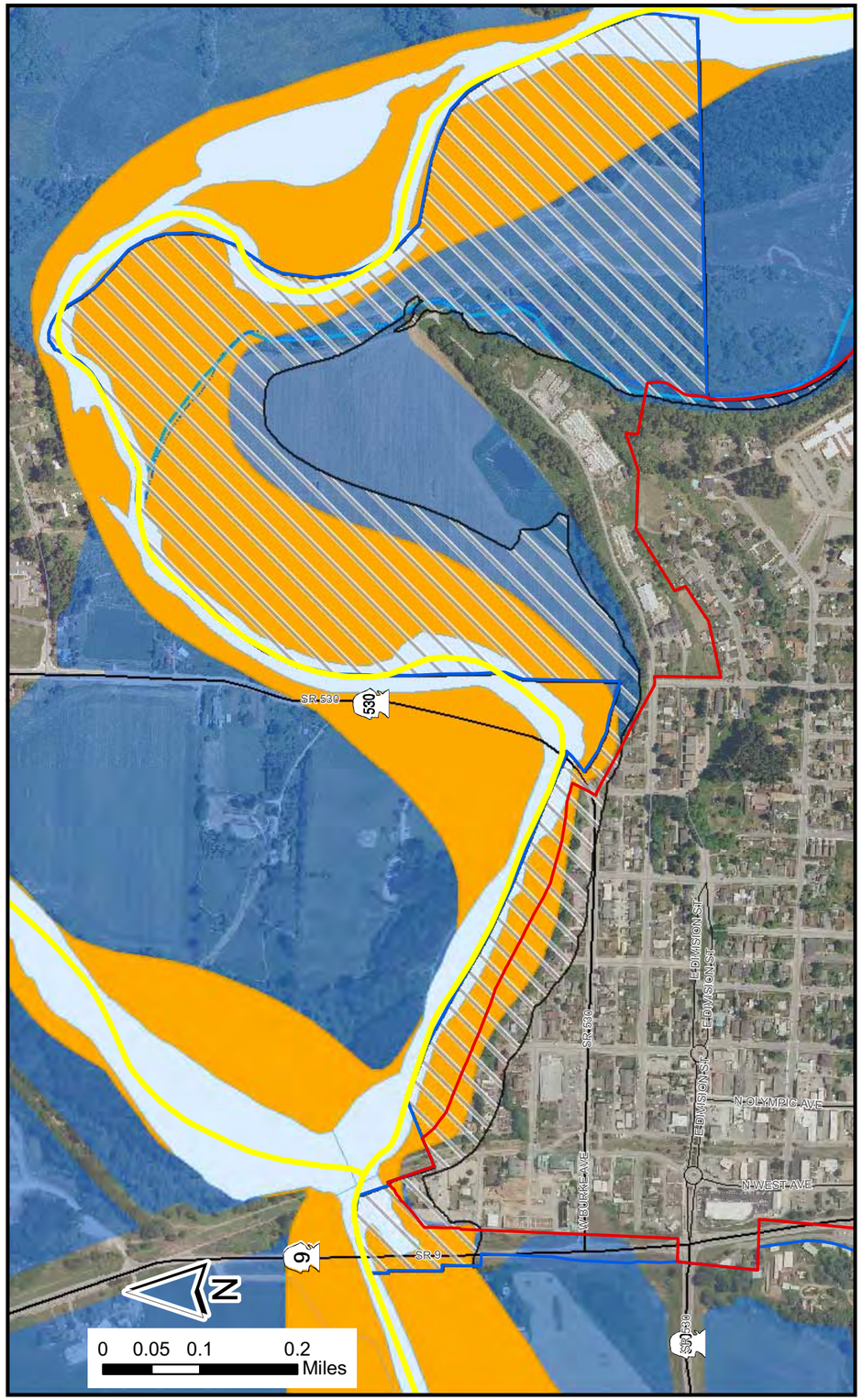
Date:
04/29/2010

File:
Figure7_11x17_10.mxd

Cartographer:
kdk



CITY OF ARLINGTON



City of Arlington
Shoreline Master Plan

Figure 7a
Streams,Floodplain and Floodway: Old Town and Island Crossing

Legend

- Arlington Mapped Streams
- Channel Subject to Migration*
- FEMA Floodplain
- FEMA Floodway
- Proposed Jurisdiction
- South Slough
  Area of additional analysis

DRAFT

*'Channels subject to migration' recieved from Snohomish County, 2010.
Draft dFIRM floodplain and floodway data provided by FEMA, 2009

- City Limits
- City UGA
- Local roads
- Streams
- Rivers
- Ponds

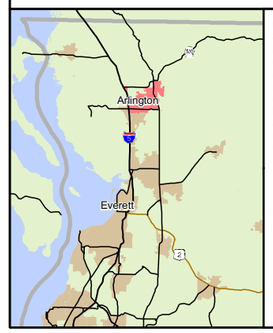
Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Aerials taken in June 2009.

Date:
04/29/2010

File:
Figure7a_11x17_10.mxd

Cartographer:
kdk

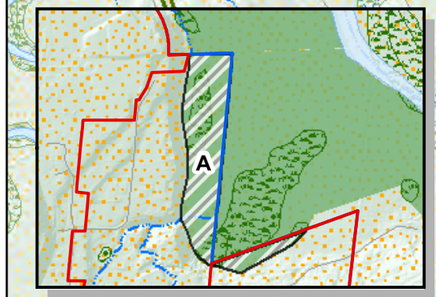


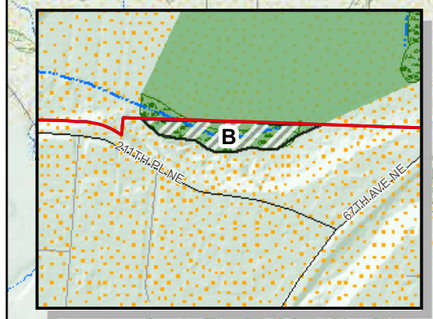
CITY OF ARLINGTON

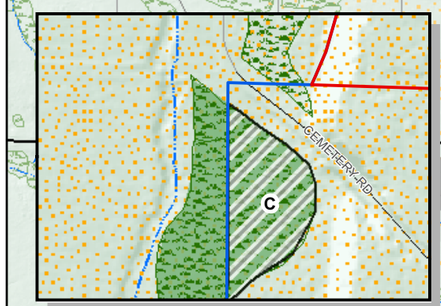
City of Arlington
Shoreline Master Plan

Figure 8
Aquifer Recharge and Wetlands

Inset Maps:
Shoreline Jurisdiction Areas







Detailed Island Crossing and Old Town maps are shown in figures labeled 'Figure [figure #]a'.

Legend

Wetlands

- NWI Wetlands*
- Arlington Mapped Wetlands

Aquifer Recharge Areas

- Floodplain and outwash deposits**
- Proposed Jurisdiction
- South Slough
  Area of additional analysis

*NWI Wetlands downloaded from USFW Wetlands Mapper 2010.
**100,000k geology downloaded from WaDNR 2010.

- City Limits
- City UGA
- Local roads
- Airport
- Rail line
- Streams
- Rivers
- Ponds

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

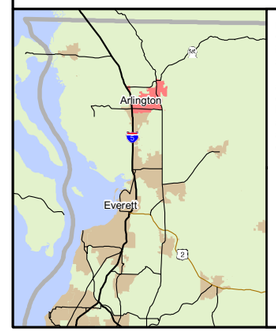
Topography provided by Puget Sound LiDAR Consortium, downloaded summer 2009.

