

Appendix C:
Shoreline Inventory and Characterization

CITY OF FIFE SHORELINE MASTER PROGRAM UPDATE

INVENTORY AND CHARACTERIZATION

PREPARED FOR:



CITY OF FIFE
COMMUNITY DEVELOPMENT
5411 23RD STREET EAST
FIFE, WASHINGTON 98424

PREPARED BY:

GRETTE ASSOCIATES, LLC
2102 NORTH 30TH SUITE A
TACOMA, WASHINGTON 98403
(253) 573-9300

151 SOUTH WORTHEN, SUITE 101
WENATCHEE, WASHINGTON 98801
(509) 663-6300

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¹ All figures are located at the end of the document for easy reference. In some instances, some figures are also inserted into the body of document to provide further clarification of the text (e.g. the location of a reach). Page numbers are provided in this table for those figures that are incorporated into the body of the document.

INTRODUCTION

This report is intended to provide baseline information on the existing ecosystem processes and shoreline functions occurring within the City of Fife's (City) shoreline jurisdiction (Figures 1, 1A and 1B) to provide a basis for the update of the City's Shoreline Master Program (SMP). The City of Fife Urban Growth Areas (UGAs) are not included in this study as the City does not anticipate the annexation of these areas before the next shoreline master program update is scheduled to occur. City staff did confer with the adjacent jurisdiction, Pierce County, to ensure these areas were reviewed within the County Inventory and Analysis Document and that the results of that document corresponded to the findings as outlined in this document. This document utilizes the information resources identified in the Shoreline Inventory, submitted to the Washington State Department of Ecology (Ecology) in June 2010 as part of the SMP update. This document describes larger-scale (i.e., watershed) physical and biological processes occurring in the City's shoreline jurisdiction as well as specific shoreline functions based on a shoreline reach analysis. Finally, this report analyzes opportunities for shoreline protection and restoration, as well as public access and shoreline uses, and provides information on specific data gaps or limitations that were identified during the analysis and characterization process as well as recommendations as to how those data gaps should be addressed.

1.1 STUDY AREA BOUNDARY

The City of Fife, which is 5.7 square miles in area, is located to the southeast of the City of Tacoma and to the west of the City of Milton and is located in the Puyallup River floodplain near the head of Commencement Bay in north Pierce County. Figure 2 shows an aerial view of the City and surrounding areas. The estimated 2009 population was 7,810. The shoreline within the City of Fife is approximately 6.13 miles long.

Two water bodies within the City are regulated under the State Shoreline Management Act (SMA). The Puyallup River is listed as such under the Washington State Administrative Code (WAC 173-18-310). Hylebos Creek is not on this list, but does meet the flow requirements for SMA regulation in the City as well as in the neighboring City of Milton.

This study focuses on the water bodies inside the City, including associated wetlands and the shore lands within 200 feet upland of the Puyallup River and Hylebos Creek. Consistent with the Shoreline Management Act, the study area includes the aquatic area, the edge of the water body as defined as the ordinary high water mark (OHWM) and shorelands within 200 feet upland of the OHWM (Figures 1, 1A, and 1B).

The Puyallup River waterward of the OHWM is under the sole jurisdictions of the Puyallup Tribe of Indians. Refer to Figure 7. In addition, the Sha Dadx wetland area and the hydrologic connection between the Oxbow wetland and the Puyallup River as well as the surrounding upland areas for both wetlands, are also under the jurisdiction of the Puyallup Tribe of Indians. Pursuant to RCW 37.12.060,

Nothing in this chapter shall authorize the alienation, encumbrance, or taxation of any real or personal property, including water rights and tidelands, belonging to any Indian or any Indian tribe, band, or community that is held in trust by the United States

or is subject to a restriction against alienation imposed by the United States; or shall authorize regulation of the use of such property in a manner inconsistent with any federal treaty, agreement, or statute or with any regulation made pursuant thereto; or shall confer jurisdiction upon the state to adjudicate, in probate proceedings or otherwise, the ownership or right to possession of such property or any interest therein; or shall deprive any Indian or any Indian tribe, band, or community of any right, privilege, or immunity afforded under federal treaty, agreement, statute, or executive order with respect to Indian land grants, hunting, trapping, or fishing or the control, licensing, or regulation thereof.

The baseline analysis provided by this document includes all shorelines within City limits including those areas that are under the jurisdiction of the Puyallup Tribe of Indians. However further Shoreline Master Program Update tasks, including but not limited to policy and regulation development will be conducted in such a manner as to maintain compliance with both those laws and rules defining the Shoreline Management Update process as well as those laws and rules defining tribal jurisdiction.

1.2 METHODOLOGY

As noted in the introduction, the purpose of this document is to provide baseline information regarding City shorelines in order to inform the SMP update. It is intended to integrate information from a number of existing sources in order to address the requirements of the Shoreline Management Act (SMA) and to identify gaps for which existing information is not available. It relies heavily on adaptation of existing information and analyses of City shorelines. New data gathering and extensive re-analysis of existing data is not a requirement of the SMP update process and is therefore outside of the scope of the City's SMP update.

This document addresses City shorelines at two different spatial scales: ecosystem/regional and reach. Regional information is largely in narrative form and comes from documents addressing conditions at Water Resource Inventory Area (WRIA), County, watershed, or basin level. All of the documents and other resources used for the characterization process are identified within the Inventory (Appendix A). Some of the sources from which regional-scale information were drawn include:

- *Salmon Habitat Limiting Factors Report for the Puyallup River Basin (Water Resource Inventory Area 10)* (Kerwin 1999)
- *City of Fife Draft Comprehensive Plan* (City of Fife 2005)
- *Draft City of Fife Shoreline Inventory* (Grette Associates 2004)

Reach scale information is largely based on review of geospatial data available in map format from the City and Pierce County. The geospatial data layers available to be utilized for reach review are summarized in the Shoreline Inventory (Appendix A). Additionally, aerial photos,

site visits, and institutional knowledge within the City all were used to supplement information at the reach scale.

In order to best use limited grant resources, this Inventory and Characterization is focused on reach-scale analysis of conditions and opportunities within the City shorelines. Regional information is presented within the context of City shorelines where it is available from the sources listed above, but will not be the sole source of information used by the City during the SMP update process. Pierce County completed an Inventory and Analysis of the jurisdictional shoreline area in 2009 as part of their SMP update process which was also used as a reference for this document. Additionally, Ecology is preparing analyses of watershed processes for Puget Sound shorelines that will become available in 2010. The City intends to supplement the regional information provided herein with County and Ecology information as it becomes available during the SMP update process.

1.3 REPORT ORGANIZATION

This report is organized to correlate with requirements of Shoreline Management Act (SMA), Revised Code of Washington (RCW) 90.58, and its implementing guidelines in Washington Administrative Code (WAC) 173-26. It is intended to review large-scale information, and scale down sequentially to smaller reaches (reaches defined below in Section 1.4). This approach combines the requirement outlined in WAC 173-26-201(3)(d), Ecology's draft SMP Handbook Chapter 7 *Shoreline Inventory and Characterization* (Ecology 2009), and Ecology's guidance document *Protecting Aquatic Ecosystems: A Guide for Puget Sound Planners to Understand Watershed Processes* (Stanley et al. 2005).

1.4 SHORELINE REACHES

During the inventory process, the City of Fife divided the shoreline into a number of lineal segments according to environmental characteristics (e.g., significant wetlands, undeveloped habitat) and land use (e.g., zoning, existing and planned future land use) (Table 1, Figures 2, 2A and 2B). In some instances, study segments can also be identified according to the City of Fife street systems (e.g., from 4th Street East to 12th Street East along the Hylebos). However the street systems were only utilized in instances where a change in environmental characteristics, land use, or zoning was also present. For example, it was not possible to correlate a segment break to the street system for Puyallup Reach 2 (P2), which is primarily comprised of remnant oxbow of the Puyallup River that now functions as a large, wetland complex with a hydrologic connection to the River but also contains a smaller restored wetland habitat area identified as Sha Dadx (formerly the "Frank Albert Road Wetland") (Section 4.2).

Table 1. Shoreline inventory reaches in the City of Fife.

Study Segment (Reach)	Location	Description	Approx. Length (ft)	River Mile
P1	Puyallup	I-5 Bridge (West City Limit) upstream to the hydrological connection to the Oxbow wetland upstream of 54th Ave	13,150	2.4 - 4.9
P2	Puyallup	Oxbow wetland, hydrological connection to Oxbow wetland, Sha Dadx wetland	Associated wetland (63 acres)	4.9
P3	Puyallup	Upstream edge of the hydrological connection to the Oxbow wetland to Freeman Rd (southeast city limit)	9,840	4.9-6.8
H1	Hylebos	Fife City limit (north, co-terminus of 57th and 55th Ave E) upstream to 4th St E, both banks	1,650	0.3-0.6
H2	Hylebos	4th St E upstream to 12th St E; both banks	3,335	0.6-1.3
H3	Hylebos	12th St E upstream to 70th; both banks,	4,380	1.3-2.1

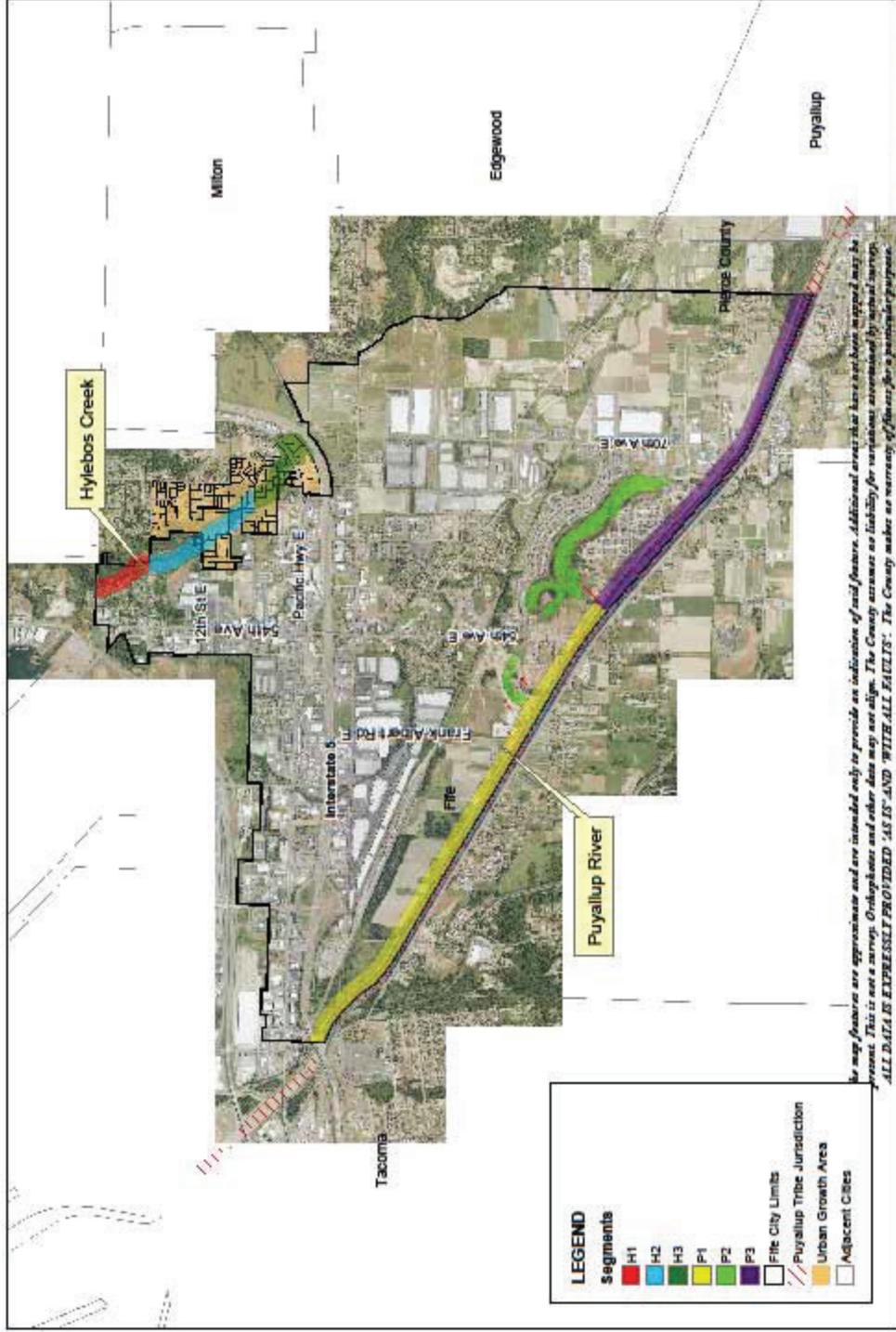
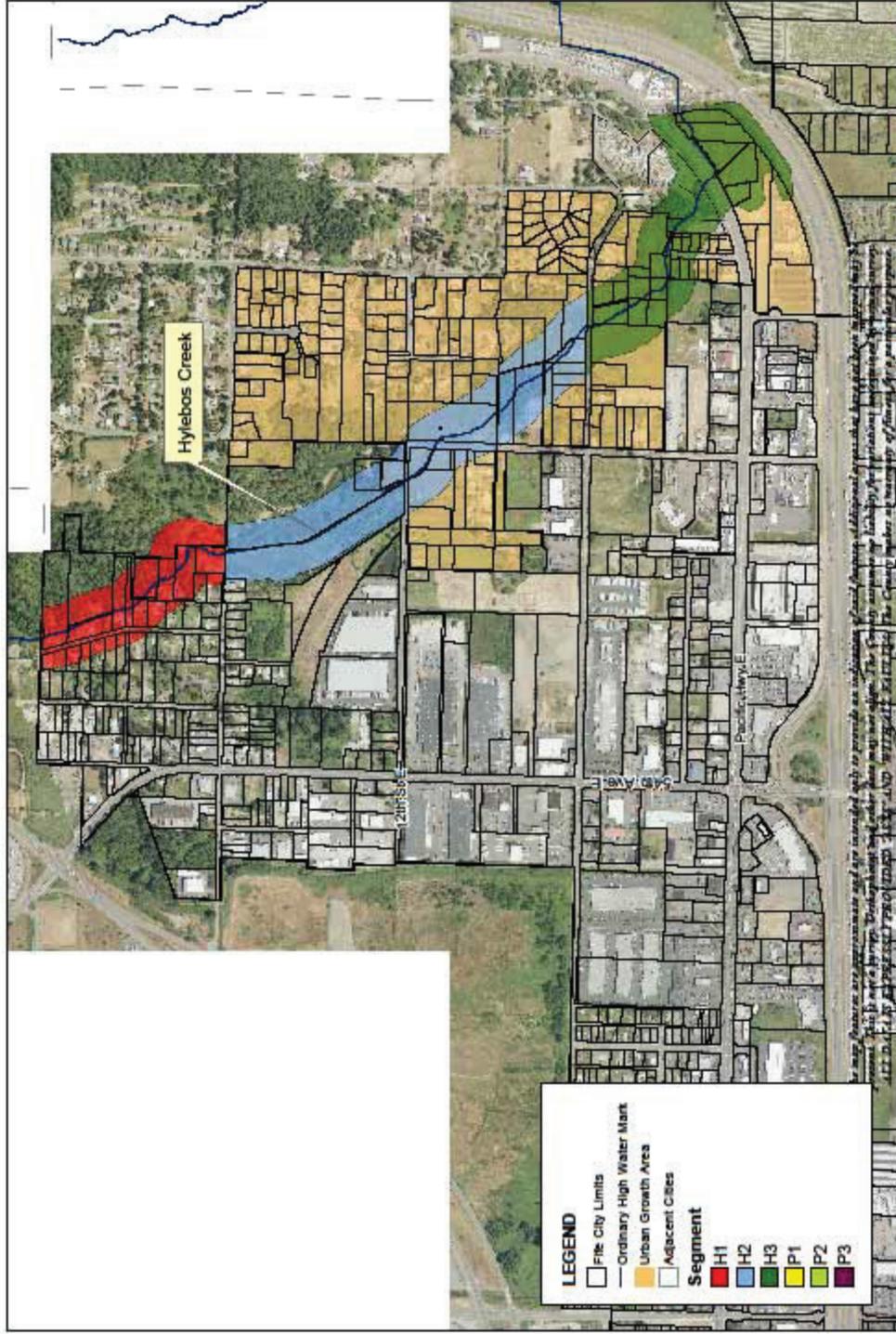