DRAFT

Date:
04/29/2010

File:
Figure8_11x17_10.mxd

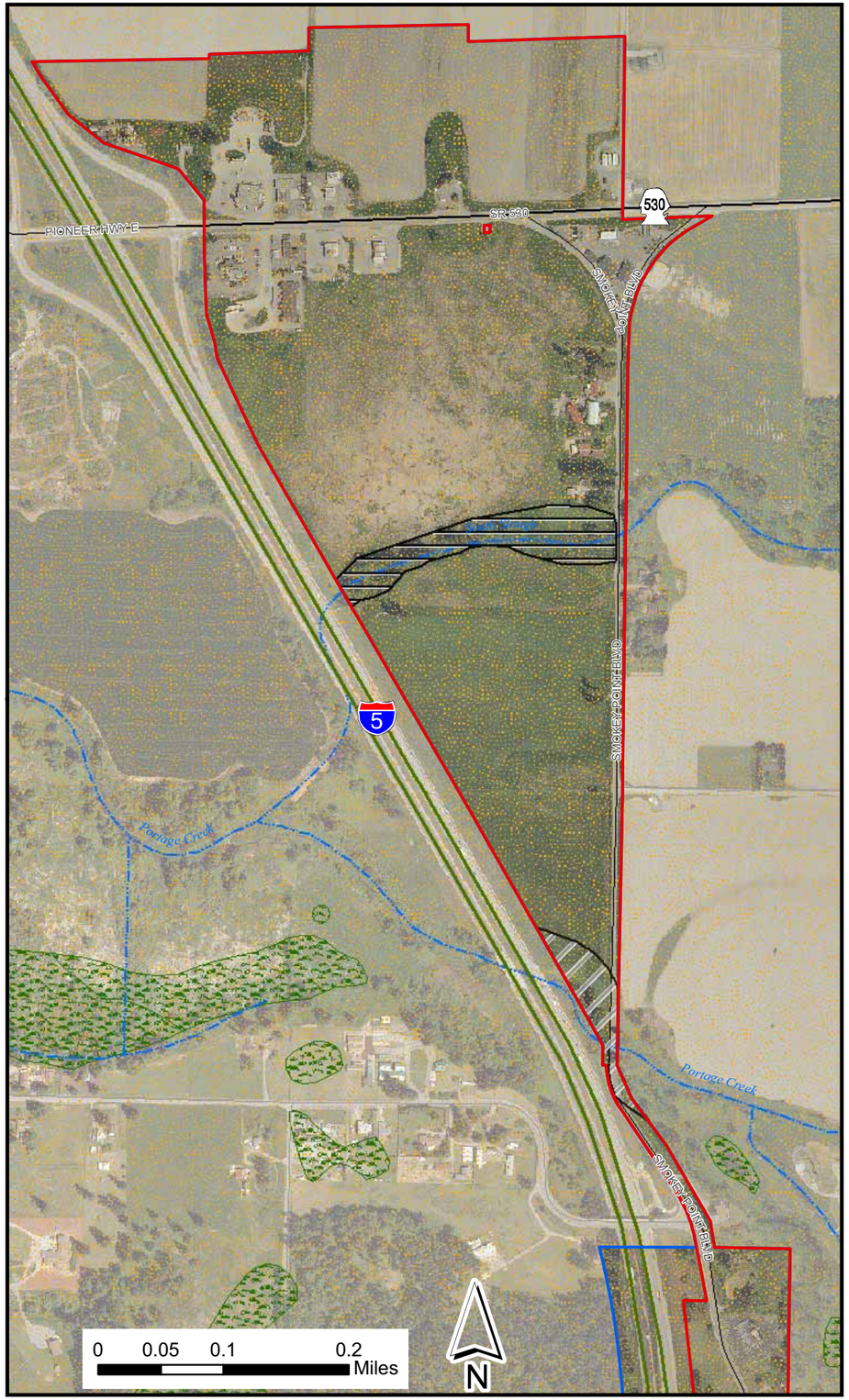
Cartographer:
kdk

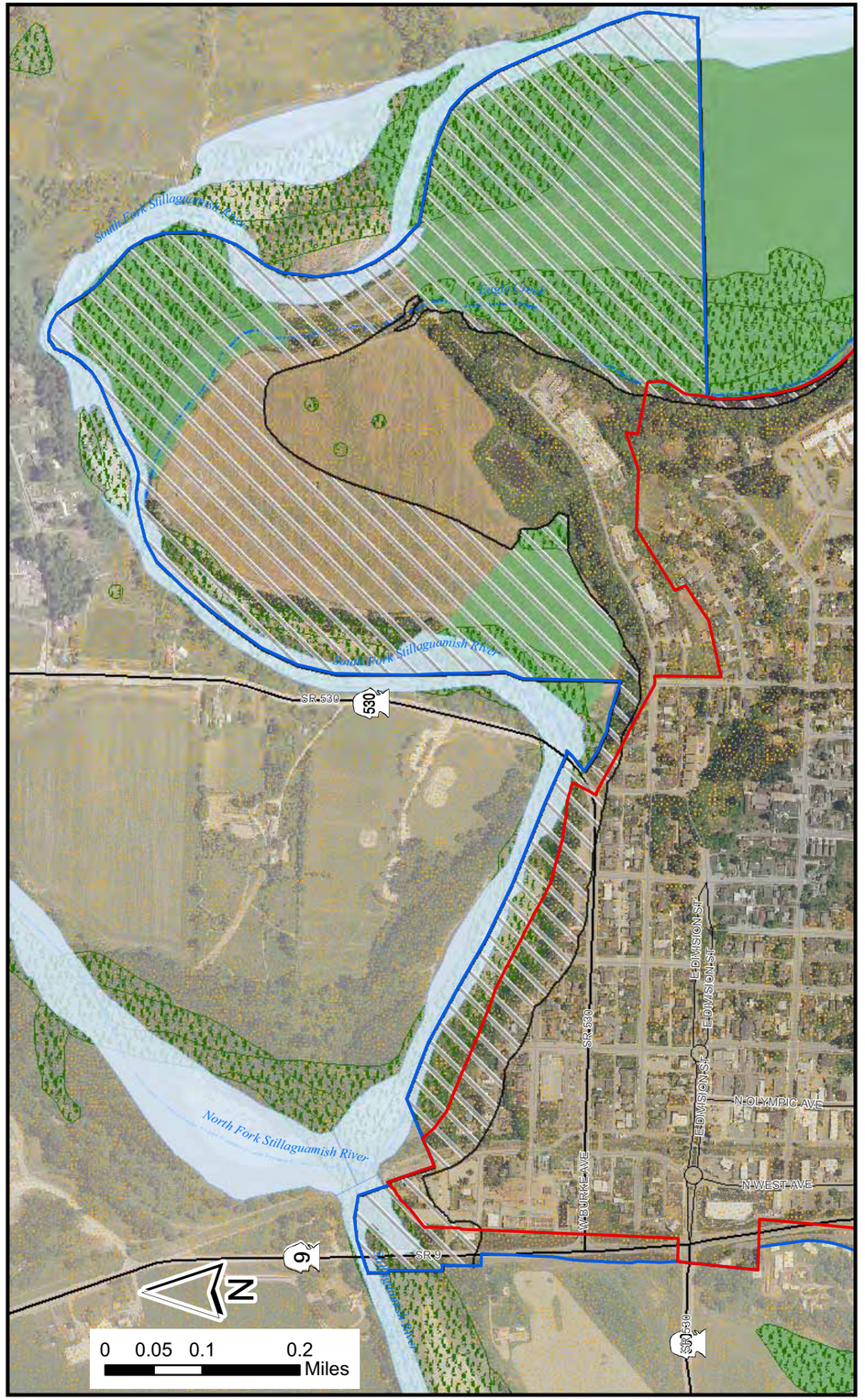


CITY OF ARLINGTON

0 0.25 0.5 1 1.5 2 Miles

N





City of Arlington
Shoreline Master Plan

Figure 8a
Aquifer Recharge and Wetlands: Old Town and Island Crossing

Legend

Wetlands

NWI Wetlands*

Arlington Mapped Wetlands

Aquifer Recharge Areas

Floodplain and outwash deposits**

Proposed Jurisdiction

South Slough
Area of additional analysis

DRAFT

*NWI Wetlands downloaded from USFW Wetlands Mapper 2010.
**100,000k geology (non-glacial till deposits) downloaded from WaDNR 2010.

City Limits

City UGA

Local roads

Streams

Rivers

Ponds

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Aerials taken in June 2009.

Date:

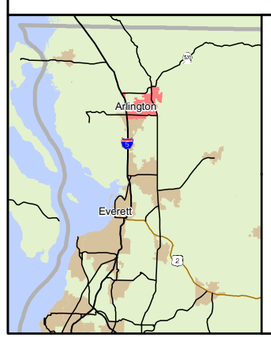
04/29/2010

File:

Figure8a_11x17_10.mxd

Cartographer:

kdk

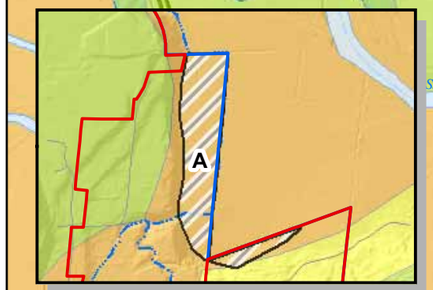


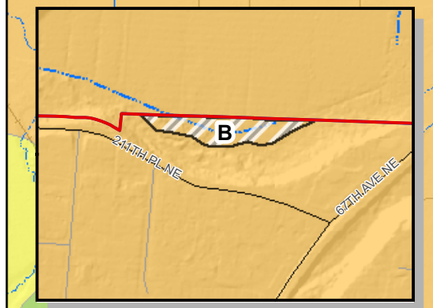
CITY OF ARLINGTON

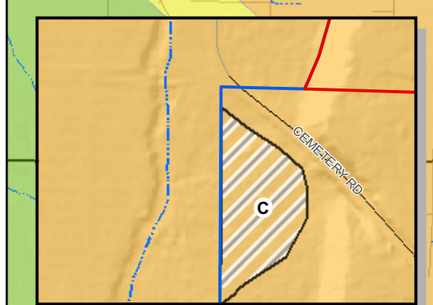
City of Arlington
Shoreline Master Plan

Figure 9
Geologic Hazards - Ground Shake During an Earthquake

Inset Maps:
Shoreline Jurisdiction Areas







Detailed Island Crossing and Old Town maps are shown in figures labeled 'Figure [figure #]a'.

Legend

Site Class

- F - Requires site specific investigation
- E - Soft soil
- D-E
- D - Stiff soil
- C-D
- C - Very dense soil & rock
- B-C
- B - Rock
- Proposed Jurisdiction
- South Slough

Area of additional analysis

- City Limits
- City UGA
- Local roads
- Airport
- Rail line
- Streams
- Rivers
- Ponds

Increasing amplification of ground shaking

DRAFT

In 1997, a method for soil column amplification efforts was adopted to determine the potential for strong shaking in a particular area during an earthquake.

Designation of site classes was based on shear wave velocity data obtained in many of the geology units shown in the 1:100,000-scale geologic mapping.

Site Class B represents a soft rock condition, where shaking is neither reduced nor amplified in an earthquake. Site classes S through E represent increasingly softer soil conditions and increasing amplification of shaking in an earthquake. Site class F is unusual soil conditions where site-specific investigation will indicate the amplification of shaking.

From WA DNR, Site Class Map of Snohomish County, Washington (2004).

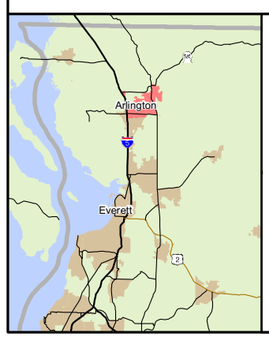
Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Topography provided by Puget Sound LiDAR Consortium, downloaded summer 2009.