FIGURE 2
 Study Segments
 Fife Shoreline Master Plan
 Fife, WA



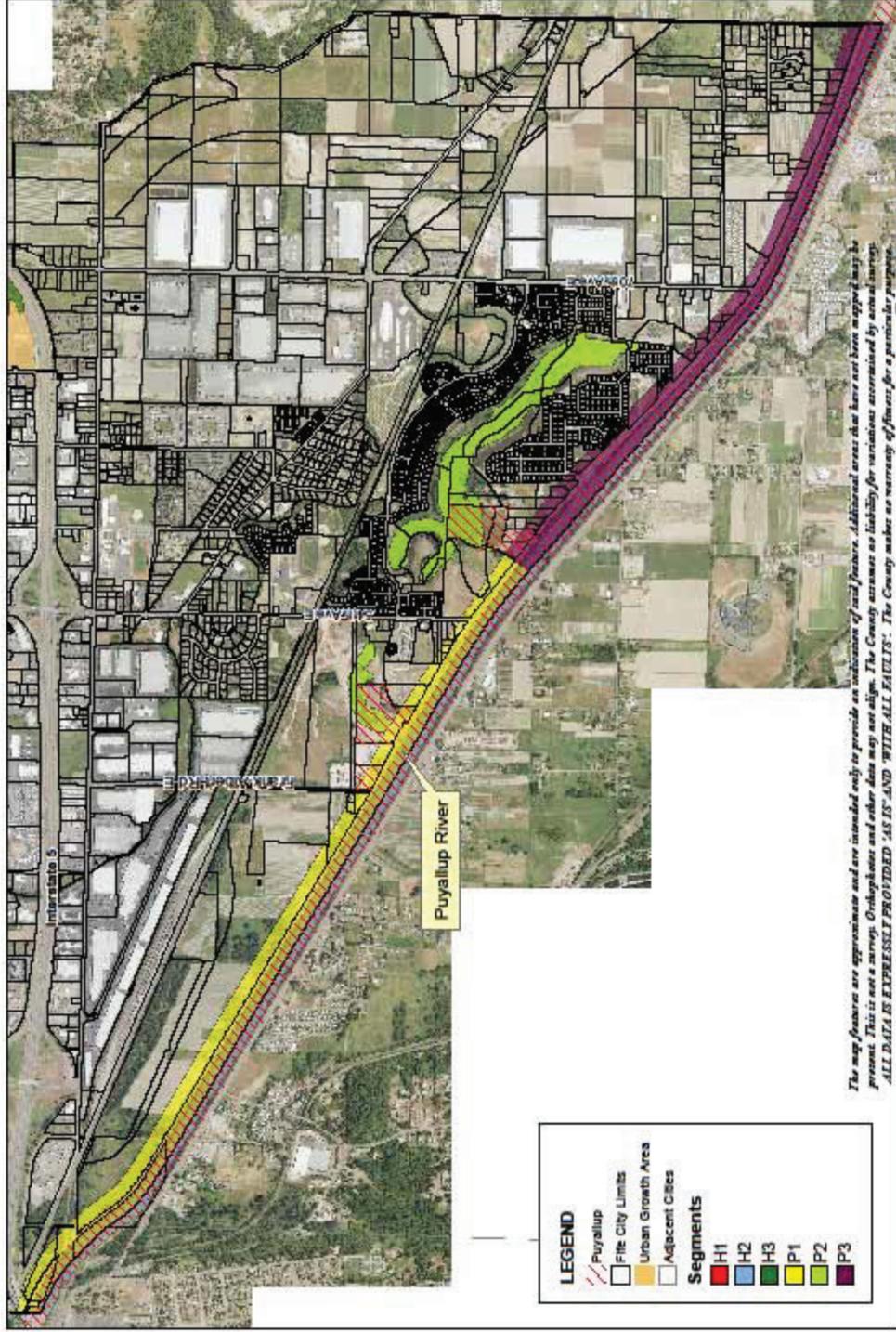


FIGURE 2B
 Study Segments -Puyallup Segment
 Fife Shoreline Master Plan
 Fife, WA

Note: Text within this Characterization, specifically for those reaches associated with Hylebos Creek, refers to left and right stream banks. This refers to bank orientation when facing upstream.

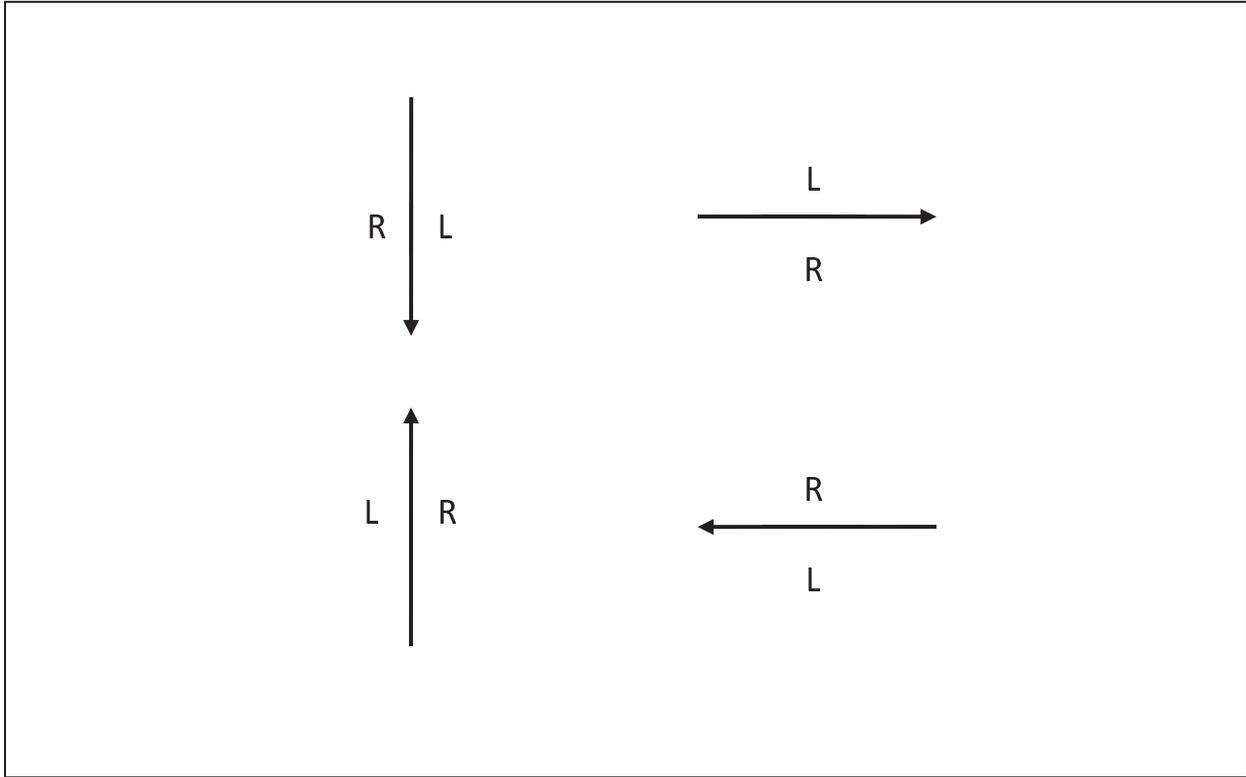


Diagram 1. Left and Right bank designations for various flow scenarios.

2 ECOSYSTEM CONTEXT

The City of Fife is located in the Puyallup River floodplain near the head of Commencement Bay in north Pierce County and is bordered by the Puyallup River to the south. The land was historically used by the Puyallup Indian Tribe and was included in its Reservation Lands within the 1856 amendments to the Medicine Creek Treaty. Just over a century later, in 1957, the City of Fife was incorporated and has been expanded periodically since that time. However, a significant portion of the City is still owned by the Tribe (Figure 7). The City's present corporate limits and urban growth area are shown in Figure 1.

As noted in the introductory text of this document, the City of Fife contains two water bodies that are regulated under the State Shoreline Management Act. These two water bodies are the Puyallup River and Hylebos Creek. In order to place the jurisdictional riparian shorelines of the City of Fife within an ecosystem context, the following subsections describe the natural and development characteristics of the larger watershed.

2.1 WATERSHED NATURAL CHARACTERISTICS

The City of Fife is located entirely within the within the Puyallup Water Resource Inventory Area (WRIA 10). WRIA 10 is approximately 1,065 square miles (673,133 acres) in size and contains over 728 miles of rivers and streams that flow over 1,287 linear miles. WRIA 10 is located in both King and Pierce County jurisdictions. However, the majority of the WRIA is located within Pierce County jurisdiction. As such, the densest areas of population within this WRIA are located in Pierce County and include cities of Tacoma, Puyallup and Fife. The Puyallup River basin was one of the first watersheds in the Puget Sound to experience the full impacts of industrial, urban, and agricultural development (Kerwin 1999). As such, habitat and other watershed characteristics within WRIA 10 have been negatively impacted.

The major water systems within WRIA 10 include the White, Carbon and Puyallup Rivers. The Puyallup River is the largest drainage in WRIA 10. Pursuant to WAC 173-18-310, the Puyallup River is a shoreline of statewide significance. The Puyallup River is approximately 45 miles long. Its headwaters are the glaciers located on the western side of Mount Rainier and its mouth is at Commencement Bay. The Carbon and White Rivers flow into the Puyallup River upstream of the City of Fife. The City of Fife is located along River Miles 2.4 and 6.8 of the Puyallup River.

The Salmon Habitat Limiting Factors Report for the Puyallup River Basin (WRIA 10) separates the basin into six subbasins as follows: (1) Commencement Bay and Puget Sound Nearshore, (2) Lower Puyallup (RM 0.0 to 41.7), (3) Upper Puyallup (RM 41.7 to headwaters), (4) Carbon River, (5) White River, (6) Independent Tributaries to Puget Sound (including Hylebos Creek) (Kerwin 1999). Of those six subbasins, the City of Fife contains portions of both the Lower Puyallup River subbasin and the Hylebos Creek subbasin².

² The Pierce County Surface Water Management website refers to Lower Puyallup River and Hylebos Creek Watersheds. Although a map overlay analysis was not completed as part of this report, the area identified as

Lower Puyallup subbasin

The Lower Puyallup subbasin is comprised of the downstream portion of the Puyallup River and begins below the confluence of the White River adjacent to the City of Puyallup (RM 0.0 to 41.7).

The Puyallup River channel within this subbasin has been modified utilizing dikes, revetments, and levees along both banks downstream of RM 28.6 to Commencement Bay. The placement of these water flow modifications has straightened and confined the river to an active channel width of approximately 130 feet and the resulting habitat is simplified throughout the subbasin (Kerwin 1999).

Hylebos Creek subbasin

The Hylebos Creek subbasin is comprised of the extent of the Hylebos Creek and drains approximately 18,300 acres and is connected to 25 miles of streams, 11 named lakes, and wetlands (Kerwin 1999). The Creek originates from Lake Geneva and Lake Killarney about four miles north and east of the City of Milton. The City of Fife is located along River Miles 0.3 and 2.1 of Hylebos Creek.

Hylebos Creek is thought to have been one of the most productive small stream systems in southern Puget Sound. However, due to the altered state of the creek, salmonid production is greatly reduced (Kerwin 1999). Alteration for this subbasin includes residential development, areas of channelization, modification/reduction/removal of adjacent wetlands, erosion and frequent flooding.

The City's location near the terminus of the subbasin for both the Puyallup River and Hylebos Creek makes its shorelines susceptible to influence from conditions and practices in the rest of the basin. The level of development in both subbasins, particularly in the Hylebos basin, has resulted in very high road density as well as other impervious areas (e.g., parking lots, buildings). In addition to development, forestry and hydrology management (dams, diversions, and other forms of flood control) have also impacted the condition of watershed functions and processes for both subbasins.

2.1.1 Precipitation

WRIA and Pierce County based climate and precipitation information is discussed in a number of documents (Kerwin 1999, ESA Adolphson 2007). As is general for Western Washington area, Pierce County and the City of Fife typically experience a relatively long, mild wet season spanning fall to spring and a short, cool, dry season during the summer. In this area, the majority of rainfall occurs from November through April.

watersheds by Pierce County are assumed to be generally consistent with the areas identified as subbasins within the Salmon Habitat Limiting Factors Report. As the Limiting Factors report was utilized as the primary document for the ecosystem characterization, use of the terminology subbasin is maintained throughout this report.

Average City temperatures are in the 60's in the summer and in the 40's during the winter. The warmest month of the year for the City is August with an average maximum temperature of 78.40 degrees Fahrenheit. The coldest month of the year for the City is January with an average minimum temperature of 32.90 degrees Fahrenheit.

The annual average precipitation at Fife is between 35 to 55 inches per year (City of Fife 2002). Winter months tend to be wetter than summer months. November is generally the wettest month of the year, with an average rainfall of 6.11 inches.

2.1.2 Vegetation

The primary source of information regarding vegetation within WRIA 10 is the Salmon Habitat Limiting Factors Report for the Puyallup River Basin (Kerwin 1999). This document indicates that vegetation within this WRIA is generally subject to vegetation-related stressors including urbanization, agricultural uses, riparian fragmentation, floodplain modifications, and increased amounts of impervious surface. General information on the vegetation within the Lower Puyallup River and Hylebos Creek subbasins is summarized from the Limiting factors report in the following text:

Lower Puyallup River subbasin

Historic records of the Puyallup River indicate that coniferous riparian habitat was present along the lower mainstem of the River. However, the construction of revetments and levees along the lower river has resulted in substantial modification to riparian vegetation including the elimination of connectivity to side and off channel habitat. Maintenance of the levees often eliminates adjacent vegetation and eliminates sources of LWD (See also Section 3.6 of this document). Remaining habitat is fragmented and only 5% of the mainstem of the Puyallup contains high quality habitat (Kerwin 1999). No areas of high quality habitat directly adjacent to the OHWM of the Puyallup River are located within the City. Development of the levee, roads, residences, parks, commercial and industrial uses have all altered shoreline vegetation presence and cover. Invasive species, including Himalayan blackberry (*Rubus armeniacus*) and Reed Canary Grass (*Phalaris arundinacea*) are present in many disturbed areas.

Hylebos Creek subbasin

Historic land use surveys of the Hylebos subbasin depict the area as containing coniferous forests interspersed with frequent disturbance (burning). Recent growth in this area has resulted in the replacement of habitat areas with urban, residential and industrial areas. Pierce County estimates that the range of impervious surface within the Hylebos Creek basin ranges from 2 to 53 percent. Degradation of aquatic processes and functions is observable when impervious surfaces reach 10 percent (Booth 1997). However, further studies indicate that impervious surfaces should not exceed 5% if high quality ecosystems associate with Puget Sound lowland streams are to be retained.

2.1.3 Surficial Geology and Soils

Soils information was primarily derived from the *Soil Survey of Pierce County Area, Washington* (Zulauf 1979). The soils of Pierce County formed mainly in glacial drift deposited by the most recent several continent-sized glacial ice sheets. This 3,000-foot thick glacier, emanating from Canada, formed most of the topography and waterways of the area between 13,000 and 15,000 years ago. The predominant deposit, and therefore parent soil material, is glacial till. It generally consists of compact basal till covered by a thin discontinuous layer of ablation till that was deposited during glacial retreat.

After the glacial retreat, the Puget Sound waters extended into the Puyallup and Lower White River valleys and layers of silt and clay accumulated in the associated estuaries. The present location of the Puget Sound in relation to the general location of the Puyallup and White rivers within the ecosystem results from a combination of Mount Rainier lahars and fluvial deposition.

The predominant soils in Fife are the Sultan, Briscot, Puyallup, and Pilchuck series. Each of these series is formed in alluvium and is likely to have resulted from the lahars and fluvial deposition described above. These soils range from poorly drained to moderately well drained (Zulauf 1979).

2.1.4 Topography

The City of Fife lies within an abandoned floodplain from the Puyallup River that is located on top of a previous mudflow from Mount Rainier. The amount of gradient (vertical drop) from one end of the City to the other is only a few feet (City of Fife 2002).

2.2 LAND USE

2.2.1 Historic

Historically, the area north of Interstate 5 was emergent tidal marsh land, while the area south was a combination of freshwater wetlands and uplands. During the late 1800s much of the area was used for agriculture, requiring ditching and draining of both tidal and freshwater wetlands. In 1874, the first railroad was constructed across the head of Commencement Bay, waterward of the area that is now Fife, thereby initiating the conversion of the Bay's tideflats to a highly urbanized seaport. This conversion, in combination with flood control efforts made in the wake of the 1906 diversion of the White River into the Puyallup (made permanent by the Corps in 1914), resulted in channel hardening at the mouths of both the Puyallup and the Hylebos. Levees were constructed along much of the lower Puyallup, including the reach that defines the south edge of the City.

During the early and mid 20th century, agriculture continued to be a primary land use in the area that is now Fife. However as the Port of Tacoma facilities expanded during the mid and late part of the century, land use began to shift toward industry and commercial uses. These have included regionally significant trade and commerce, and also commercial uses that benefit from visibility on the Interstate 5 corridor. The City's Comprehensive Plan (2005) recognizes the ultimate

conversion of agricultural lands to other urban uses by designating them with traditional urban designations (e.g., residential, commercial, industrial, etc.).

The City has a limited series of historic aerial photos that are more than twenty years old. There is a single image of the City with limits taken in 1984 (print, color, 1:4,800), images of different parts within the City from 1978 that include some of the Puyallup River and all of Hylebos Creek within the City (print, black and white, 1:4,800), and some undated images taken as a single series including some of the Puyallup River (print, black and white, 1:2,400). The undated series pre-dates 1978.

These aerial photos clearly demonstrate the development of commercial, industrial, and residential areas in the City. Even in 1984, there remained large tracts of agriculture in areas that have since been developed. However, changes in shoreline areas have been significantly lower in magnitude than those along the Interstate 5 corridor. In some cases, access has been restricted since the beginning of the photographic record. The north end of Levee Road was at one time open to all vehicle traffic, and there were two active roads, Berens and Ferguson Roads, where road beds still exist.

The same is true on Hylebos Creek, where there was greater vehicular access and activity on the left bank between 4th and 8th Streets East from an old gravel mine, and included clearing within the shoreline area. With the exception of some commercial and industrial development (e.g., near Frank Albert Road East and 70th Avenue East on the Puyallup River, and near Pacific Highway on the Hylebos), shoreline land use has either remained relatively constant or been reduced according to the photographic record.

2.2.2 Current

Existing land use designations in the City include residential, commercial/service, education, public facilities, industrial, utilities, open space/recreation, resource land and vacant. Developable vacant land comprises a considerable portion of the area within the City. Commercial and industrial uses are also common in the City.

Existing land use practices on these shorelines were observed using aerial photos, field visits, and review of City GIS data. On the Puyallup River, waterward of Levee Road, the entire shoreline is comprised of the Puyallup River Levee, which is not developable. There are some areas of trees or shrubby vegetation, but not enough to characterize it as forested. Shoreline jurisdiction extends landward of the levee, and includes Levee Road and a narrow strip of adjacent land.

Most of the shore lands downstream of Frank Albert Road are vacant and have been cleared or otherwise used for agriculture. There are scattered residences with access from the road whose property extends into the shoreline jurisdiction. Upstream of Frank Albert Road to 70th Avenue East most of the land has been cleared and much of it has been subdivided into single-family residential properties. At 56th Avenue East there is a small group of houses with frontage on Levee Road whose properties extend into the shoreline jurisdiction. Land use in the area immediately adjacent to 70th Avenue East includes commercial (dumpster storage) and medium-

density residential (mobile homes and single family). The remainder of the Puyallup River shoreline along Levee Road is being utilized for agriculture. However, current and future zoning designations for the City have zoned this land for residential and commercial uses.

Approximately one-quarter mile southeast of 54th Avenue East is the hydrological connection between the Puyallup River and the Oxbow Wetland. Because of this connection, the wetland is included in the shoreline jurisdiction. The Puyallup Tribe of Indians has a considerable interest in biological and cultural integrity of the Oxbow Wetland. Most of the area adjacent to the wetland was cleared and used for agriculture in the recent past. Multiple residential subdivisions now surround this wetland.

Along the Hylebos, most of the land is developed as single family residential dwelling units or is vacant, undeveloped land. A wetland mitigation area (Milgard Nature Area) is on the right bank between 4th and 8th Streets East in an area that is in industrial use. The left bank of the Hylebos, across from the Milgard site, contains another restoration site (Hylebos Estuary Wetlands Project). There is a small area on the south side of Pacific Highway within the shoreline jurisdiction that is designated for multiple uses (high-density residential, commercial) and has scattered homes.

3 WATERSHED PROCESSES

Ecology's *Protecting Aquatic Ecosystems: A Guide for Puget Sound Planners to Understand Watershed Processes* guidance (Stanley et al. 2005, referenced hereafter as *Protecting Aquatic Ecosystems*) provides a framework for assessing important watershed processes. The six processes addressed by this guidance are the delivery, movement, and loss of water, sediment, phosphorus and toxins, nitrogen, pathogen, and large woody debris within a watershed. This guidance has been recommended by Ecology to fulfill the regional-scale analysis of shoreline process and function during the SMP update process.

Watershed-scale (regional) analysis has been limited to what can be reasonably inferred from the documents and information gathered during the Inventory phase of the SMP update. The City will be able to supplement this information with pertinent regional analyses conducted as part of the Pierce County SMP update and Ecology's analysis of watershed processes in Puget Sound.

Because Fife's shorelines are almost entirely riverine, with the exception of a few associated wetlands, the six watershed processes have variable degrees of influence on shoreline function. Additionally, the majority of the Lower Puyallup River and Hylebos subbasins are outside of City jurisdiction, shoreline or otherwise. For each process addressed below, relative importance of each watershed process for influencing Fife's shorelines is assessed. This is followed by a brief discussion of delivery, movement, and loss of each process component within the watershed. Finally, potential alterations of those processes are assessed as much as possible based on inventory information. This assessment has been completed using modified tables describing indications of alteration based on *Protecting Aquatic Ecosystems* appendices. This approach is intended ensure that all six watershed processes have been considered despite the limited nature of the assessment.

Information in this section is largely drawn from the *Salmon Habitat Limiting Factors Report* (Kerwin 1999), with other documents referenced as noted.

3.1 WATER

Within the City shorelines, water movement is primarily controlled by freshwater flow, as opposed to tidal flow movement related to marine processes. However, there may be some tidal influences near the mouths of the Puyallup River and Hylebos Creek that affects water movement within the City. As the majority of water movement is related to freshwater flow, the larger watershed process (e.g. precipitation) is important for informing shoreline function within the City. Delivery, movement, and loss of water within larger watershed are described briefly below on best available information. However, a complete analysis of water processes within the Lower Puyallup River and Hylebos subbasins is beyond the scope of this Inventory and Characterization document.

Freshwater delivery into the City from precipitation is described in Section 2.1.1. The majority of rainfall occurs from the third week of October through the month of June, and average annual rainfall varies from 35-55 inches. Only a small portion of this precipitation falls as snow.

As noted in Section 2.1, water transport within the Lower Puyallup River subbasin has been significantly modified from its historic condition. This includes the construction of hydroelectric dam(s), logging of forest lands and the construction of logging roads, significant development in the lower basin, extensive agricultural practices in the floodplain, and a major flood control effort that has resulted in straightening and channel hardening of much of river below approximately river mile 28 to the mouth at Commencement Bay, including the installation of a complex system of levees, revetments, and dikes on both sides of the River.

The Hylebos Creek subbasin is also highly modified as a result of rapid growth in south King County, Federal Way, Milton, as well as northeast Tacoma and Pierce County. Kerwin (1999) characterized the Hylebos Creek basin as “one of the most heavily urbanized subbasins in the State”. The conversion of lowland forests to highly developed urban area has resulted in a significantly flashier creek with overall lower flows and seriously degraded water quality.

The City shorelines adjacent to the Puyallup River contain a levee that extends the entire length of the City’s jurisdiction. This levee protects adjacent land use but also modifies water flow and removes connectivity to floodplain as well as off and side channel habitat. The City shorelines adjacent to Hylebos Creek are less modified than those adjacent to the Puyallup River and may provide a relatively larger capacity for surface water storage than the Puyallup River shorelines. However, water flows within Hylebos Creek are substantially smaller than those of the Puyallup River and as such the need for surface water storage along the Hylebos is unlikely to be as necessary as it is along the Puyallup. Most of the developed shoreline more likely runs off into the Puyallup or Hylebos either overland or by way of the City’s storm drain system.

Within the Lower Puyallup and Hylebos subbasins, some amount of water loss would be expected from evaporation and transpiration; however the majority of surface water loss is more likely due to drainage to Commencement Bay from the Puyallup River and Hylebos Creek. Once water has drained to marine areas, tidal processes become the dominant mechanism in its movement, including export outside of Commencement Bay towards the Puget Sound. At the City scale, it is anticipated that drainage would by far be the dominant form of water loss.

A number of the causes of change and indicators of alteration described in Table B-3 of Protecting Aquatic Ecosystems are present in the Lower Puyallup River and Hylebos subbasins, in particular those related to development along stream and wetland corridors. These indicate that water movement, particularly surface and shallow sub-surface movement, has been altered in this system. As stated previously, water movement within the Puyallup River shoreline areas is primarily controlled by levees and revetments along the Puyallup River rather than watershed-processes. As such, up-stream watershed-scale alterations to water transport (excluding flood events) are unlikely to result in significant affect to existing shoreline conditions. However, water movement within Hylebos Creek is not a restricted as it is along the Puyallup. As such, up-stream watershed-scale alterations are more likely to result in an affect to shoreline conditions.