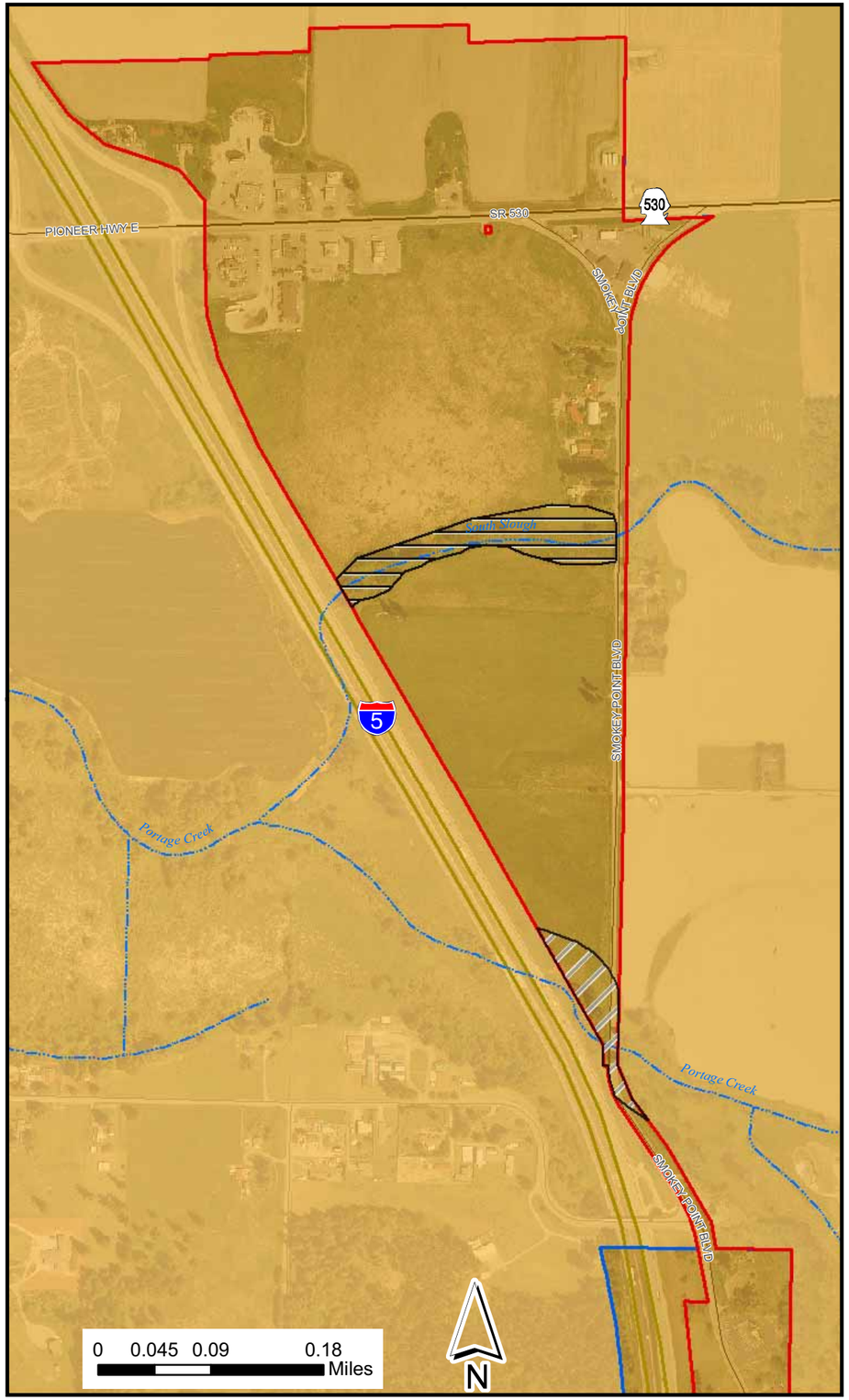
Date:
04/29/2010

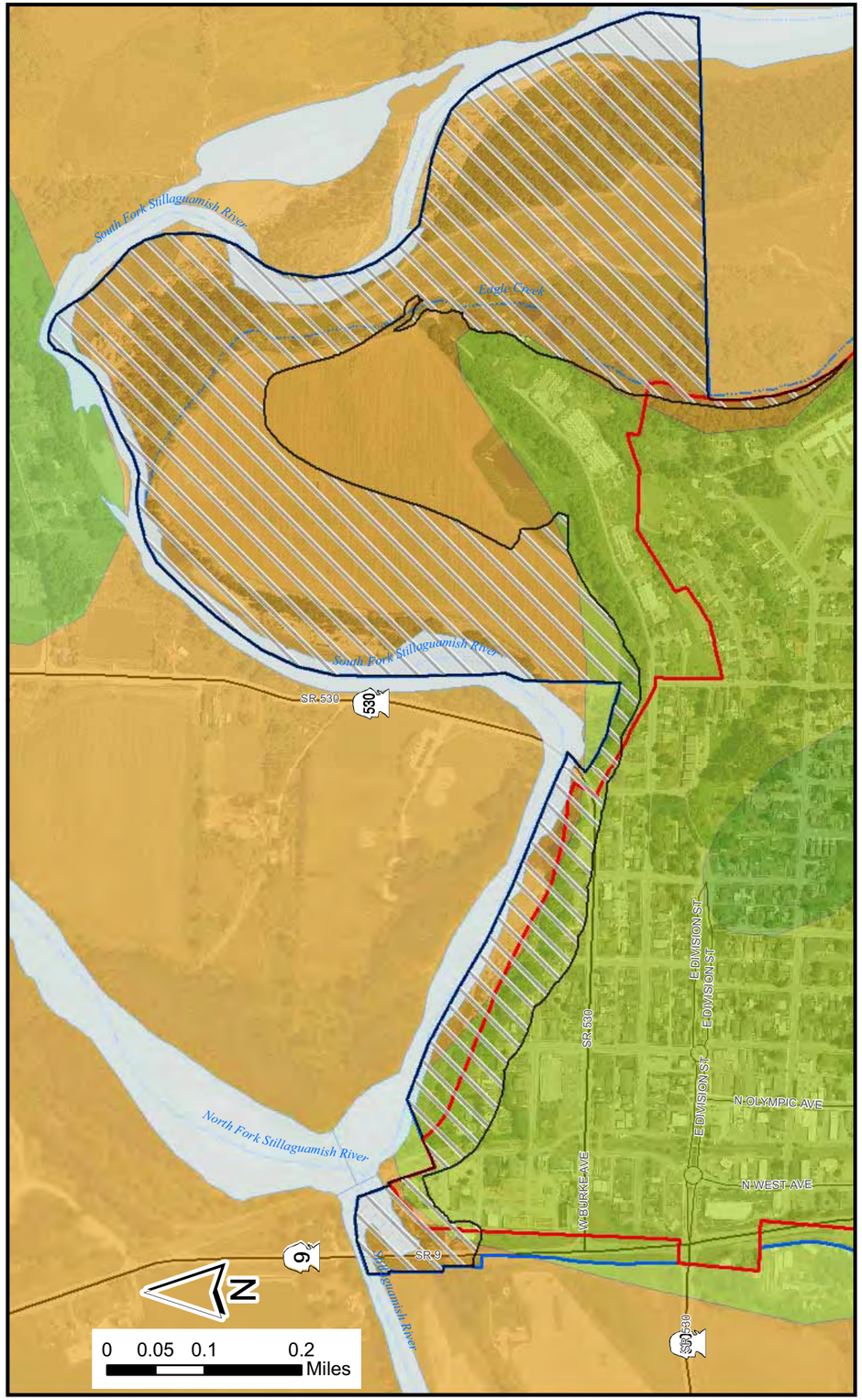
File:
Figure9_11x17_10.mxd

Cartographer:
kdk



CITY OF ARLINGTON





City of Arlington
Shoreline Master Plan

Figure 9a
Ground Shake During an Earthquake: Old Town and Island Crossing

Legend

Site Class

- F - Requires site specific investigation
- E - Soft soil
- D-E
- D - Stiff soil
- C-D
- C - Very dense soil & rock
- B-C
- B - Rock

Increasing amplification of ground shaking

- Proposed Jurisdiction
- South Slough
  Area of additional analysis
- City Limits
- City UGA
- Local roads
- Streams
- Rivers
- Ponds

DRAFT

In 1997, a method for soil column amplification efforts was adopted to determine the potential for strong shaking in a particular area during an earthquake.

Designation of site classes was based on shear wave velocity data obtained in many of the geology units shown in the 1:100,000-scale geologic mapping.

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From WA DNR, Site Class Map of Snohomish County, Washington (2004).

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Aerials taken in June 2009.

Date:

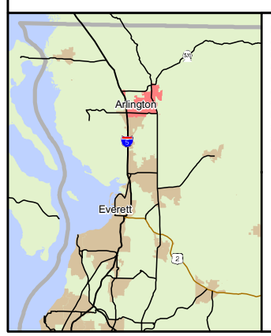
04/29/2010

File:

Figure9a_11x17_10.mxd

Cartographer:

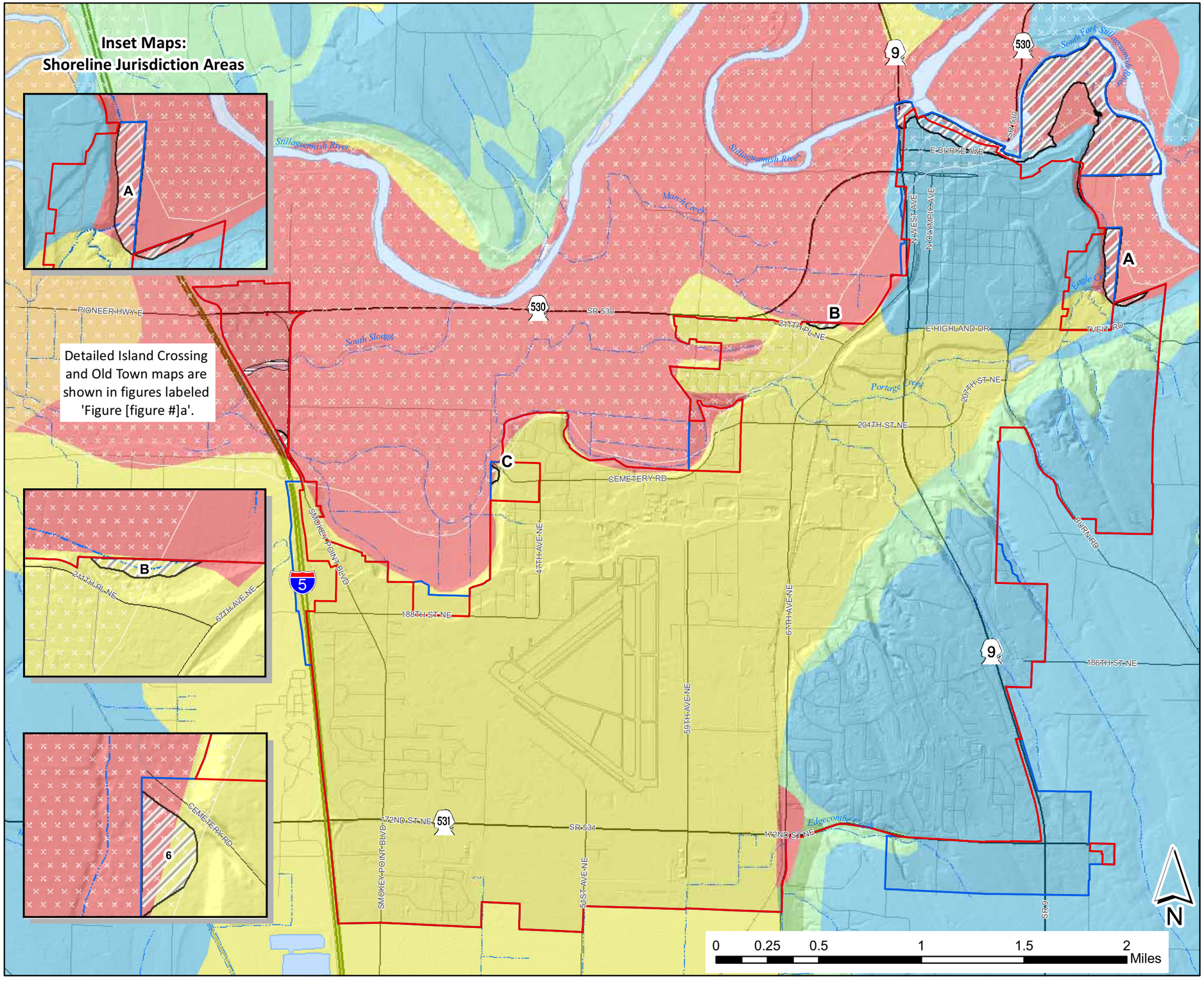
kdk



CITY OF ARLINGTON

City of Arlington
Shoreline Master Plan

Figure 10
Geologic Hazards - Lahars, Liquefaction & Landslides



Legend

- USGS Lahar Hazard
- Landslide Area (Wa DNR)

Liquefaction Susceptibility

- high
- moderate to high
- low to moderate
- low
- very low to low
- very low

Increasing likehood of liquefaction

- Proposed Jurisdiction
- South Slough
  Area of additional analysis
- City Limits
- City UGA
- Local roads
- Airport
- Rail line
- Streams
- Rivers
- Ponds

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Topography provided by Puget Sound LiDAR Consortium, downloaded summer 2009.

DRAFT

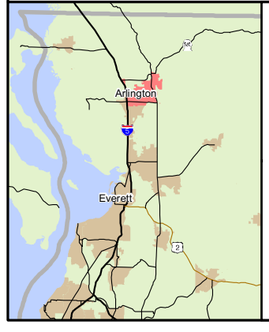
Liquefaction occurs when strong earthquake shaking causes soils to rapidly lose strength and behave like quicksand. Liquefaction susceptibility provides an estimate of the probability that soil will liquefy from the shaking during an earthquake. The susceptibility probability ranges from very low (minimal chance of liquefaction) to high (liquefaction is likely to occur).

WA DNR, Liquefaction Susceptibility Map of Snohomish County, Washington (2004).

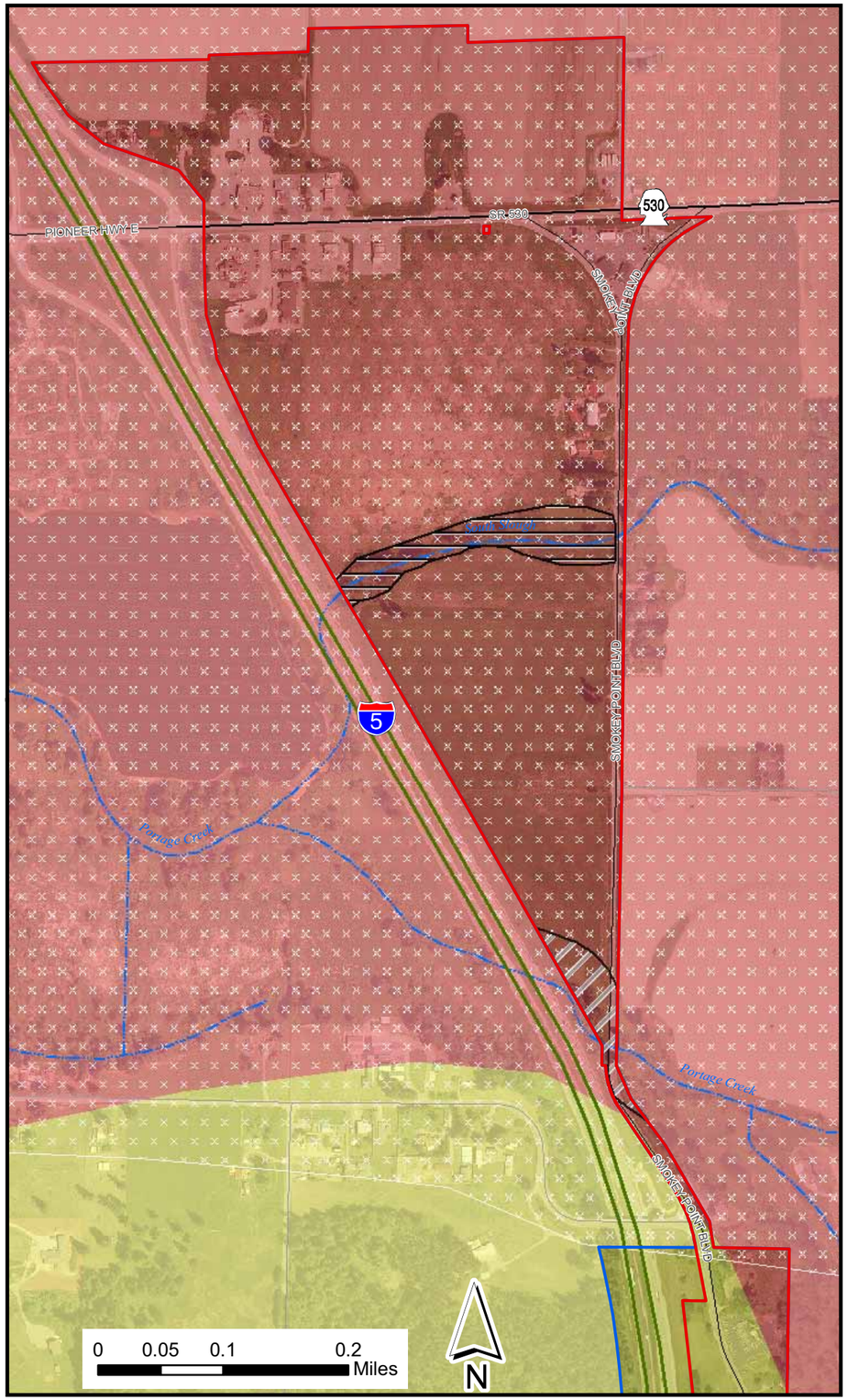
Date:
04/29/2010

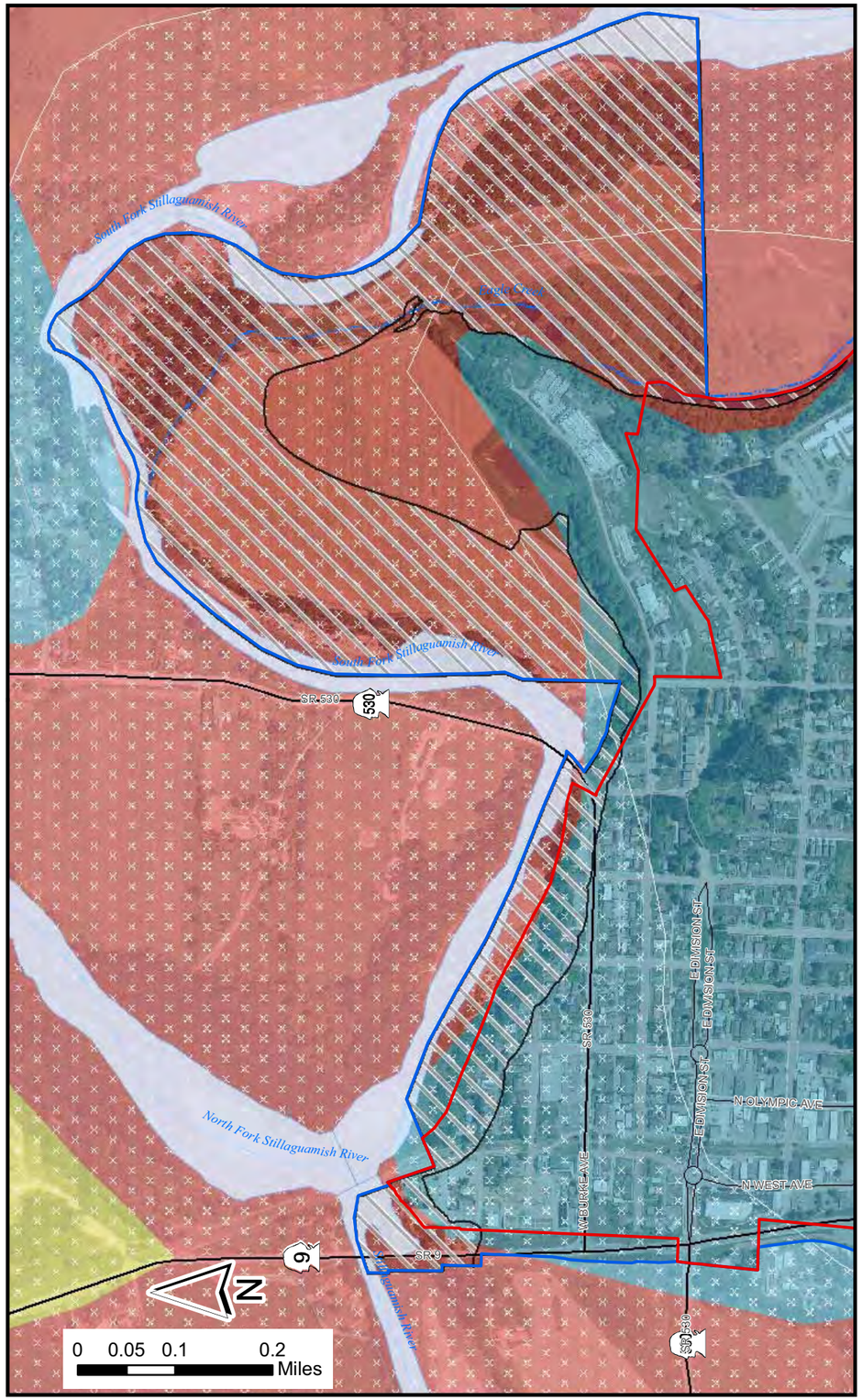
File:
Figure10_11x17_10.mxd

Cartographer:
kdk



CITY OF ARLINGTON





City of Arlington
Shoreline Master Plan

Figure 10a - Lahars, Liquefaction & Landslides: Old Town and Island Crossing

Legend

- USGS Lahar Hazard
- Landslide Area (Wa DNR)

Liquefaction Susceptibility

- high
- moderate to high
- low to moderate
- low
- very low to low
- very low

Increasing likehood of liquefaction

- South Slough
- *Area of additional analysis*
- Proposed Jurisdiction
- City Limits
- City UGA
- Local roads
- Streams
- Rivers
- Ponds

DRAFT

Liquefaction occurs when strong earthquake shaking causes soils to rapidly lose strength and behave like quicksand. Liquefaction susceptibility provides an estimate of the probability that soil will liquefy from the shaking during an earthquake. The susceptibility probability ranges from very low (minimal chance of liquefaction) to high (liquefaction is likely to occur).

WA DNR, Liquefaction Susceptibility Map of Snohomish County, Washington (2004).

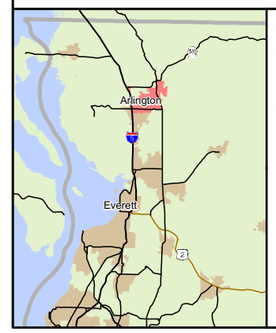
Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Aerials taken in June 2009.

Date:
04/29/2010

File:
Figure10a_11x17_10.mxd

Cartographer:
kdk

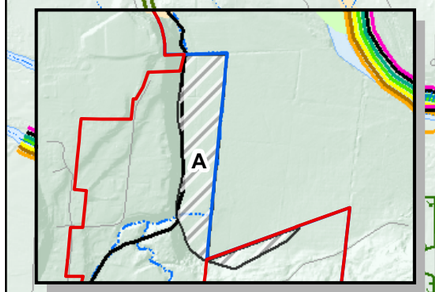


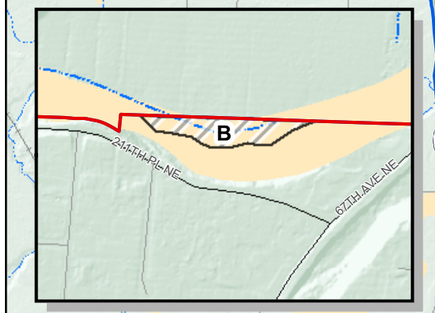
CITY OF ARLINGTON

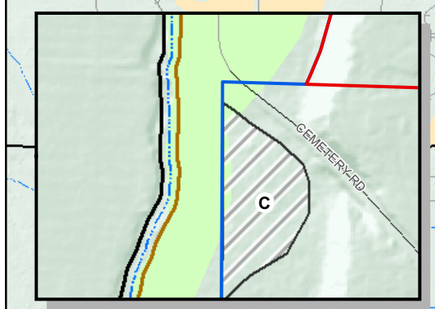
City of Arlington
Shoreline Master Plan

Figure 11
WDFW Priority Habitats & Species

Inset Maps:
Shoreline Jurisdiction Areas







Detailed Island Crossing and Old Town maps are shown in figures labeled 'Figure [figure #]a'.

Legend

Species
- Bull Trout
- Chinook
- Chum
- Coho
- Cutthroat
- Pink
- Steelhead

Site Type
- Winter Eagle Concentration Site
- Swan Winter Feeding Site
- Riparian Areas
- Wetland Areas
- Proposed Jurisdiction
- South Slough
  Area of additional analysis

Species and Site Type information provided by Washington Dept of Fish and Wildlife WDFW.

- City Limits
- City UGA
- Local Roads
- Airport
- Rail line
- Streams
- Rivers
- Ponds

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

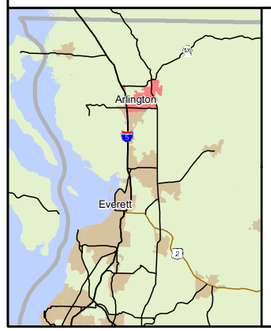
Topography provided by Puget Sound LiDAR Consortium, downloaded summer 2009.