Table 2. Indicators of altered water delivery, movement, and loss within the Lower Puyallup River/ Hylebos subbasins

Component of Process	Sub-Component	Indicators of Alteration	Present in the Lower Puyallup River/Hylebos subbasins
Delivery	Climate	(none included in Protecting Aquatic Ecosystems Table B-3)	Not evaluated ¹
	Precipitation	Non-forested vegetation in rain-on-snow zones	No
Movement	Surface, overland flow	Watershed imperviousness Stormwater discharge pipes Drainage ditches in seasonally saturated areas Loss of seasonally saturated areas	Yes
	Surface, storage	Loss of depressional wetlands Straight-line hydrography in depressional wetlands Straight-line hydrography of stream reaches with floodplains Dikes and levees on stream reaches with floodplains Dams	Yes
	Below surface, shallow subsurface flow	New construction Land uses with impervious cover on geologic deposits of low permeability Non-forested vegetation on geologic deposits of low permeability	Yes
	Below surface, recharge	Non-forested vegetation on geologic deposits of high permeability Land uses with impervious cover on areas of high permeability Utility lines Septic systems Unlined irrigation canals	Yes
	Below surface, vertical and lateral subsurface flow	Drawdown patterns Baseflow trends	Not evaluated ²
	Below surface, subsurface storage	Constantly wet road ditches	Not evaluated ²
	Return to surface, discharge	Well locations pumping rates and volumes	Not evaluated ²
Loss	Evaporation	(none included in Table B-3)	Not evaluated ¹
	Transpiration	Land cover	Yes
	Streamflow out of basin	Diversion structures	Not evaluated ²
	Groundwater flow out of basin	Baseflow trends Well locations, pumping volumes	Not evaluated ²

¹ Where climate is the major natural control, evaluation of these indicators is beyond the scope of regional analyses (Stanley et al. 2005).

² Evaluation of these indicators is beyond the scope of the City’s Inventory and Characterization. The City will utilize Watershed Process analyses completed by Pierce County as part of their SMP update, and by Ecology, to inform water processes and indicators of alteration.

3.2 SEDIMENT

Delivery, movement, and loss of sediment within the Lower Puyallup and Hylebos subbasins are described briefly below based on best available information with a focus on the City shorelines of the Puyallup River and Hylebos Creek; a complete analysis of sediment processes within the Lower Puyallup River/Hylebos subbasins is beyond the scope of this Inventory and Characterization document.

Sediment delivery into the Puyallup River and Hylebos subbasins likely occurs through all three mechanisms described in Protecting Aquatic Ecosystems: surface erosion, mass wasting and in-channel erosion (Table 3). Large amounts of fine sediment load are found throughout the Lower Puyallup subbasin (Kerwin 1999); the majority of this sediment load is likely provided by the headwater glaciers as well as upstream watersheds. The development of the levee along the Puyallup River is likely to prevent the shorelines within the city from providing substantial contribution to the sediment load, with the exception of occasional levee failures. In addition, the levee also serves to reduce areas of off and side channel habitat and the straightening of the river also result in the ability of the shorelines to act as a storage area for sediment.

Due to the relative lack of shoreline armoring/levees, as compared to the Puyallup shorelines within the City, as well as the existing off and side channel habitat areas (both existing and created), it is anticipated that the shorelines adjacent to Hylebos Creek have the potential to contribute to and be modified by watershed sediment processes. In addition, the Limiting Factors Report finds that sediment problems will persist with increases in water flow (Kerwin 1999). However, no specific information regarding sediment transport within Hylebos Creek was identified during the inventory process.

Table 3. Indicators of altered sediment delivery, movement, and loss within the Lower Puyallup River/Hylebos Subbasins

Component of Process	Sub-Component	Indicators of Alteration	Present in the Lower Puyallup River/Hylebos Subbasins
Delivery	Surface erosion	Non-forested land cover on highly erodible slopes adjacent to aquatic resources New construction draining to aquatic resources Row crops agriculture draining directly to aquatic resources Roads within 200 ft of aquatic resources	Yes
	Mass wasting	Roads in high mass wasting hazard areas Non-forested land cover on high mass wasting hazard areas	Not evaluated ¹
	In-channel erosion	Straight-line hydrography in unconfined channels Urban land cover	Yes
Movement	Sedimentation	Loss of depressionnal wetlands Straight-line hydrography in depressionnal	Yes

		wetlands Straight-line hydrography on stream reaches with floodplains or depositional channels Dikes and levees on stream reaches with floodplains	
Loss	n/a	Use local data	Not evaluated ¹

¹ Evaluation of these indicators is beyond the scope of the City's Inventory and Characterization. The City will utilize Watershed Process analyses completed by Pierce County as part of their SMP update, and by Ecology specifically for Puget Sound marine shorelines, to inform water processes and indicators of alteration.

3.3 PHOSPHORUS AND TOXINS

Because the City's shorelines are located near the confluence of both the Puyallup River and Hylebos Creek into Commencement Bay, one of the primary concerns for the interaction between City Shorelines and watershed-scale phosphorus and toxins processes is how they affect delivery into Commencement Bay and ultimately Puget Sound, whether from the entire subbasins or areas within the City. However, no information sources have been identified during the SMP update that directly informs phosphorus and toxins movement within the subbasins and a complete analysis of the phosphorus and toxin transport processes within the Lower Puyallup River and Hylebos subbasins is beyond the scope of this Inventory and Characterization. As such, the analysis of the delivery, movement and loss of phosphorus and toxins within the City is limited to the information available via Ecology's 303(d) listings as well as the information provided in the Limiting factors report.

Ecology's 303(d) and Level 4 listings of the Puyallup River within the City include fecal coliform and mercury. Level 2 listings for the Puyallup River include dissolved oxygen. Phosphorus and specific toxins are not listed for the Puyallup River within the boundaries of the City.

Ecology's 303(d) listings of Hylebos Creek within the City include fecal coliform. Level 2 listings include dissolved oxygen. The Limiting Factors Report indicates that Hylebos Creek has been found to contain elevated levels of phosphorus (Kerwin 1999); however this is not reflected within the information available on the Washington State Department of Ecology's Water Quality Assessment website. Toxins were not listed on Ecology's 303(d) list for the Hylebos within the City. In addition, monitoring by the Friends of the Hylebos also indicate that pH, dissolved oxygen, and nitrates, while acceptable now, may be worsening over time.

Other documents generally identify stormwater run off, sewer, and septic systems as concerns within the Lower Puyallup River and Hylebos subbasins, all of which may result in increased phosphorus and toxin loads within the City water bodies. Both urban and agricultural land use are prominent in the basin, which may indicate altered processes according to Protecting Aquatic Ecosystems Table D-2 (Table 4).

Table 4. Indicators of altered phosphorus and toxins delivery, movement, and loss within the Lower Puyallup River/Hylebos subbasins.

Component of Process	Sub-Component	Indicators of Alteration	Present in the Lower Puyallup River/Hylebos Subbasins
Delivery	Phosphorus sources	Urban land use Agricultural land use Agricultural land use adjacent to dairies	Yes
	Toxin sources	Urban land use Row crop land use	Yes
	Surface Erosion	(Table 3 – Sediment Delivery, Movement, and Loss)	Yes (see Table 3)
Movement	Biotic uptake and decomposition	(none included in Protecting Aquatic Ecosystems Table D-2)	Not evaluated ¹
	Adsorption (P)	Straight-line hydrography in depressional wetlands with mineral soils Loss of depressional wetlands with mineral soils Urban land cover in areas of clay soils adjacent to aquatic ecosystems	Not evaluated ¹
	Adsorption (T)	Straight-line hydrography in wetlands with organic or clay soils Loss of wetlands with organic or clay soils	Not evaluated ¹
	Sedimentation	(Table 3 – Sediment Delivery, Movement, and Loss)	Yes (see Table 3)
Loss		(Table 2 – Water Delivery, Movement, and Loss)	Yes (see Table 2)

¹ Evaluation of these indicators is beyond the scope of the City’s Inventory and Characterization. The City will utilize Watershed Process analyses completed by Pierce County as part of their SMP update, and by Ecology specifically for Puget Sound marine shorelines, to inform water processes and indicators of alteration.

3.4 NITROGEN

A complete analysis of the nitrogen process within the Lower Puyallup River and Hylebos subbasins is beyond the scope of this Inventory and Characterization. No information sources have been identified during the SMP update review process that directly informs nitrogen movement in the Lower Puyallup River or Hylebos subbasins.

Ecology’s Water Quality Assessment information for the Puyallup River and Hylebos Creek is discussed in Section 3.3 of this document. Nitrogen is not listed within the either subbasin as a Level 5 (303 d), Level 4, or Level 2 impairment for either of the waterbodies within the City. Ammonia meets testing standards in the Puyallup River within the City of Fife (Level 1) but is not listed for the Hylebos. The Limiting Factors Report indicates that Hylebos Creek has been found to contain elevated levels of nitrogen (Kerwin 1999); however this is not reflected within the information available on the Washington State Department of Ecology’s Water Quality Assessment website.

The potential for process alteration within the Puyallup River and Hylebos Creek based on the information provided in Protecting Aquatic Ecosystems Table E-2 is provided in Table 6.

Table 5. Indicators of altered nitrogen delivery, movement, and loss within the Lower Puyallup River/Hylebos Subbasins

Component of Process	Sub-Component	Indicators of Alteration	Present in the Lower Puyallup River/Hylebos Subbasins
Delivery	Nitrogen sources	Agricultural land use Rural residential land use	Yes
Movement	Biotic uptake and decomposition	Straight-line hydrography in headwater streams	Yes
	Nitrification	Straight-line hydrography in depressional wetlands Loss of depressional wetlands	Not evaluated ¹
	Adsorption	Straight-line hydrography in headwater streams	Yes
Loss	Denitrification	Straight-line hydrography in depressional wetlands Loss of depressional wetlands	Not evaluated ¹

¹ Evaluation of these indicators is beyond the scope of the City’s Inventory and Characterization. The City will utilize Watershed Process analyses completed by Pierce County as part of their SMP update, and by Ecology to inform water processes and indicators of alteration.

3.5 PATHOGENS

Pathogens, specifically fecal coliform bacteria, are a significant concern for both the Puyallup River and Hylebos Creek within the City. Both waterbodies and a number of the associated tributaries have been included in Ecology’s 303(d) list in successive years.

Delivery, movement, and efforts to reduce levels of fecal coliform within both the Lower Puyallup River and Hylebos are described briefly below on best available information. As with the other watershed-scale processes, complete analysis of the pathogen process within the both the Lower Puyallup River and Hylebos subbasins is beyond the scope of this document.

In natural systems, delivery of fecal coliform and other pathogens is from wildlife fecal material. Some delivery from wildlife (terrestrial and aquatic) is pertinent within the Lower Puyallup River and Hylebos subbasins. However, in altered systems fecal coliform loads are more likely due to domestic animals (agricultural and residential) and failing septic systems. Portions of both the Lower Puyallup River and Hylebos subbasins have a large component of rural residential land use which may result in both mechanisms. This likely contributes to increased fecal coliform levels within both subbasins.

Increased fecal coliform delivery is likely exacerbated by alterations in its movement through the watershed. Specifically, alterations described in Table F-2 of Protecting Aquatic Ecosystems have reduced the watershed’s ability to slow downstream transport, which has in turn reduced sedimentation potential (Table 7). Both the Puyallup and Hylebos contain segments that have been channelized (Kerwin 1999). Ultimately, this results in less fecal coliform being retained within the watershed, or it being retained for a shorter period of time. This affects the ability for

natural predation by other microbes to remove it from the system. Therefore, not only is more fecal coliform being delivered, but the system is less able to remove it. Within both subbasins as well as within City shorelines, it is likely that increased impervious surface has likely increased the rate of fecal coliform transport, similarly reducing opportunity for sedimentation and eventual predation. Increased impervious surface in developed areas outside of City shorelines are also likely to contribute to increased fecal coliform impairments in the creeks and Bay.

Table 6. Indicators of altered pathogen delivery, movement, and loss within the Lower Puyallup River/Hylebos Subbasins.

Component of Process	Sub-Component	Indicators of Alteration	Present in the Lower Puyallup River/Hylebos Subbasins
Delivery	Fecal inputs	Rural residential land use	Yes
Movement	Transport (overland, surface, and subsurface flow; recharge)	Straight-line hydrography Urban land cover and/or impervious cover Ditching on geologic deposits of low permeability	Yes
	Adsorption	Loss of depressional wetlands Straight-line hydrography in all depressional wetlands	Not evaluated ¹
	Sedimentation	(Table 3 – Sediment Delivery, Movement, and Loss)	Yes (see table 3)
Loss	Death	Loss of depressional wetlands	Yes

¹ Evaluation of these indicators is beyond the scope of the City’s Inventory and Characterization. The City will utilize Watershed Process analyses completed by Pierce County as part of their SMP update, and by Ecology to inform water processes and indicators of alteration.

3.6 LARGE WOODY DEBRIS

Large woody debris (LWD) has been increasingly identified as an important habitat component for channel morphology and salmonids in river systems. LWD within a stream system can result in the formation of an upstream pool as well as a downstream plunge pool as water flows around the wood. The pools provide deeper water habitats that allow for hiding and resting areas and are also important during low streamflow periods. These pools can also provide cover habitat for juvenile fish. LWD can also modify the velocity of waterflow within a stream, especially behind large rootwads. These areas of reduced velocity provide areas for the fish to rest. In larger streams and rivers, LWD can also serve to trap and accumulate smaller pieces of wood, branches, leaves and other organic materials that provide complexity and diversity to in-stream habitat.

LWD can be recruited to a stream or river from bankside vegetation in the immediate area including side and off channel habitats and from upstream sources. The most common recruitment process for LWD into a stream system is primarily streambank erosion and windthrow. However, the construction of levees, dikes and revetments has separated the main channel from contributing side and off-channel aquatic habitats.