DRAFT

Date:
04/29/2010

File:
Figure11_11x17_10.mxd

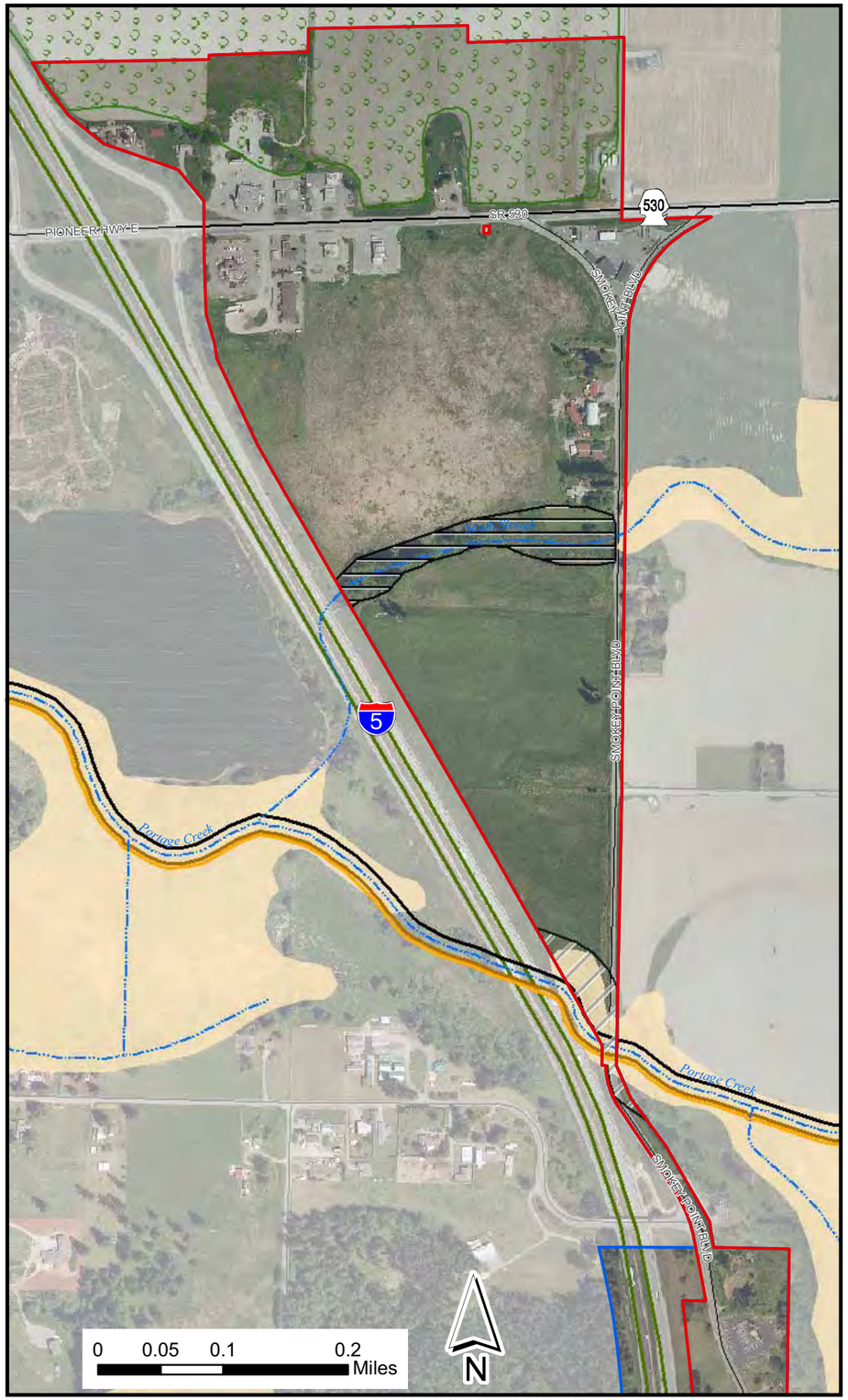
Cartographer:
kdk

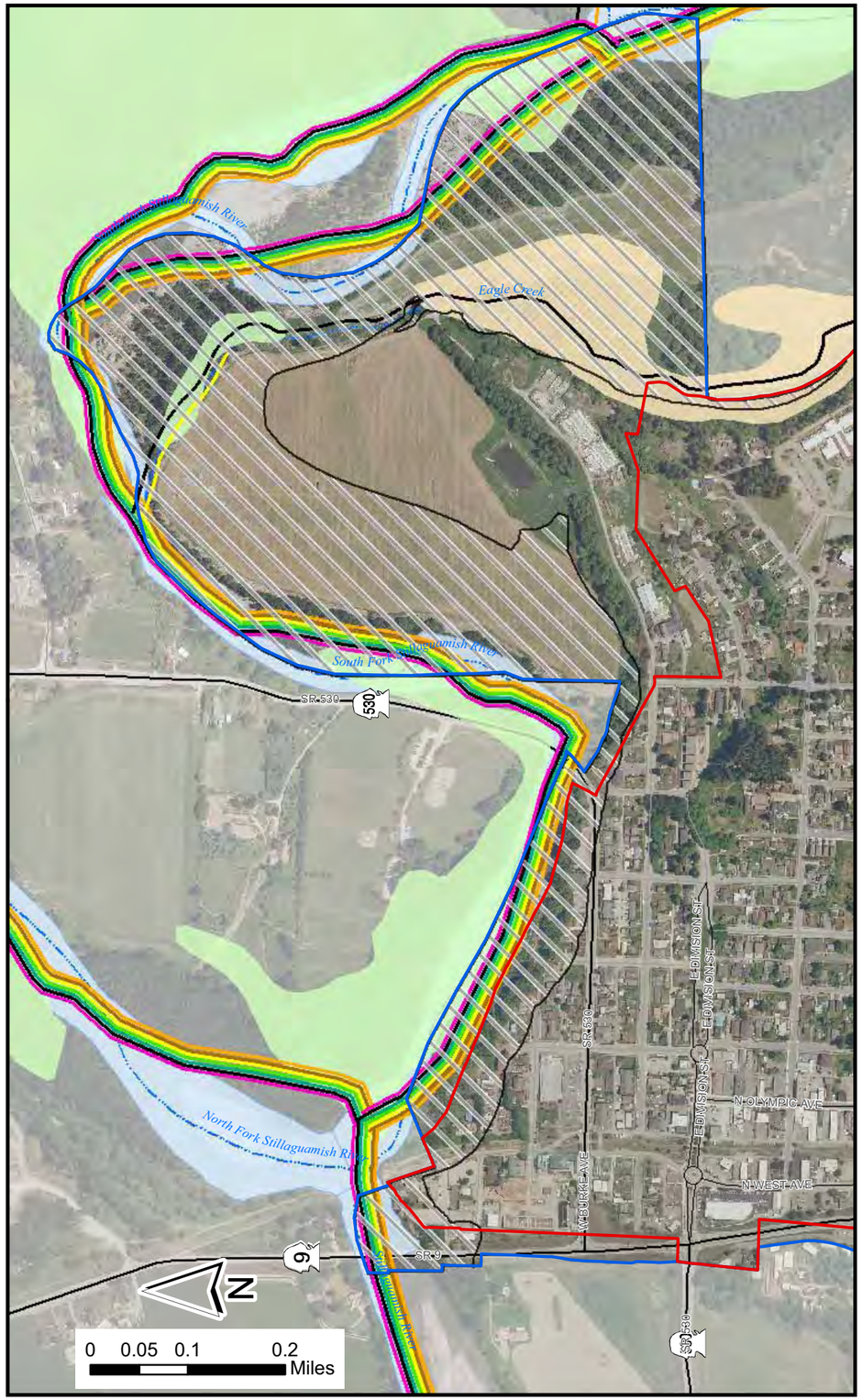


CITY OF ARLINGTON

N

0 0.25 0.5 1 1.5 2 Miles





City of Arlington
Shoreline Master Plan

Figure 11a
WDFW Priority Habitats & Species: Old Town and Island Crossing

Legend

Species

- Bull Trout
- Chinook
- Chum
- Coho
- Cutthroat
- Pink
- Steelhead

Site Type

- Winter Eagle Concentration Site
- Swan Winter Feeding Site
- Riparian Areas
- Wetland Areas
- Proposed Jurisdiction
- South Slough

Area of additional analysis

Species and Site Type information provided by Washington Dept of Fish and Wildlife WDFW.

- City Limits
- City UGA
- Local Roads
- Streams
- Rivers
- Ponds

DRAFT

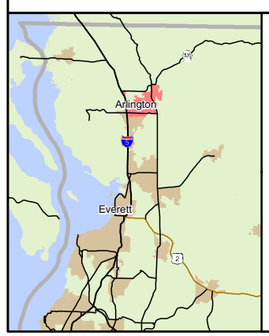
Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Aerials taken in June 2009.

Date:
04/29/2010

File:
Figure11a_11x17_10.mxd

Cartographer:
kdk



CITY OF ARLINGTON

City of Arlington
Shoreline Master Plan

Figure 12
2006 NOAA's C-CAP Landcover

Inset Maps:
Shoreline Jurisdiction Areas

Detailed Island Crossing and Old Town maps are shown in figures labeled 'Figure [figure #]a'.

Legend

2006 CCAP Landcover
- Unclassified
- High Intensity Developed
- Medium Intensity Developed
- Low Intensity Developed
- Developed Open Space
- Cultivated
- Pasture/Hay
- Grassland
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Scrub/Shrub
- Palustrine Forested Wetland
- Palustrine Scrub/Shrub Wetland
- Palustrine Emergent Wetland
- Estuarine Forested Wetland
- Estuarine Scrub/Shrub Wetland
- Estuarine Emergent Wetland
- Unconsolidated Shore
- Bare Land

- Proposed Jurisdiction
- South Slough
- *Area of additional analysis*
- City Limits
- City UGA
- Local roads
- Airport
- Rail line
- Streams
- Rivers
- Ponds

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Topography provided by Puget Sound LiDAR Consortium, downloaded summer 2009.

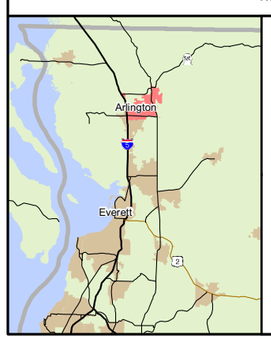
Landcover provided by the NOAA's Coastal Change Analysis Program (C-CAP), 2006 classification of Landsat scenes.