The delivery, movement, and loss of LWD within the larger watershed are described briefly below and is based on best available information the remainder of the section text is focused the jurisdictional shorelines of the Puyallup River and Hylebos Creek. A complete analysis of LWD processes within the Lower Puyallup River and Hylebos subbasins is beyond the scope of this Inventory and Characterization.

LWD in the Lower Puyallup subbasin has been described as “virtually absent” (Kerwin 1999).

Along the Puyallup shoreline, the river is completely disconnected from vegetation across Levee Road, with the exception of the Oxbow wetland. Vegetation from the levee itself is the only potential source of LWD. However, practices of the US Corps of Engineers (between RM 0 and RM 3) and the Pierce County River Improvement District (upstream of RM 3) generally dictate the removal of trees greater than six inches in diameter at breast height (Kerwin 1999), thereby eliminating the capacity for the shoreline to function as a source for LWD.

Much of shoreline on the Hylebos has been developed and cleared of large woody vegetation up to the Creek banks. However, since there are large reaches where forested habitat extends to the shoreline, including most of the left bank, there is capacity for LWD recruitment. No quantitative data exist on LWD frequency in these two shoreline areas, but based on field observations it is very low in both areas. This is consistent with Kerwin’s (1999) assessment that LWD is a limiting factor for salmonids in both the Puyallup and the Hylebos.

A number of the indicators of alterations described in Protecting Aquatic Ecosystems Table G-2 are present within the subbasins (Table 8). In addition reach specific LWD information is provided in section 4 of this document.

Table 7. Indicators of altered large woody debris delivery, movement, and loss within the Lower Puyallup/Hylebos Subbasins.

Component of Process	Sub-Component	Indicators of Alteration	Present in the Lower Puyallup River/Hylebos Subbasins
Delivery	Streambank erosion	Dikes and levees Straight-line hydrography in floodplains Non-forested land cover within 100 ft of stream in a floodplain	Yes
	Mass wasting	Non-forested land cover on high mass wasting hazard areas	Not evaluated ¹
	Windthrow	Non-forested land cover within 100 ft of streams	Yes
Movement	Storage	Dikes and levees Straight-line hydrography in floodplains	Yes
Loss	Breakage/Decomposition	(not included in Protecting Aquatic Ecosystems Table G-2)	--

¹ Evaluation of these indicators is beyond the scope of the City’s Inventory and Characterization. The City will utilize Watershed Process analyses completed by Pierce County as part of their SMP update, and by Ecology to inform water processes and indicators of alteration.

4 SHORELINE CHARACTERISTICS AND FUNCTIONS

An assessment of the characteristics and functions of the shoreline is necessary to provide a means of developing viable land use regulations and permitting frameworks. Per WAC 173-26-201(3)(d)(i)(C), shoreline ecological functions for rivers includes, but are not limited to:

- Hydrologic: Transport of water and sediment across the natural range of flow variability; attenuating flow energy; developing pools, riffles, gravel bars, recruitment and transport of large woody debris and other organic material.
- Shoreline vegetation: Maintaining temperature; removing excessive nutrients and toxic compound, sediment removal and stabilization; attenuation of flow energy; and provision of large woody debris and other organic matter.
- Hyporheic functions: Removing excessive nutrients and toxic compound, water storage, support of vegetation, and sediment storage and maintenance of base flows.
- Habitat for native aquatic and shoreline-dependent birds, invertebrates, mammals; amphibians; and anadromous and resident native fish: Habitat functions may include, but are not limited to, space or conditions for reproduction; resting, hiding and migration; and food production and delivery.

Per WAC 173-26-201(3)(d)(i)(C), shoreline ecological functions for wetland includes, but are not limited to:

- Hydrological: Storing water and sediment, attenuating wave energy, removing excessive nutrients and toxic compounds, recruiting woody debris and other organic material.
- Vegetation: Maintaining temperature; removing excessive nutrients and toxic compound, attenuating wave energy, removing and stabilizing sediment; and providing woody debris and other organic matter.
- Hyporheic functions: Removing excessive nutrients and toxic compound, storing water and maintaining base flows, storing sediment and support of vegetation.
- Habitat for aquatic and shoreline-dependent birds, invertebrates, mammals; amphibians; and anadromous and resident native fish: Habitat functions may include, but are not limited to, space or conditions for reproduction, resting, hiding and migration; and food production and delivery.

The following text of this section of the document provides information on the current land use of each of the identified reaches as well as information on hydrologic, vegetation, and habitat functions.

The current land use section provides information on existing land use as well as current and future zoning designations. The current and future zoning designations are established by current zoning maps as well as by the City of Fife's Comprehensive Plan. This section also

provides data on transportation infrastructure, utilities, and water dependent uses and structures. This section is concluded with information on public access within the reach including direct and/or view access as provided by City parks, trails/pedestrian easements, and public street ends. The information regarding infrastructure, utilities, water dependent uses/structures, and public access was gathered utilizing the knowledge of City of Fife staff, City of Fife GIS mapping data, and Pierce County GIS mapping data. Review of available aerial photography resources including available Pierce County GIS data and online resources was conducted to confirm or expand upon existing mapped data such as confirmation of shoreline armoring types. The current land use section also commonly provides information on archeological, cultural, and historic resources within in a reach. However, at this time, there are no known archeological, cultural, or historic resources mapped within the City reaches. As such this information is not included.

The hydrologic functions section provides information on shoreline armoring and any other noted shoreline modifications, outfalls and streams located within the reach, FEMA data, and sediment transport.

The vegetation functions section provides a qualitative overview of the vegetation within the reach and includes information regarding level of disturbance and amount of habitat.

The habitat functions section provides information on habitat within the reach including fish use, wetlands, and terrestrial habitat. Data was obtained by reviewing WDFW, City of Fife and various on-line mapping resources. The following anadromous fish species may frequent Liberty Bay: bull trout, chinook salmon, chum salmon, coho salmon and steelhead trout. Use of each reach within the City by these species is assumed.

Each function subsection is concluded with an assessment of the functionality. A rating of high, medium-high, medium, medium-low or low based upon the identified components is provided.

A summary table of the function assessment for each reach is provided at the end of this chapter.

4.1 PUYALLUP REACH 1 (P1)

Segment P1 is the most downstream City of Fife shoreline segment on the Puyallup River. It is 13,510 feet in length and extends on the left bank from the City limit at RM 2.4 (at the Interstate 5 bridge) at the downstream extent to RM 4.9, the where the Oxbow wetland is connected to the Puyallup River. As noted in Section 1.1 of this document, the Puyallup River waterward of the OHWM is under the sole jurisdiction of the Puyallup Tribe of Indians. Figures 3B, 4B and P1 provide a visual representation of the data provided below in Table 8 pertaining to this reach.

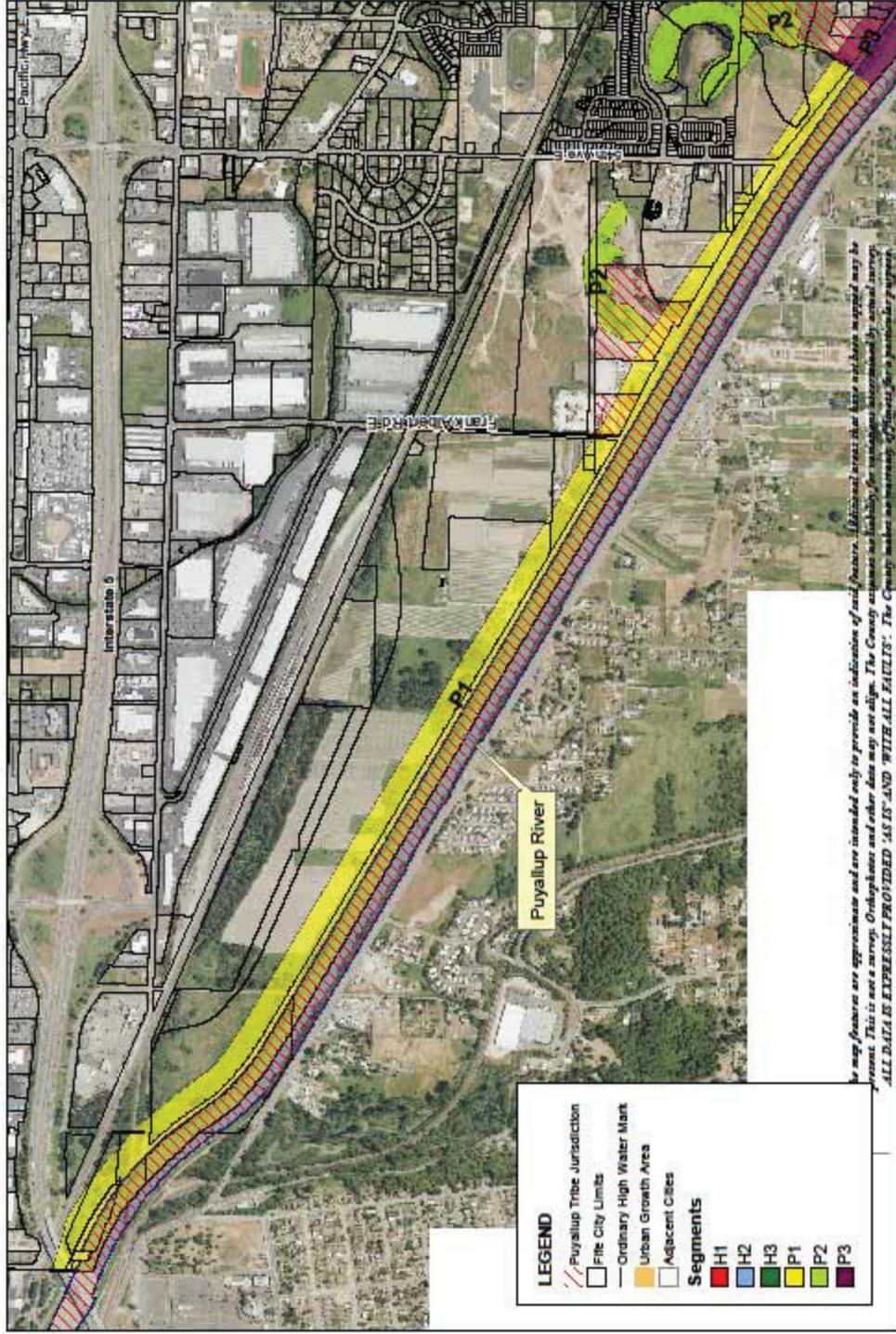


FIGURE P1
 Study Segments -Puyallup Segment
 Fife Shoreline Master Plan
 Fife, WA

Table 8. P1 Summary

Land Use Types ¹	Shoreline Indicators ²	Public Shoreline Access ⁴	Habitat ⁵
Total Acreage – 206.76 Commercial/Service – 9.36 acres (4.52%) Open Space/Recreation – 0.06 acres (0.03%) Resource Land – 34.62 acres (16.74%) Single Family Residential – 20.34 acres (9.84%) Vacant – 136.68 acres (66.11 %) Water Body – 5.70 acres (2.76 %)	Permanently protected areas ³ - 34.68 acres Water quality list, 303(d) – Yes, fecal coliform and mercury Linear Feet of Levees - 13,150 feet (entire length of shoreline)	View Access is available throughout reach from the adjacent N Levee Road. Informal areas of direct access have been created. No formal public access areas such as parks and /or trails are identified.	No mapped priority habitat areas within the reach. Vegetation adjacent to the shoreline is primarily invasive species, such as Himalayan blackberry and is subject to levee maintenance.

1 Data derived from Pierce County and City of Fife GIS data. Refer to figure 3B of this document. Percentages may not equal 100% due to rounding.

2 Shoreline indicators based upon available No Net Loss indicators as identified by Washington State Department of Ecology. See also Section 6.1 of this document.

3 Based upon GIS Resource Land and Open Space/Recreation designation.

4 Data derived utilizing Washington State public access data resources and City of Fife GIS data.

5 Data derived by aerial review conducted by Grette Associates and City of Fife and Pierce County GIS Data.

Current Land Use

Existing land use designations within this reach include commercial/service (4.52%), Open Space Recreation (0.03%), Resource Land (16.74%), Single Family Residential (9.84%), Vacant (66.11%), and water body (2.76%). Current zoning designations within this reach include Industrial, Community Commercial, and Neighborhood Residential (Figure 4B). The Future Land Use Map found in the City of Fife Comprehensive Plan indicates that zoning designations will remain similar to the current zoning designations. Much of the vacant land has been used for agricultural at some point in the past, but there are large areas that are completely undeveloped, particularly at the downstream end of the segment. Most of the land downstream of Frank Albert Road is owned by railroad companies and is zoned for industrial uses, and the remaining shoreline is either residential or commercial. Based on this, future land use will likely result in greater shoreline development and greater land use density; although the levee area (waterward of Levee Road) is generally undevelopable and will likely remain the same.

The dominant feature of this segment is the levee, which runs the length of the City shoreline along the Puyallup River. Levee Road runs parallel to the River at the top of the bank for the length of the segment, but it is closed to public vehicle access at approximately the halfway point, downstream of Frank Albert Road.

There are two mapped stormwater inputs into the Puyallup River mapped in this reach. One input is located at the terminus of Frank Albert Road E and is culverted. The other input is mapped as

an open ditch and is located at the southern end of the reach and is associated with the reach terminus as well as the Oxbow wetland.

Review of aerial photographs did not result in the identification of any water dependent uses, such as marinas, or water dependent uses or structures, such as docks or piers within this reach. Water-related enjoyment may be provided by views from the adjacent, informal trail system as well as North Levee Road and Melroy Bridge.

Direct public access to the waterfront may be obtained from informal breaks in the vegetation on the levee. These informal breaks provide access for pedestrians as well as off-road vehicles.

Hydrologic Function

Water quality is somewhat impaired, with Category 5, 2, and 1 303(d) listings. The channel has been straightened, hardened, and permanently fixed, all of which have contributed to reduced capacity for functioning salmonid habitat. Land use practices in the greater watershed have also negatively affected salmonid habitat by altering hydrology and water quality. Major modifications to basin hydrology (such as dams, diversions, and the re-routing of the White River into the Puyallup Basin) also have had negative implications on salmonid habitat in this segment.

Due to the high levels of channel modification, including the levee that extends along the entire length of the reach, as well as the impaired water quality evidenced by the 303(d) listings, the hydrologic function of this reach is considered to be low.

Vegetation Function

The levee and Levee Road completely disconnect most, if not all, of the shoreline area from the Puyallup River, and therefore restrict its ability to provide any function for salmonid habitat in this segment. Other than the vegetation on the levee, which is subject to maintenance practices by the Corps and Pierce County River Improvement District, there is no functioning riparian habitat. Vegetation management on the levee severely restricts the potential for woody debris recruitment from the banks, although overhanging levee vegetation (relatively continuous fringe of willow, alder, and blackberry) does provide some shade and refuge opportunities for fish in the mainstem. Levee vegetation is primarily herbaceous or shrubby, with some small stands of relatively young alder or cottonwood.

Due to the level of alteration to the vegetation as well as the potential for future alteration, the vegetation function of this reach is considered to be low.

Habitat Function

Eight species of salmonids (chinook, chum, coho, pink, sockeye, steelhead, cutthroat, bull trout) use this reach of the Puyallup River for migration. Chinook, coho, and likely chum also spend time rearing there. There are no other records of priority habitats and species within the shoreline area of this segment, but other priority species present in the greater area (e.g., avian species) are likely to at least transit through the area.

The entire segment is part of a greater aquifer recharge and seismic hazard areas. There are no wetlands, 100-year flood zones, or steep slopes mapped within this reach. There are also large areas of open space, including undeveloped land and agricultural areas that are likely to provide wildlife habitat, at least for birds, deer, and small mammals. However, there are no designated habitat areas according to the PHS inventory. Limited vehicle access in the downstream reach also means that the undeveloped areas are less subject to regular human disturbance than those further upstream.

Due to the minimal levels of mapped habitat and in conjunction with the habitat disturbance presented by the reduced hydrologic and vegetation functions, the overall habitat function rating for this reach is low.

4.2 PUYALLUP REACH 2 (P2)

Segment P2 consists of two wetland complexes, the Sha Dadx wetland area and the Oxbow wetland, plus the hydrologic connection between Oxbow wetland and the Puyallup River, located at RM 4.9. There is no shoreline length associated with this segment, as it has no shoreline frontage. However, as both wetland areas are associated with the Puyallup River, the shoreline jurisdiction extends to the upper edge of the wetland. It is 63 acres in area. As noted in Section 1.1 of this document, the Sha Dadx wetland areas are solely under the jurisdiction of the Puyallup Tribe of Indians. Portions of the Oxbow wetland including the hydrologic connection to the Puyallup River are under the Tribe's jurisdiction; the remaining portions would be under shoreline jurisdiction. Figures 3B, 4B and P2 provide a visual representation of the data provided below in Table 9 pertaining to this reach.

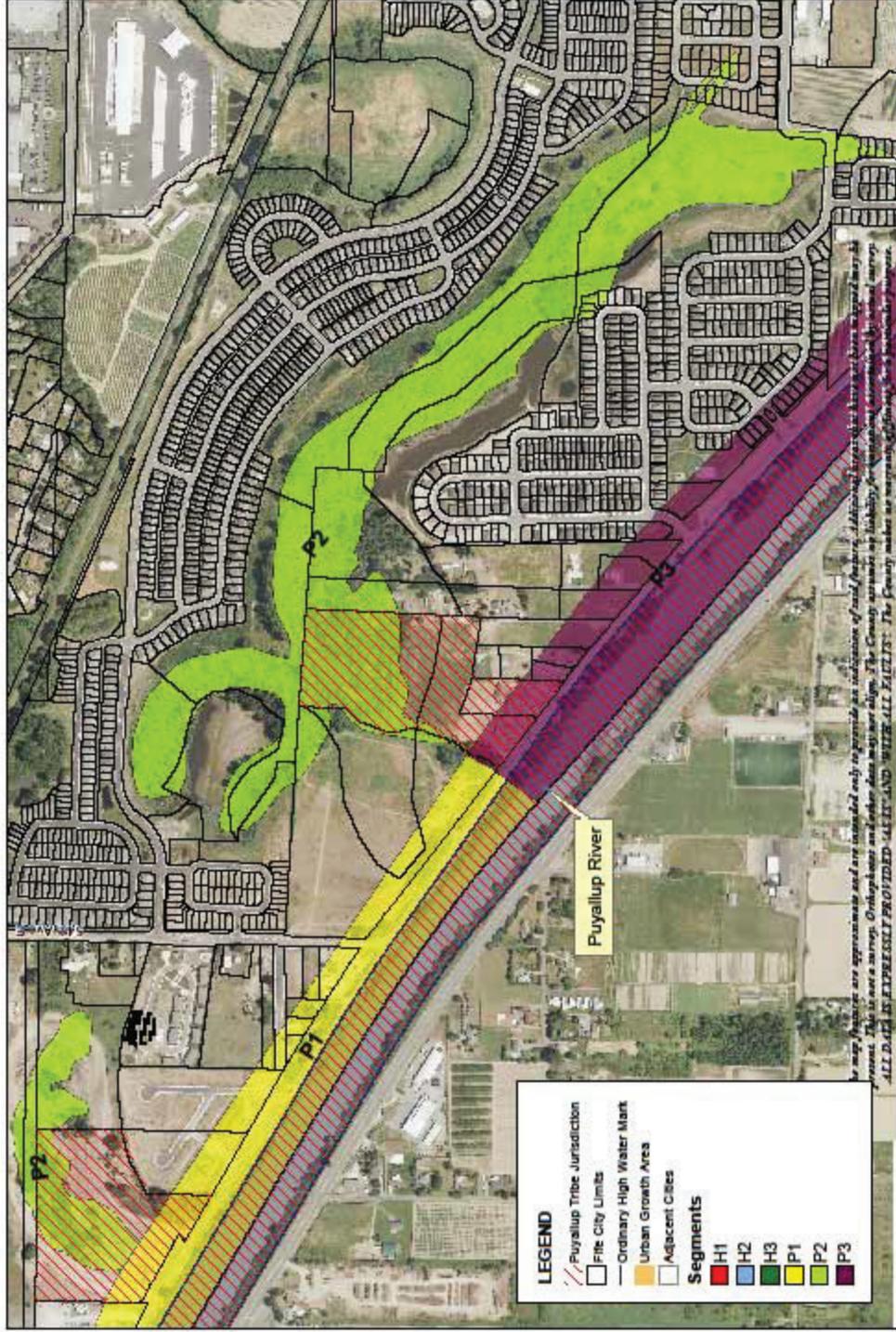


Table 9. P2 Summary.

Land Use Types ¹	Shoreline Indicators ²	Public Shoreline Access ⁴	Habitat ⁵
Total Acreage – 138.61 Open Space/Recreation – 25.27 acres (18.23 %) Resource – 42.14 acres (30.40%) Vacant – 60.17 acres (43.41%) Single Family Residential – 7.87 acres (5.68%) Transportation, Communication, Utility – 3.16 acres (2.28%)	Permanently protected areas ³ – 67.41 acres Water quality list, 303(d) – No Linear Feet of Levees – 0 feet	No formal public access, such as trails, exists for either wetland component of this reach. View access is provided by N. Levee Road. In addition, unintended pedestrian access to the Oxbow wetland may occur by the residents of the adjacent residential development.	Reach contains mapped critical areas, based on wetlands, aquifer recharge and seismic hazard areas, and flood zones. Reach wetlands include forested components, which increases their habitat value. The Oxbow wetland contains large area of undisturbed habitat, which is uncommon in the immediate vicinity.

1 Data derived from Pierce County and City of Fife GIS data. Refer to figure 3B of this document. Percentages may not equal 100% due to rounding.

2 Shoreline indicators based upon available No Net Loss indicators as identified by Washington State Department of Ecology. See also Section 6.1 of this document.

3 Based upon GIS Resource Land and Open Space/Recreation designation.

4 Data derived utilizing Washington State public access data resources and City of Fife GIS data.

5 Data derived by aerial review conducted by Grette Associates and City of Fife and Pierce County GIS Data.

Current Land Use

Existing land use for reach P2 includes Open Space Recreation (18.23%), Resource Land (30.40%), Single Family Residential (5.68%), Transportation/Communication/Utility (2.28%), and Vacant (43.41%). Refer to Figure 3B. Current zoning designations include industrial, commercial, residential and public use/open space (Figure 4B). The wetland areas themselves are largely undisturbed and serve as either as a resource or open space parcel for the surrounding parcels. The Oxbow wetland is bordered by neighborhood residential/high density residential areas, with some industrial areas on the southeast margin. The area around Frank Albert Road wetland is zoned for industrial and community commercial uses. Potential exists for recreational access in the wetlands and buffer areas in the form of trails and interpretive areas in compliance with the City’s critical areas ordinance.

There is no mapped transportation infrastructure within the shoreline jurisdiction of this reach, as identified on Figure 1B. However, Levee Road does provide view access to both wetlands and also crosses the points where these wetlands connect to the Puyallup River.

A storm water ditch is mapped through the majority of the Oxbow wetland (Figure 5B). However upon further review, City staff has confirmed that the line on the map is not a ditch, but more or less indicative of the conveyance of storm water through the wetland. This storm water system appears to convey water from the 70th Avenue East as well as portions of the adjacent subdivision to the north through the Oxbow system and eventually connecting with the Puyallup River.

There are no water dependent uses in this reach. Shoreline related/enjoyment uses within this reach include view access from North Levee Road.

No formal public access, such as trails, exists for either wetland component of this reach. View access is provided by N. Levee Road. In addition, unintended pedestrian access to the Oxbow wetland may occur by the residents of the adjacent residential development.

Hydrologic Function

The wetlands of this reach are likely to provide floodwater storage for adjacent development. The transport of stormwater to the Puyallup River is also facilitated by a ditch that traverses the Oxbow wetland system from 70th Avenue to the Puyallup River. Connectivity between the Oxbow wetland and the Puyallup River is restricted by the North Levee Road Crossing and associated culvert, controlled by the Puyallup Tribe of Indians. It is anticipated that the combined culvert and crossing does not provide the level of function that would exist if the crossing and culvert were not present.

Waterflow in the Sha Dadx wetland is controlled by a floodgate/culvert maintained by the Puyallup Tribe of Indians. A ring levee is located around the site to control floodwaters within the habitat area and protect the properties adjacent to the site.

Due to the flood water storage capacity, the hydrologic function of this reach is considered to be medium-high.

Vegetation Function

P2 is the most intact shoreline of the Puyallup reach series. Both wetlands within this reach, contain forested components. Neither of these wetlands is subject to the vegetation maintenance prescribed to maintain the Levee that is found in reaches P1 and P3.

Due to the relatively low level of alteration to the vegetation as well as the semi-protected nature of the existing land use, the vegetation function of this reach is considered to be medium-high.

Habitat Function

The Oxbow wetland does have potential for salmonid access, but presence has not been documented in the wetland.

The Sha Dadx wetland area is a habitat site created from a relic Oxbow channel of the Puyallup River. It provides the opportunity for off-channel habitat and is connected to the Puyallup River via a culvert. Fish use including Coho salmon has been documented by Puyallup Tribe of Indians staff (Sullivan, Per. Comm. 2010).

Both wetlands are listed as polygons in the PHS inventory, with multiple attributes including (for both):

- Wetlands (broadleaf shrub, shrub scrub, emergent, farmed, cottonwood swamps)
- Waterfowl concentrations (regular, regular large)

- Deer and raptor use

Segment P2 is entirely comprised of critical areas, based on wetlands, aquifer recharge and seismic hazard areas, and flood zones. As noted in the vegetation function text, both wetlands include forested components, which increases their habitat value. The Oxbow wetland in particular is a very large area of undisturbed habitat, which is uncommon in the immediate vicinity.

Due to the higher levels of mapped habitat relatively intact hydrologic and vegetation functions, the habitat function rating for this reach is medium-high.

4.3 PUYALLUP REACH 3 (P3)

Segment P3 is the most upstream reach in the City on the Puyallup River. It is 9,840 feet in length and extends on the left bank from the hydrologic connection to the Oxbow wetland (RM 4.9) to Freeman Road (RM 6.8). As noted in Section 1.1 of this document, the Puyallup River waterward of the OHWM is under the sole jurisdiction of the Puyallup Tribe of Indians. Figures 3B, 4B and P3 provide a visual representation of the data provided below in Table 10 pertaining to this reach.