DRAFT

Date:
04/29/2010

File:
Figure12_11x17_10.mxd

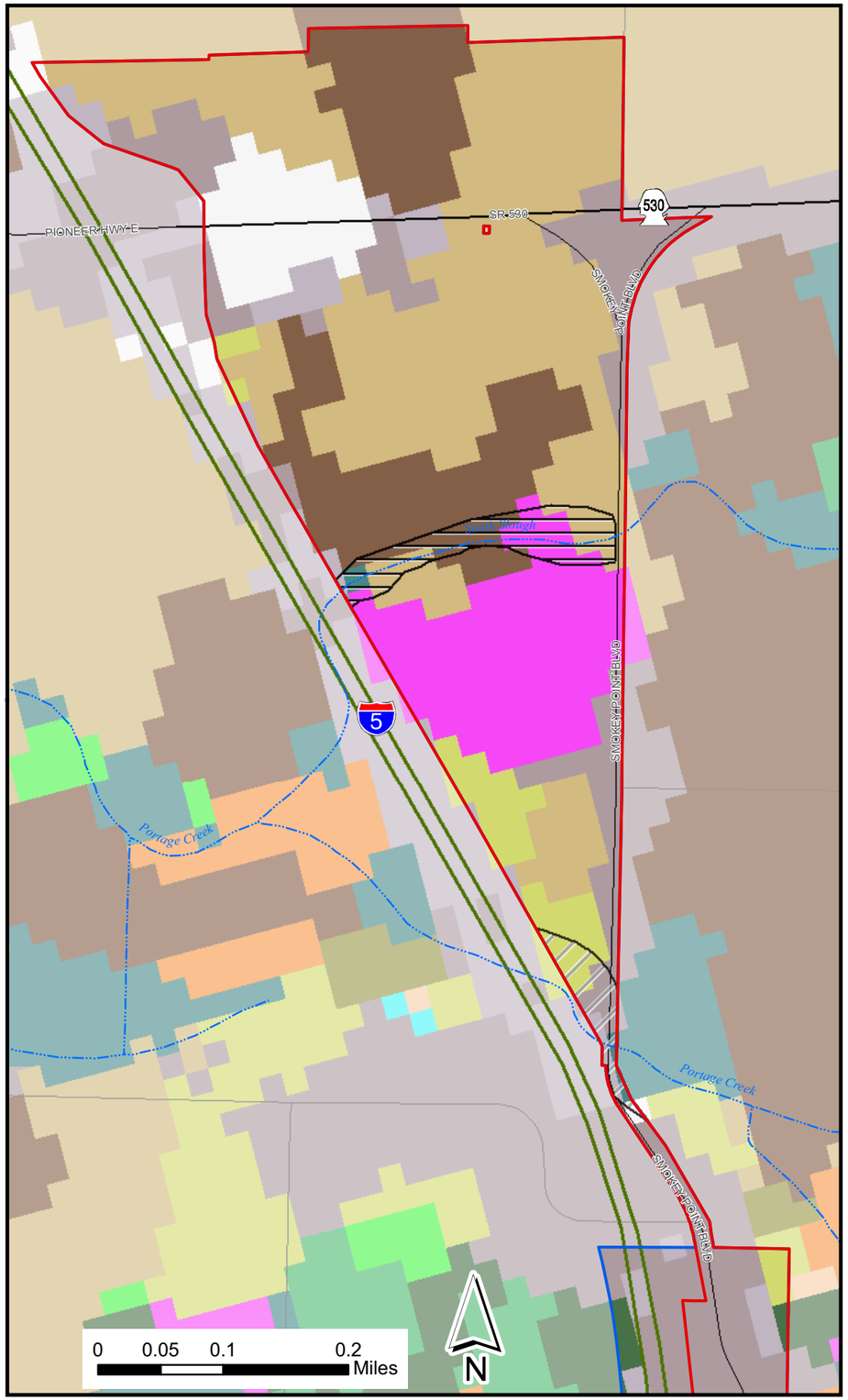
Cartographer:
kdk

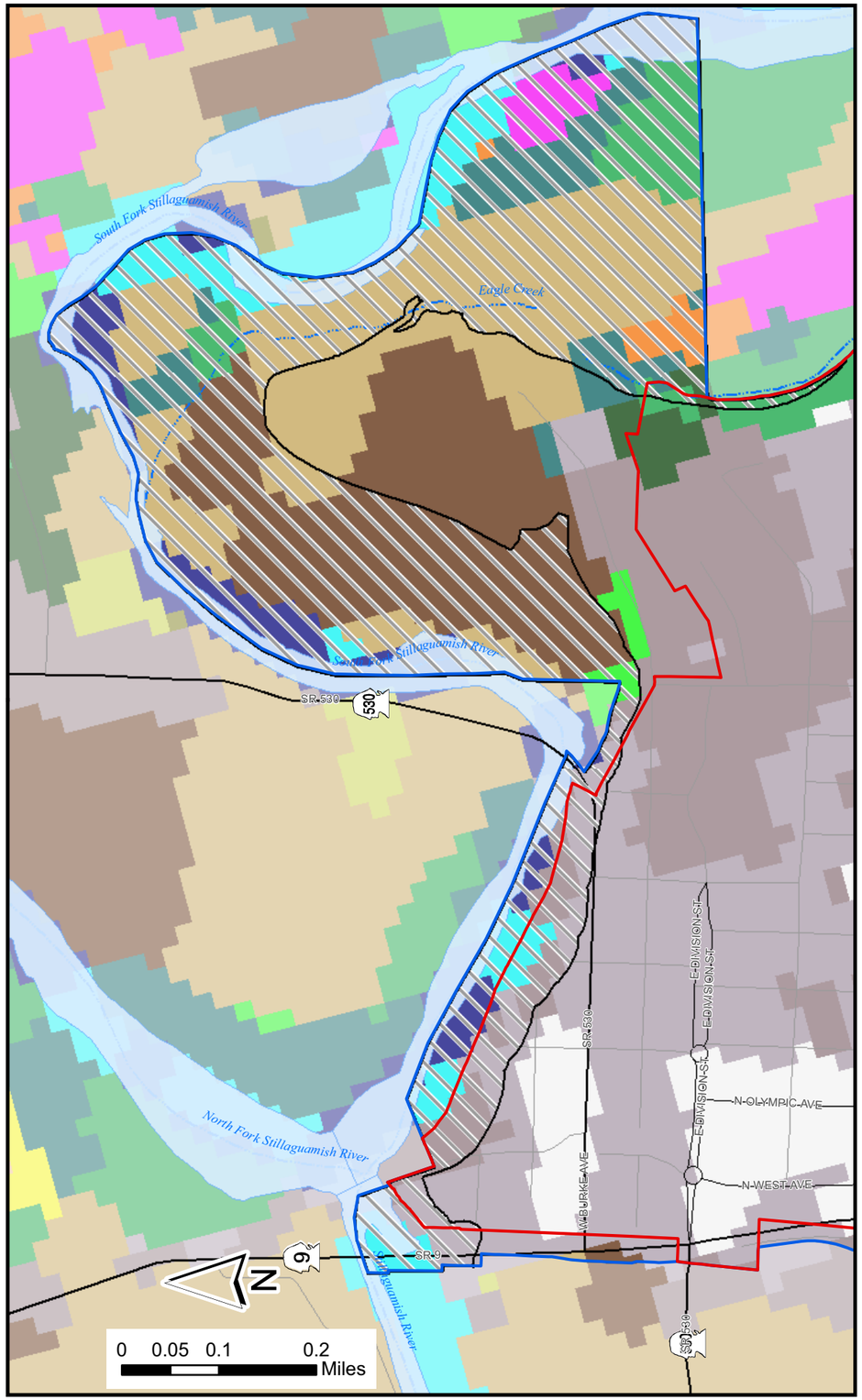


CITY OF ARLINGTON

0 0.2 0.4 0.8 1.2 1.6 Miles

N





City of Arlington
Shoreline Master Plan

Figure 12a
2006 C-CAP Landcover:
Old Town and Island Crossing

Legend

2006 CCAP Landcover

- Unclassified
- High Intensity Developed
- Medium Intensity Developed
- Low Intensity Developed
- Developed Open Space
- Cultivated
- Pasture/Hay
- Grassland
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Scrub/Shrub
- Palustrine Forested Wetland
- Palustrine Scrub/Shrub Wetland
- Palustrine Emergent Wetland
- Estuarine Forested Wetland
- Estuarine Scrub/Shrub Wetland
- Estuarine Emergent Wetland
- Unconsolidated Shore
- Bare Land

- Proposed Jurisdiction
- South Slough
- *Area of additional analysis*
- City Limits
- City UGA
- Local roads
- Streams
- Rivers
- Ponds

DRAFT

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

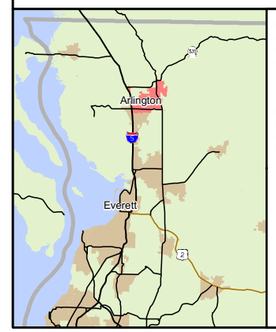
Aerials taken in June 2009.

Landcover provided by the NOAA's Coastal Change Analysis Program (C-CAP), 2006 classification of Landsat scenes.

Date:
04/29/2010

File:
Figure12a_11x17_10.mxd

Cartographer:
kdk



CITY OF ARLINGTON

City of Arlington
Shoreline Master Plan

Figure 13
2003 USGS Impervious Area

Legend

USGS Impervious Surface

Mostly impervious surface

Increasing impervious surfaces

Minimal impervious surface

Buildings

Proposed Jurisdiction

South Slough
Area of additional analysis

City Limits

City UGA

Local roads

Airport

Railroad

Streams

Rivers

Ponds

Impervious suface from the USGS National Land Cover Database Zone 09 Impervious Layer (2003).

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Topography provided by Puget Sound LiDAR Consortium, downloaded summer 2009.

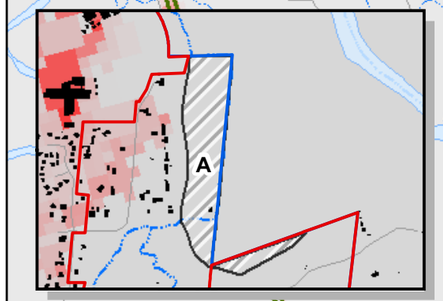
Date:
04/29/2010

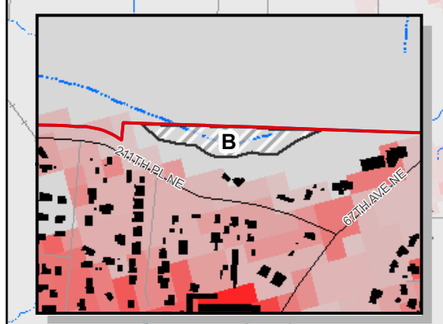
File:
Figure13_11x17_10.mxd

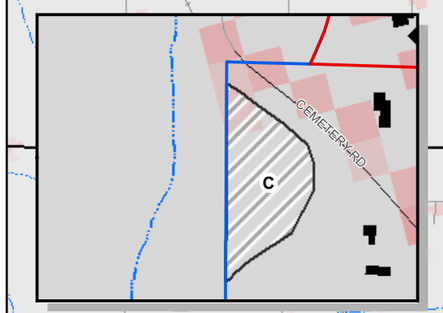
Cartographer:
kdk

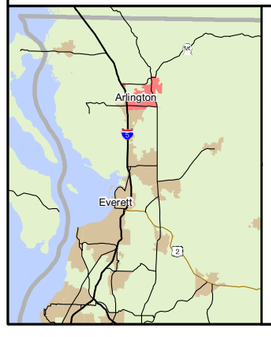
Inset Maps:
Shoreline Jurisdiction Areas

Detailed Island Crossing and Old Town maps are shown in figures labeled 'Figure [figure #]a'.





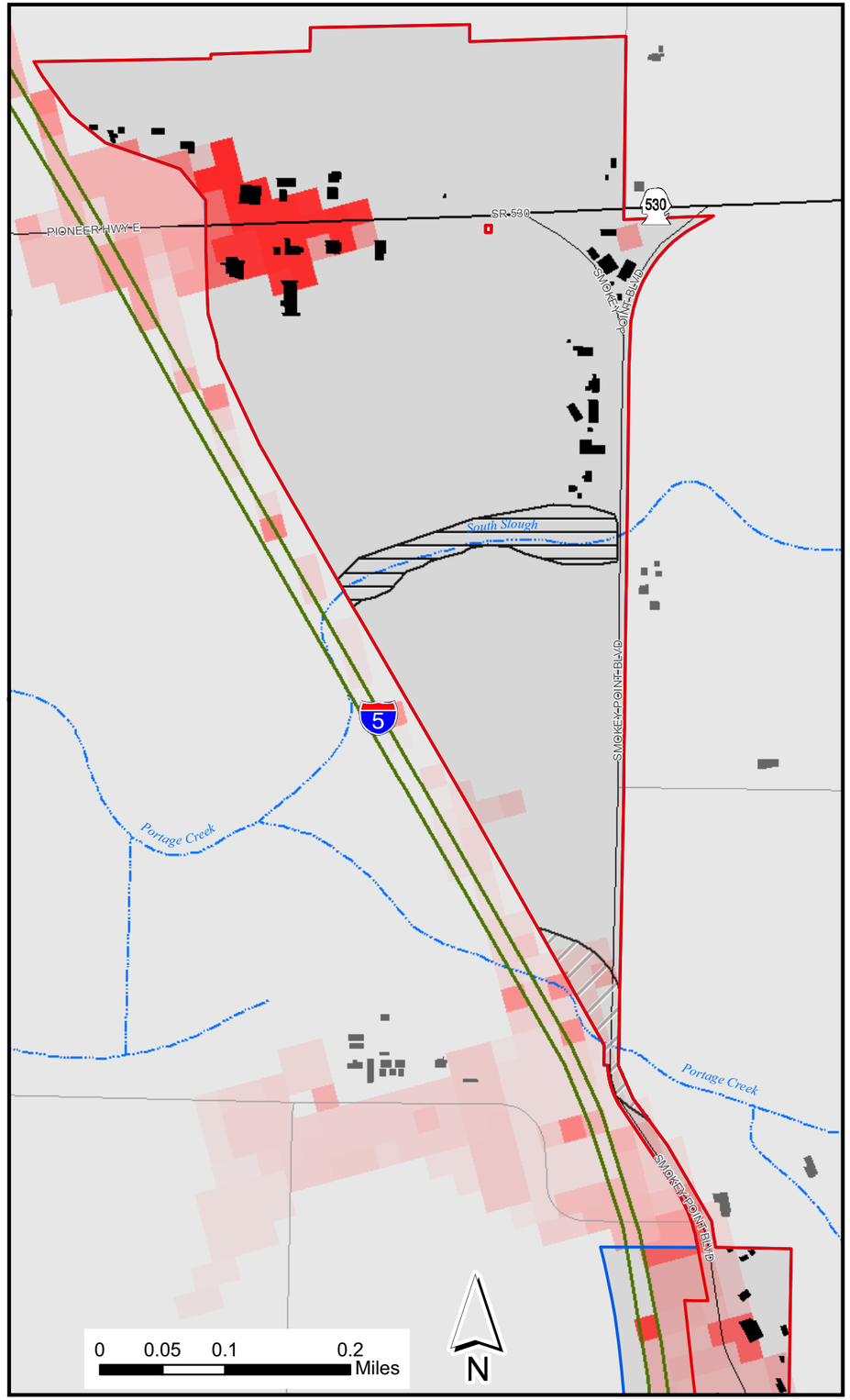


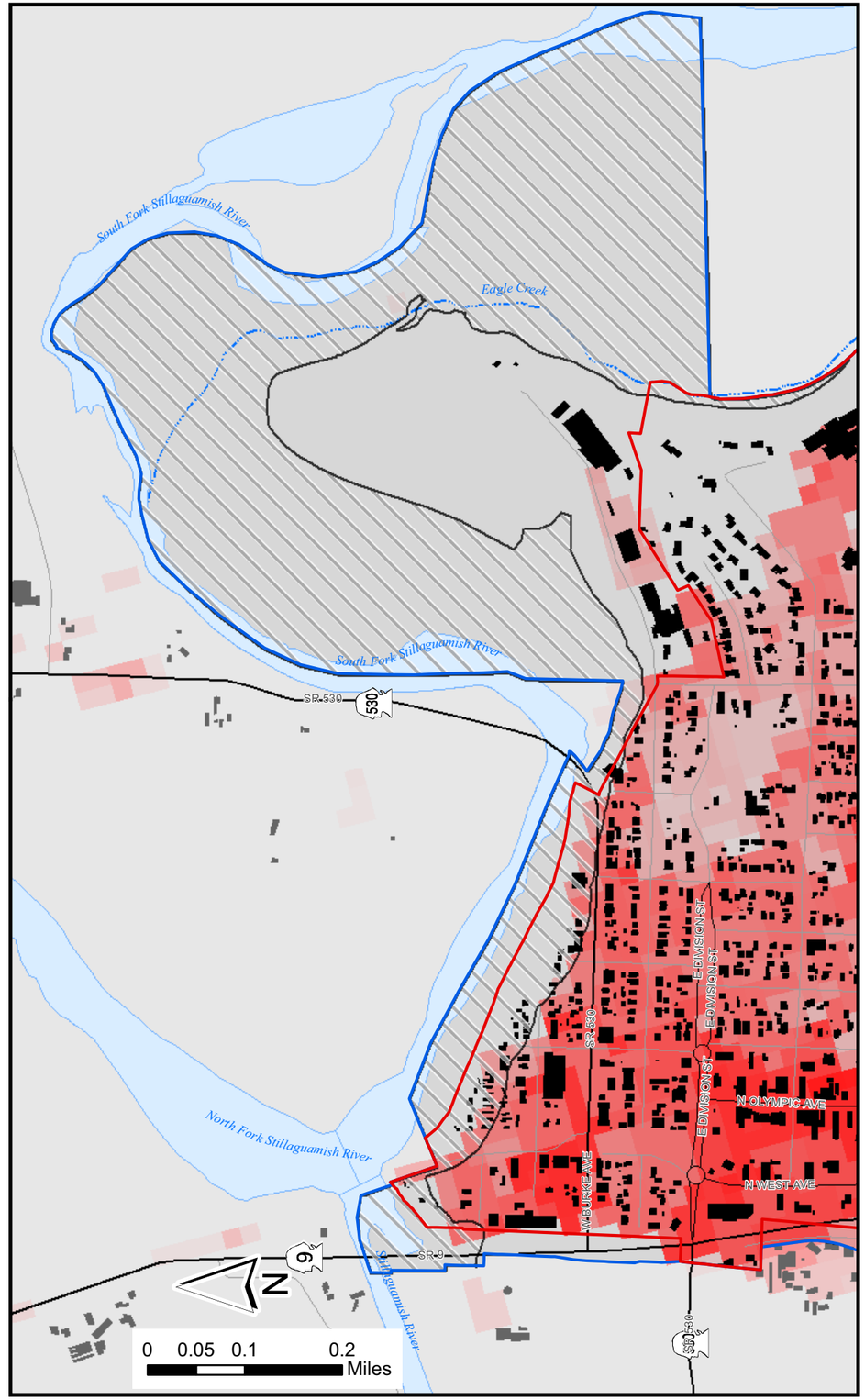


CITY OF ARLINGTON

City of Arlington
Shoreline Master Plan

Figure 13a
2003 USGS Impervious Area: Old Town and Island Crossing





Legend

USGS Impervious Surface

Mostly impervious surface

Increasing impervious surfaces

Minimal impervious surface

Buildings

Proposed Jurisdiction

South Slough
Area of additional analysis

City Limits

City UGA

Local roads

Streams

Rivers

Ponds

DRAFT

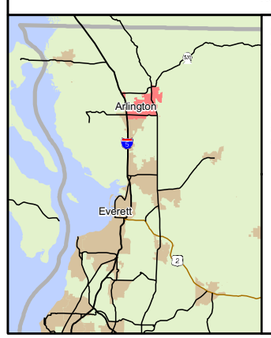
Impervious suface from the USGS National Land Cover Database Zone 09 Impervious Layer (2003).

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Date:
04/29/2010

File:
Figure13a_11x17_10.mxd

Cartographer:
kdk



CITY OF ARLINGTON

City of Arlington
Shoreline Master Plan

Figure 14
NRCS Soils

DRAFT

Inset Maps:
Shoreline Jurisdiction Areas

Detailed Island Crossing and Old Town maps are shown in figures labeled 'Figure [figure #]a'.

NRCS Soils

- AEg Alderwood-Everett gravelly sandy loam
- Ag Alderwood gravelly sandy loam
- Bs Bellingham silty clay loam
- Cf Custer fine sandy loam
- Cl Cathcart loam
- Eg Everett gravelly sandy loam
- Ks Kitsap silt loam
- Ll Lynnwood loamy sand
- Mg McKenna gravelly silt loam
- Mm Mukilteo muck
- Nl Norma loam
- Nvl Norma variant loam
- P Pits
- PKs Pastik silt loam
- PTs Puget silty clay loam
- Pf Puyallup fine sandy loam
- Pl Pilchuck loamy sand
- R Riverwash
- Rf Ragnar fine sandy loam
- SNs Sultan silt loam
- SRg Salsavar gravelly loam
- Ss Snohomish silt loam
- TM Terric Medisaprists
- TWg Tokul-Winston gravelly loams
- Tg Tokul gravelly loam
- U Urban land
- W Water

- Proposed Jurisdiction
- South Slough
- *Area of additional analysis*
- City Limits
- City UGA
- Local roads
- Airport
- Rail line
- Streams
- Rivers
- Ponds

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

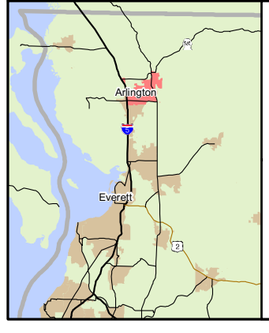
Topography provided by Puget Sound LiDAR Consortium, downloaded summer 2009.

NRCS Soils data downloaded from USDA Soil Data Mart, March 2010.