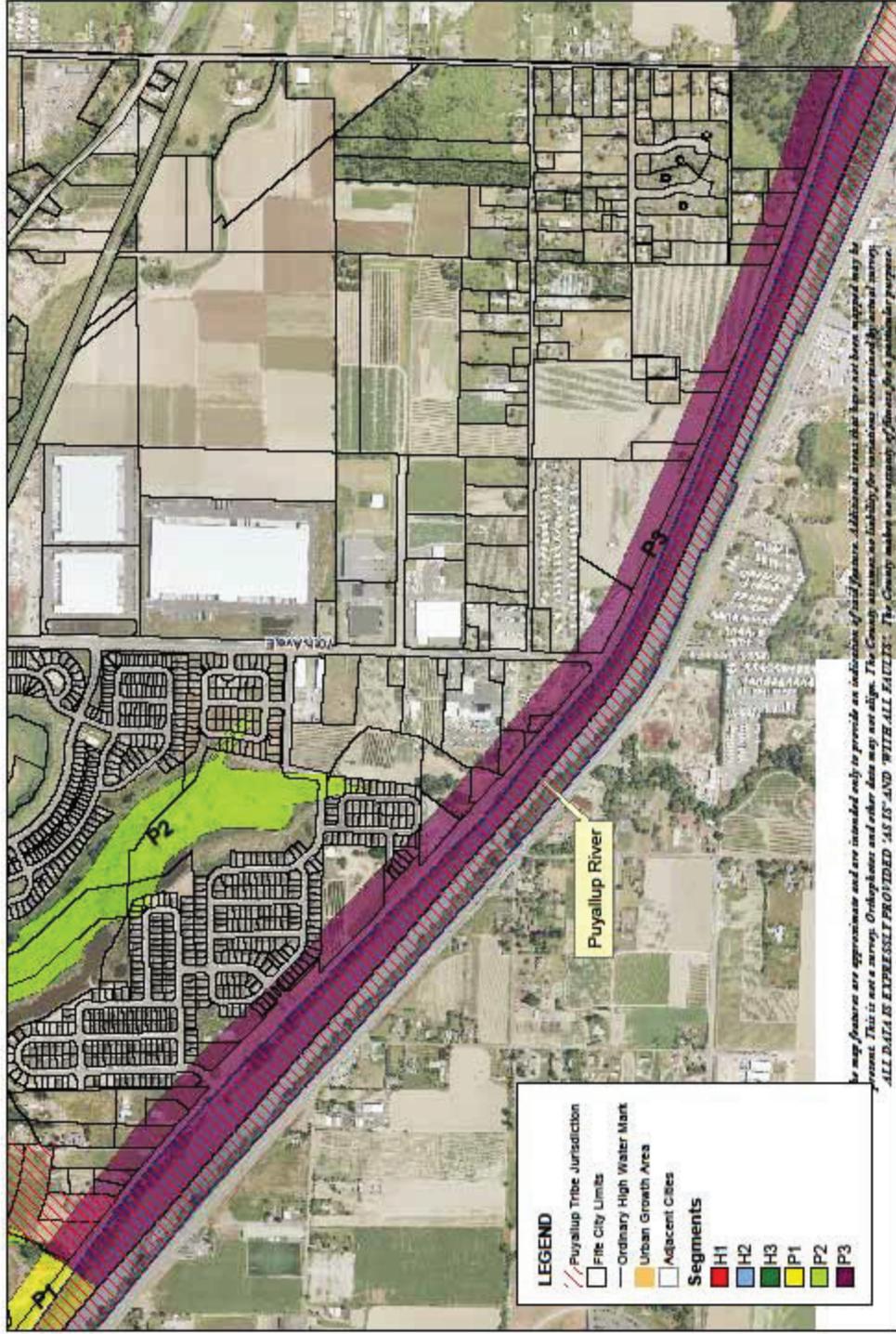


FIGURE P3
 Study Segments -Puyallup Segment
 Fife Shoreline Master Plan
 Fife, WA

Table 10. P3 Summary.

Land Use Types ¹	Shoreline Indicators ²	Public Shoreline Access ⁴	Habitat ⁵
Total Acreage- 116.87 Commercial/Service – 1.6 acres (1.37%) Industrial – 16.39 acres (14.02%) Open Space/Recreation – 0.38 acres (0.34%) Resource Land – 52.44 acres (44.87%) Single-Family Residential – 22.19 Acres (23.93%) Vacant – 13.94 acres (11.93%) Mobile Home Park – 8.20 Acres (7.01%)	Permanently protected areas ³ - 52.82 acres Water quality list, 303(d) – Yes, fecal coliform and mercury Linear Feet of Levees - 9,840 feet (entire length of shoreline)	View Access is available throughout reach from the adjacent N Levee Road. Informal areas of direct access have been created. No formal public access areas such as parks and /or trails are identified.	No mapped PHS areas within the reach. Vegetation adjacent to the shoreline is primarily invasive species, such as Himalayan blackberry and is subject to levee maintenance.

1 Data derived from Pierce County and City of Fife GIS data. Refer to Figure 3B of this document. Percentages may not equal 100% due to rounding.

2 Shoreline indicators based upon available No Net Loss indicators as identified by Washington State Department of Ecology. See also Section 6.1 of this document.

3 Based upon GIS Resource Land and Open Space/Recreation designation.

4 Data derived utilizing Washington State public access data resources and City of Fife GIS data.

5 Data derived by aerial review conducted by Grette Associates and City of Fife and Pierce County GIS Data.

Current Land Use

As with segment P1, the dominant feature of this segment is the levee. Existing land use includes Commercial/Service (1.37%), Industrial (14.02%), Open Space/Recreation (0.38%), Resource Land (44.87%), Single-Family Residential (23.93%), Vacant (11.93%), and Mobile Home Park (7.01%). Refer to Figure 3B. The area is zoned for medium density residential, commercial, and industrial uses. This indicates that the shoreline area will become increasingly developed, except for the levee itself. Potential for increased recreational use in this segment is the same as for segment P1. The Future Land Use Map found in the City of Fife Comprehensive Plan indicates that zoning designations will remain similar to the current zoning designations. Based upon current zoning designations, it is anticipated that future land use within this reach will likely include development of the undeveloped parcels pursuant to zoning, and redevelopment of previously developed properties as property value increases.

There is one mapped stormwater input into the Puyallup River mapped in this reach. This input is mapped as an open ditch and is located at the northern end of the reach and is associated with the reach terminus as well as the Oxbow wetland.

Review of aerial photographs did not result in the identification of any water dependent uses, such as marinas, or water dependent uses or structures, such as docks or piers within this reach. Water-related enjoyment may be provided by views from the adjacent, informal trail system as well as North Levee Road.

Direct public access to the waterfront may be obtained from informal breaks in the vegetation on the levee. These informal breaks provide access for pedestrians as well as off-road vehicles.

Hydrologic Function

Water quality is somewhat impaired, with Category 5, 2, and 1 303(d) listings. The channel has been straightened, hardened, and permanently fixed, all of which have contributed to reduced capacity for functioning salmonid habitat. Land use practices in the greater watershed have also negatively affected salmonid habitat by altering hydrology and water quality. Major modifications to basin hydrology (such as dams, diversions, and the re-routing of the White River into the Puyallup Basin) also have had negative implications on salmonid habitat in this segment.

Due to the high levels of channel modification, including the levee that extends along the entire length of the reach, as well as the impaired water quality evidenced by the 303(d) listings, the hydrologic function of this reach is considered to be low.

Vegetation Function

The levee and Levee Road serve to disconnect the majority of the of the associated shoreline area from the Puyallup River, and therefore restrict its ability to provide any function for salmonid habitat in this segment. Other than the vegetation on the levee, which is subject to maintenance practices by the Corps and Pierce County River Improvement District, there is no functioning riparian habitat. Vegetation management on the levee prevents the potential for woody debris recruitment from the banks, although overhanging levee vegetation (relatively continuous fringe of willow, alder, and blackberry) does provide some shade and refuge opportunities for fish in the mainstem. Levee vegetation is primarily herbaceous or shrubby, with some small stands of relatively young alder or cottonwood.

Due to the level of alteration to the vegetation as well as the potential for future alteration, the vegetation function of this reach is considered to be low.

Habitat Function

Critical areas are similar to those in segment P1. The entire segment is part of a greater aquifer recharge and seismic hazard areas. There are also three small wetlands, totaling 0.7 acre in area. There is a small forested wetland area at the intersection of Freeman Road and Levee Road that is connected to a larger wetland to the east, outside of the City, by way of a culvert under Freeman Road. There is no hydrologic connection from this wetland to the Puyallup River. There are also two other small wetlands near Levee Road, one halfway between 56th Ave and 70th Ave (emergent), and the other at the Melroy Bridge (shrub).

Salmonid use in this segment is the same as segment P1. There is also a PHS polygon the wetland at Freeman Road that has been assigned the same PHS attributes as Frank Albert Road and Oxbow wetlands: wetlands, waterfowl concentrations, and deer and raptor use.

Salmonid habitat limiting factors are the same as for segment P1. There is severely limited riparian function, no access to off-channel habitat, impaired water quality, and factors related to practices and conditions in the greater watershed.

Due to the minimal levels of mapped habitat and in conjunction with the habitat disturbance presented by the reduced hydrologic and vegetation functions, the overall habitat function rating for this reach is low.

4.4 HYLEBOS REACH 1 (H1)

Segment H1 is the most downstream reach of Hylebos Creek in the City. Located between RM 0.3 and 0.6 (4th St E), it is 1,650 feet in length. Both the right and left bank are in City jurisdiction. Figures 3A, 4A and H1 provide a visual representation of the data provided below in Table 12 pertaining to this reach.

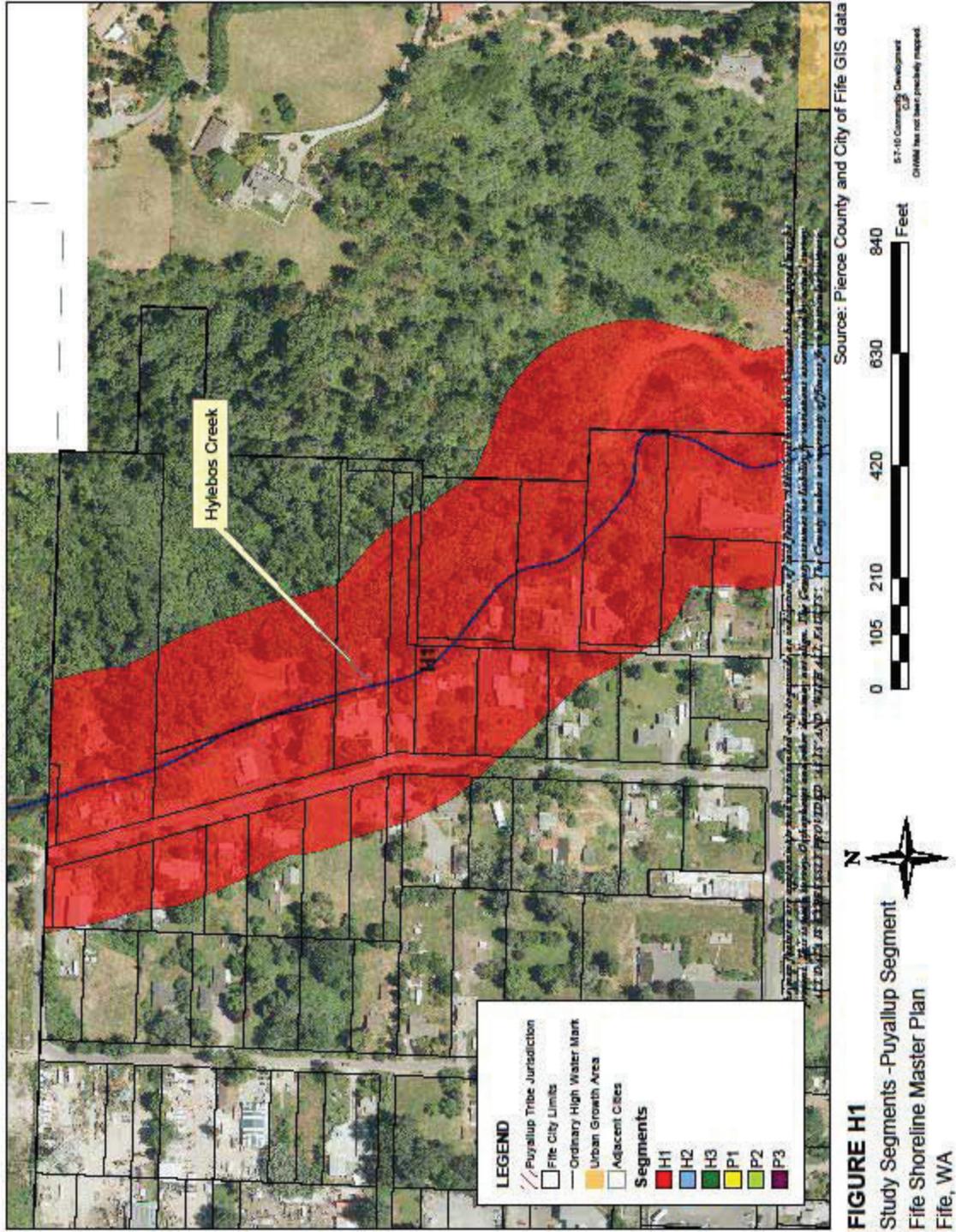


Table 11. H1 Summary.

Land Use Types ¹	Shoreline Indicators ²	Public Shoreline Access ⁴	Habitat ⁵
Total Acreage – 23.31 Multi-Family Residential – 1.34 acres (5.76%) Residential Outbuildings – 0.22 acres (0.92%) Single Family Residential – 19.97 acres (88.58%) Vacant – 1.10 acres (4.73%) Mobile Home Park – 0.39 Acres (1.65%)	Permanently protected areas ³ - 0 acres Water quality list, 303(d) – yes (bioassessment)	None	Right side of the bank contains residential development and impacts to shoreline vegetation and habitat generally associated with residential development such as shoreline armoring and ornamental vegetation and lawns. The left side of the bank also contains residential development but at a greatly reduced amount as these areas are only accessed by bridges across the Hylebos as a result shoreline vegetation and habitat appears to be generally more intact on the left side of the bank.

1 Data derived from Pierce County and City of Fife GIS data. Refer to Figure 3B of this document. Percentages may not equal 100% due to rounding.

2 Shoreline indicators based upon available No Net Loss indicators as identified by Washington State Department of Ecology. See also Section 6.1 of this document.

3 Based upon GIS Resource Land and Open Space/Recreation designation.

4 Data derived utilizing Washington State public access data resources and City of Fife GIS data.

5 Data derived by aerial review conducted by Grette Associates and City of Fife and Pierce County GIS Data.

Current Land Use

Existing land use in this segment includes Multi-family Residential (5.76%), Residential Outbuildings (0.92%), Single Family Residential (88.58%), Vacant (4.73%) and Mobile Home Park (1.65%). Refer to Figure 3A. Most of the lots are entirely within the shoreline jurisdiction. The current zoning designation for the entire reach is Neighborhood Commercial. The Future Land Use Map found in the City of Fife Comprehensive Plan indicates that the intended future zoning of this area is Mixed Medium Density Residential/Commercial. Based on current and future zoning, it is anticipated that future land use may result in greater shoreline development and greater land use density.

There is one mapped stormwater input into the Hylebos River in this reach. It is located along the northern side of 4th street and is primarily a ditch. However, a small portion of the conveyance is culverted within the shoreline jurisdiction, and is likely the result of a residential driveway.

Review of aerial photographs did not result in the identification of any water dependent uses, such as marinas. Four bridges (either foot or vehicular) were also noted during review of available aerial photographs.