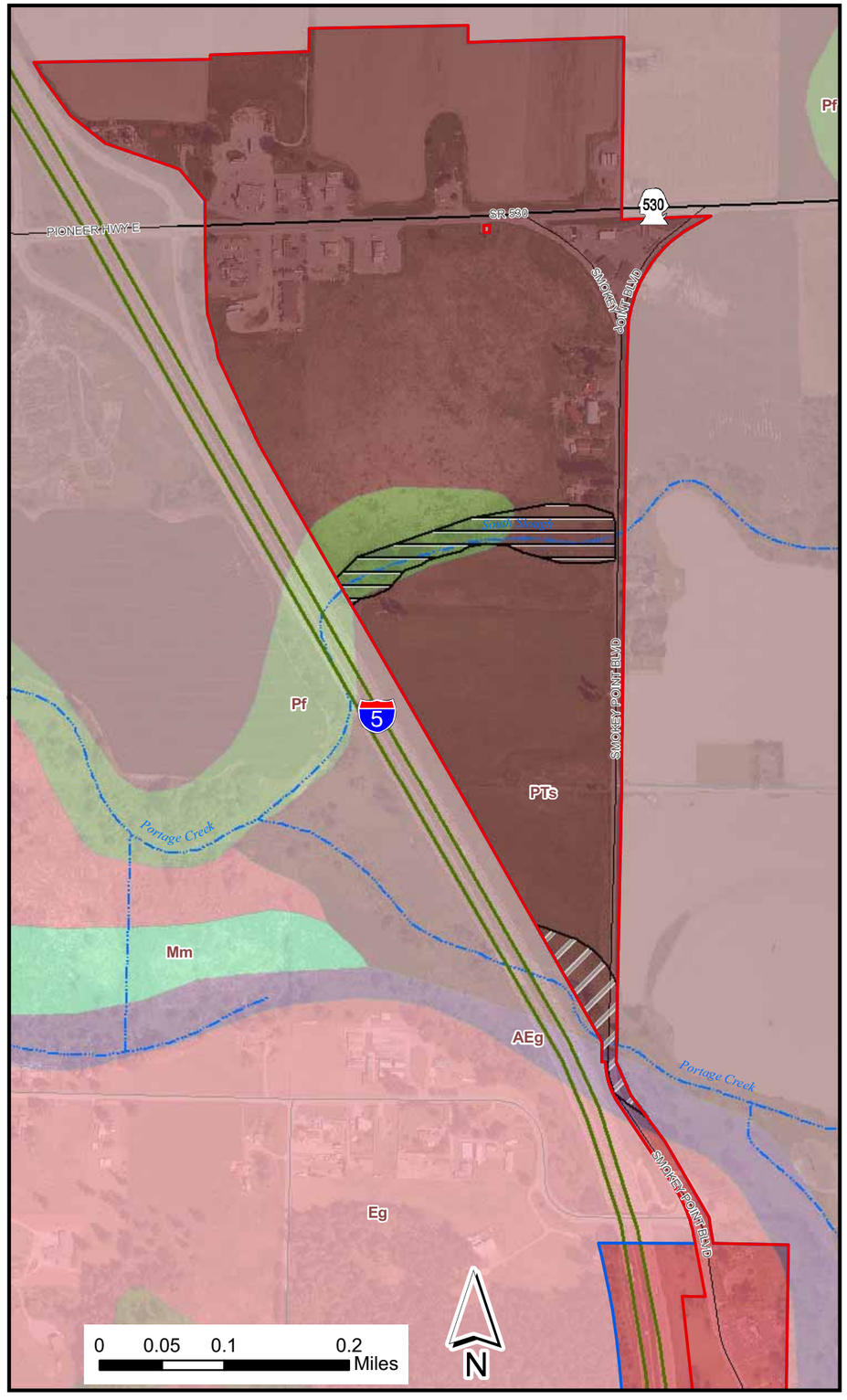
Date:
04/29/2010

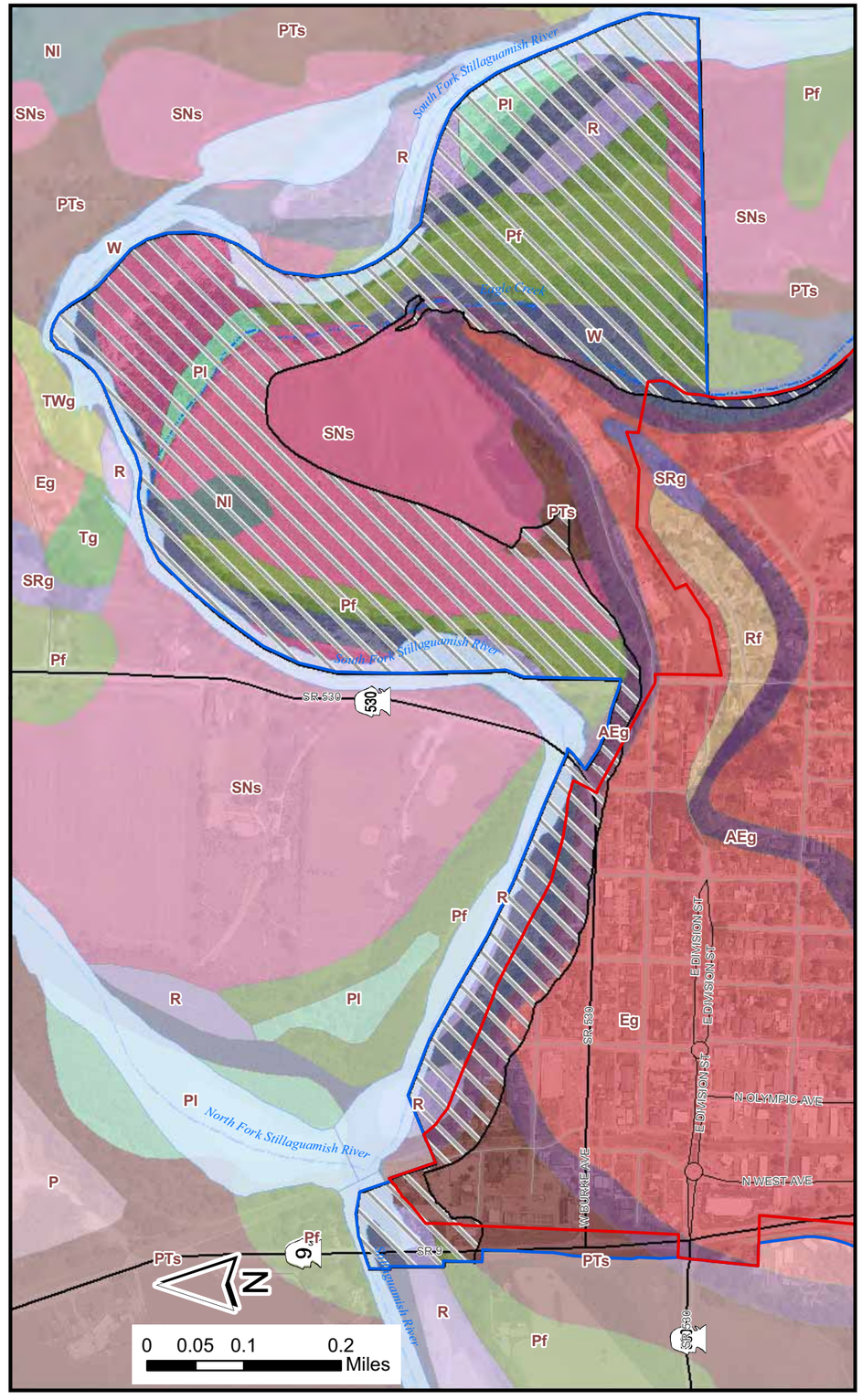
File:
Figure14_11x17_10.mxd

Cartographer:
kdk



CITY OF ARLINGTON





City of Arlington
Shoreline Master Plan

Figure 14a
NRCS Soils:
Old Town and Island Crossing

DRAFT

NRCS Soils

- AEg Alderwood-Everett gravelly sandy loam
- Ag Alderwood gravelly sandy loam
- Bs Bellingham silty clay loam
- Cf Custer fine sandy loam
- Cl Cathcart loam
- Eg Everett gravelly sandy loam
- Ks Kitsap silt loam
- Ll Lynnwood loamy sand
- Mg McKenna gravelly silt loam
- Mm Mukilteo muck
- NI Norma loam
- Nvl Norma variant loam
- P Pits
- PKs Pastik silt loam
- PTs Puget silty clay loam
- Pf Puyallup fine sandy loam
- Pl Pilchuck loamy sand
- R Riverwash
- Rf Ragnar fine sandy loam
- SNs Sultan silt loam
- SRg Salsavar gravelly loam
- Ss Snohomish silt loam
- TM Terric Medisaprists
- TWg Tokul-Winston gravelly loams
- Tg Tokul gravelly loam
- U Urban land
- W Water

Proposed Jurisdiction
South Slough
Area of additional analysis
City Limits
City UGA
Local roads
Streams
Rivers
Ponds

Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

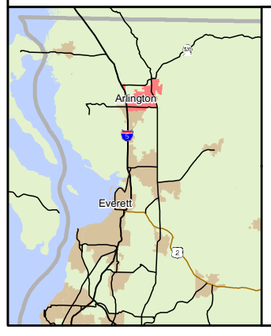
Aerials taken in June 2009.

NRCS Soils data downloaded from USDA Soil Data Mart, March 2010.

Date:
04/29/2010

File:
Figure14a_11x17_10.mxd

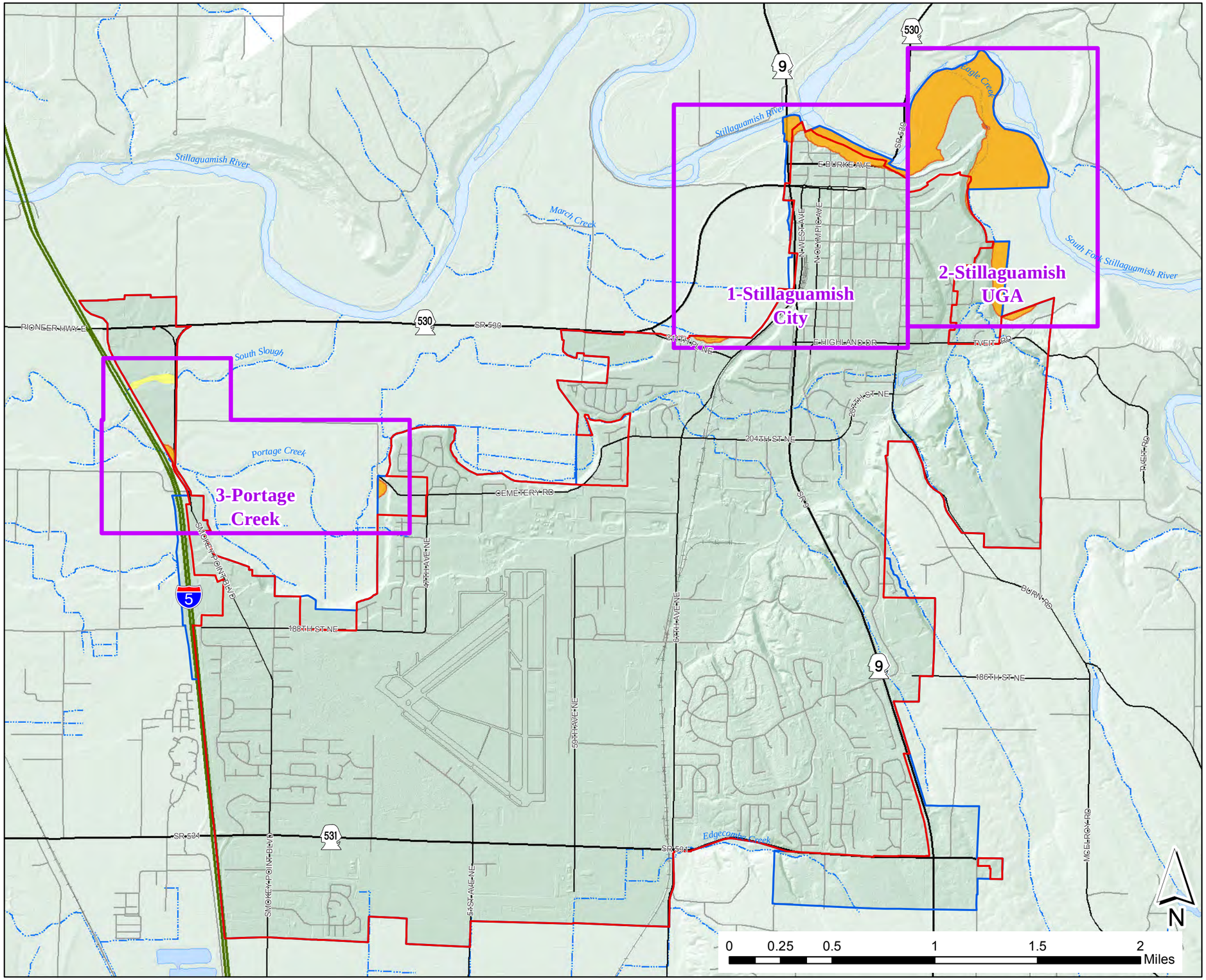
Cartographer:
kdk



CITY OF ARLINGTON

City of Arlington
Shoreline Master Plan

Figure 15
Reach Areas



Legend

- Reach Areas
- Proposed Jurisdiction
- South Slough
  Area of additional analysis
- City Limits
- City UGA
- Local roads
- Airport
- Rail line
- Streams
- Rivers
- Ponds

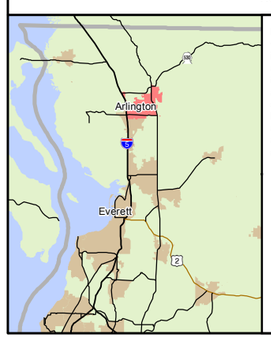
Streams and waterbodies courtesy of Snohomish County Dept of Information Systems, June 2009.

Topography provided by Puget Sound LiDAR Consortium, downloaded summer 2009.

Date: 07/15/2010

File: Figure15_11x17_10.mxd

Cartographer: kdk



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