There is no direct public access to the Hylebos Creek in this area, although view access of the southern end of the reach is available from a bridge located at the end of 4th Street East. As such,

shoreline recreational activities, if any, are likely limited to in-water activities. However, Hylebos Creek is generally too shallow and has too many obstructions (road crossings) to be accessible to small boats (e.g., kayaks, canoes). It is anticipated that there will be continue to be no opportunities for public recreation in this segment.

Hydrologic Function

Shoreline armoring along the Hylebos have not been mapped; however, review of available aerial photography indicates that portions of the left and right banks contain shoreline armoring. Residential development of the right bank, including the removal of native shoreline vegetation has likely modified the flow and velocity of precipitation inputs.

Based upon the information listed above, the hydrologic function of this reach is considered to be medium.

Vegetation Function

Vegetation on both the right and left banks of this segment have been modified by residential development. Vegetation on the left bank of this segment is somewhat less impacted than the right as access to the left bank is limited by steep slopes to the east of the Hylebos resulting in bridges extending from the right bank as the primary way to access the left bank. Along the right bank, the majority of the tree canopy has been removed and the shoreline contains lawns and ornamental shrubs associated with residential development.

Due to the reduced level of alteration to the vegetation, the vegetation function of this reach is considered to be medium-low.

Habitat Function

Segment H1 includes a number of critical areas. The 100-year flood zone extends up into the shoreline area. There are areas of erosion and landslide hazards. The entire segment is part of the greater seismic hazard and aquifer recharge areas. There are no identified habitat conservation areas, or substantial open spaces available for habitat.

Five species of salmonids (chinook, chum, coho, steelhead, cutthroat) are present in Hylebos Creek. It is likely that chinook, coho, and chum also spend time rearing there. There are no other PHS records within the shoreline area of this segment, but other priority species present in the greater area (e.g., bald eagles) are likely to at least transit through the area.

In general, Hylebos Creek is much more connected to its floodplain than is the Puyallup River in the City of Fife. There is no structure comparable to the levee in this stream. The channel at the upstream extent of segment H1 is not stabilized, but it is likely that banks in front of some of the residences have been stabilized with riprap or other similar material, which is detrimental to instream salmonid habitat. There are no barriers to access in the mainstem of the Creek, but there is no off-channel habitat available for fish. It is apparent from aerial photos that most of the

riparian vegetation has been removed along this reach, also reducing habitat function. However, the left bank in this area is forested, and the creek is relatively narrow.

Based upon the information provided above the habitat function of this reach is considered to be medium-high.

4.5 HYLEBOS REACH 2 (H2)

Segment H2 consists of both banks Hylebos Creek between 4th Street East (RM 0.6) and 12th Street East (RM 1.3). It is 3,335 feet in length, portions of the right and left bank are within City jurisdiction. Figures 3A, 4A and H2 provide a visual representation of the data provided below in Table 12 pertaining to this reach.

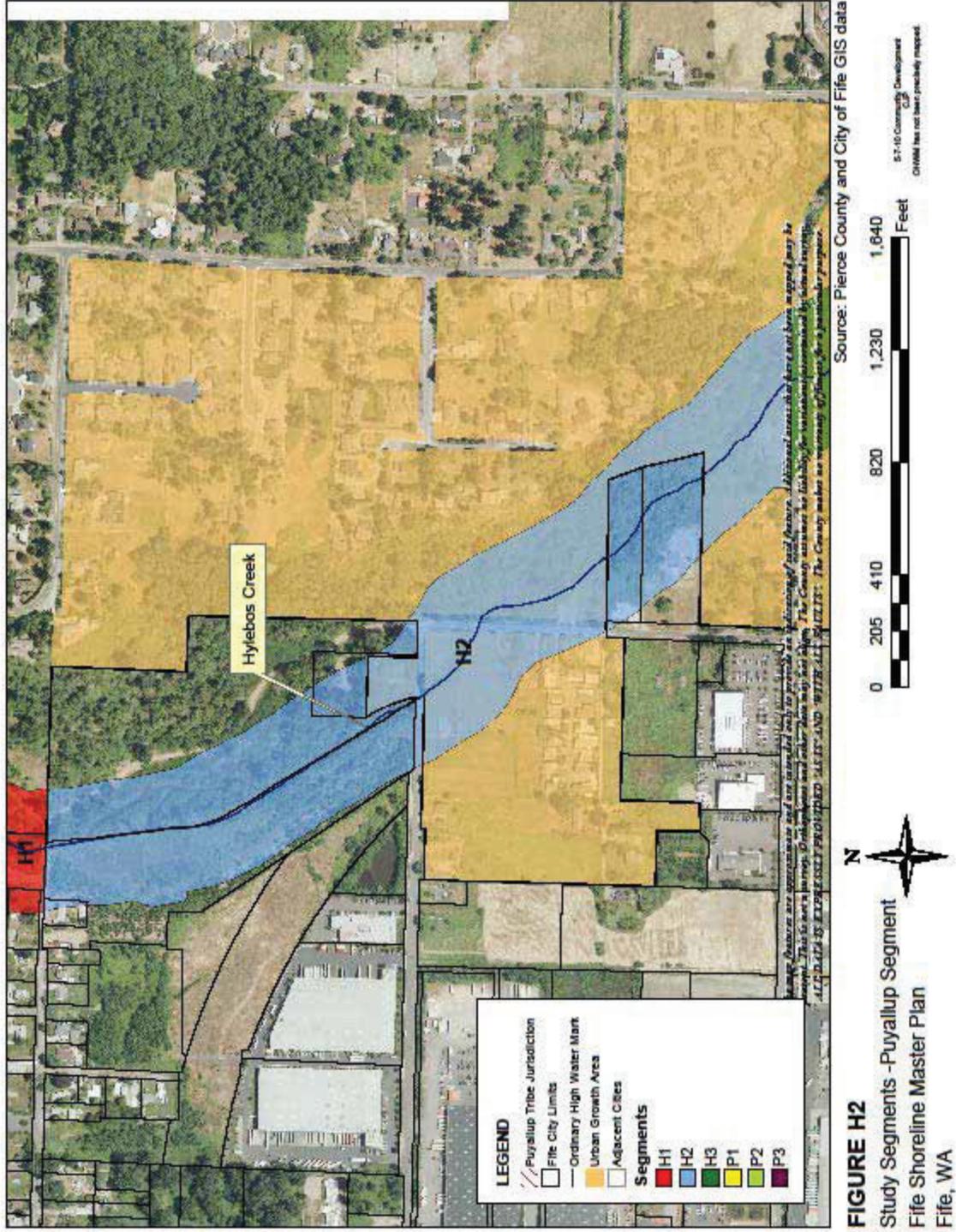


Table 12. H2 Summary.

Land Use Types ¹	Shoreline Indicators ²	Public Shoreline Access ⁴	Habitat ⁵
Total Acreage – 30.36 Mobile Homes – 1.37 acres (4.51%) Open Space – 24.33 acres (80.15 %) Single Family Residential – 0.38 acres (1.25 %) Transportation, Communication, Utility – 4.28 acres (14.10 %)	Permanently protected areas ³ - 24.33 acres Water quality list, 303(d) – yes (bioassessment)	4 th Street Bridge Milgard Nature Area Hylebos Estuary Nature Area	Northern portion of the reach contains restored off and side channel habitat on both the right and left banks (Milgard Nature Area and Hylebos Nature area). For the remainder of the reach, the right bank contains residential development and associated modification to shoreline habitat including lawns and ornamental vegetation. Review of aerial photos indicate that the left bank is fairly intact and contains forested canopy.

1 Data derived from Pierce County and City of Fife GIS data. Refer to Figure 3B of this document. Percentages may not equal 100% due to rounding.

2 Shoreline indicators based upon available No Net Loss indicators as identified by Washington State Department of Ecology. See also Section 6.1 of this document.

3 Based upon GIS Resource Land and Open Space/Recreation designation.

4 Data derived utilizing Washington State public access data resources and City of Fife GIS data.

5 Data derived by aerial review conducted by Grette Associates and City of Fife and Pierce County GIS Data.

Current Land Use

Existing land use within this reach includes Mobile Homes (4.51%), Open Space (80.15 %), Single Family Residential (1.25 %), and Transportation, Communication, Utility (14.10 %). Refer to Figure 3A. Current zoning designations within this reach include neighborhood commercial, public use open space, industrial, small lot residential, and single family residential. The future land use map found in the City of Fife Comprehensive Plan indicates that zoning designations will remain similar to current zoning designations. Based on current and future zoning, it is anticipated that future land use may result in greater shoreline development and greater land use density.

Segment H2 has relatively more open space than do any of the other segments within the City. Included in this segment are the Milgard Nature Area, Hylebos Estuary Nature Area, two City well sites, and a great deal of vacant land, including much of the forested hillside on the left bank. Residential development is almost entirely limited to the right bank of Hylebos Creek in this area. The Milgard Nature Area is zoned industrial, but because it is a mitigation area, it is unlikely that land use will change on that site in the future. The remaining area of this segment is designated either single family or zoned small lot residential. On the right bank, there is potential for increased residential development as vacant, formerly agricultural land is converted to residential use.

However, the left bank is mostly forested, steep slopes that are on the backside of residential lots on the hill above Hylebos Creek. Under the City’s critical areas ordinance, these areas are likely to remain undeveloped. The Milgard Nature Area and Hylebos Estuary Nature area currently

provides the most opportunity for shoreline access and recreation on Hylebos Creek. Although there are no formal trails or interpretive areas in the Milgard Nature area, the area is available for bird watching and other low-impact activities. The Hylebos Estuary Nature area contains a public trail as well as interpretive signage.

Transportation infrastructure, including 8th Street East, 12th Street East, and 64th Avenue East, is located within the shoreline jurisdiction of this reach.

A storm water ditch that flows into the Hylebos is mapped adjacent to the southern side of 8th Street East (Figure 5A).

There are no water dependent uses in this reach, such as marinas or other commercial uses. Shoreline related/enjoyment uses within this reach include view access from Milgard and Hylebos Estuary Nature areas.

There is no direct public access to the Hylebos Creek in this area, although view access of the northern end of the reach is available from a bridge located at the end of 4th Street East. In addition view access may also be obtained from trails associated with the Milgard and Hylebos Estuary Nature areas. Shoreline recreational activities, if any, are likely limited to in-water activities. However, Hylebos Creek is generally too shallow and has too many obstructions (road crossings) to be accessible to small boats (e.g., kayaks, canoes). It is anticipated that there will be continue to be no opportunities for public recreation in this segment.

Hydrologic Function

Due to the high percentage of dedicated open space and intact forest canopy that exists along the left bank of this reach segment, it is anticipated that overall impacts to hydrologic function within this reach are minimal. However, some impact to normal hydrologic processes may occur within the reach on the right side of the bank southeast of 8th Street, where the majority of the residential development and modification to shoreline vegetation is located. In addition, given the proximity of residential development to the shoreline it is anticipated that some form of shoreline armoring may be present within this area.

Hylebos Creek is crossed by both 8th Street East and 62nd Avenue East in this reach.

Based upon the information listed above, the hydrologic function of this reach is considered to be medium-high

Vegetation Function

As noted in the hydrologic function section, the majority of this reach contains either undisturbed or restored habitat with a relatively small portion of the reach containing residential development.

Due to the low amount of alteration to the vegetation, the vegetation function of this reach is considered to be medium-high.

Other Habitat Function

There are a number of critical areas in segment H2. The 100-year flood zone extends up into the shoreline area on both banks. Much of the left bank, with its steep slopes, is an erosion and landslide hazard area. The entire right bank and areas of the left bank are part of the greater seismic hazard and aquifer recharge areas. The Milgard Nature area and Hylebos Estuary Nature Area have identified wetland areas that based on aerial photos and field observations include emergent, shrub-scrub, and forested components. There is an additional wetland area on the left bank upstream from 62nd Avenue East that appears to be primarily emergent vegetation.

In addition to the salmonids in Hylebos Creek, the PHS inventory includes two polygons on the left bank in this segment. Immediately adjacent to Hylebos Creek is a polygon extending almost the length of shoreline area that is identified as undeveloped riparian habitat. It provides general habitat for birds and mammals, and limited salmonid habitat. Landward of that polygon, extending north from 12th Street East is identified as urban natural open space comprised of steep slopes and bluffs, providing raptor habitat and bird and mammal refugia.

Many of the same limiting factors from segment H1 apply to this segment. However, there is significantly more riparian vegetation and much larger areas of completely undeveloped shoreline in this segment. The channel has been stabilized in a number of places, including a timber bulkhead on both banks between 4th Street East and 8th Street East. There also are areas where the banks are stabilized, particularly the left bank upstream of 62nd Avenue East.

Based upon the information listed above, the habitat function rating for this reach is medium-high.

4.6 HYLEBOS REACH 3 (H3)

Segment H3 is the most upstream reach of the Hylebos Creek, extending 4,380 feet from the 70th Avenue East (RM 2.1) to 12th Street East (RM 1.3), with the exception of a small area of unincorporated Pierce County immediately downstream of the Pacific Highway crossing. Figures 3A, 4A and H3 provide a visual representation of the data provided below in Table 13 pertaining to this reach.



Table 13. H3 Summary.

Land Use Types ¹	Shoreline Indicators ²	Public Shoreline Access ⁴	Habitat ⁵
Total Acreage -2.03 Single Family Residential – 2.03 acres (100.00%)	Permanently protected areas ³ - 0 acres Water quality list, 303(d) – yes (bioassessment)	No direct public access, such as parks, was identified in this reach. The Hylebos is crossed by 12 th Street and Pacific Highway E in this jurisdiction.	The majority of the habitat in this reach is disrupted either by residential or commercial development. The northern portion of the segment, from 12 th Street to Pacific Highway contains adjacent forested canopy of varying widths. The majority of Hylebos Creek to the south of Pacific Highway is channelized with poor quality adjacent vegetation.

1 Data derived from Pierce County and City of Fife GIS data. Refer to Figure 3B of this document. Percentages may not equal 100% due to rounding.

2 Shoreline indicators based upon available No Net Loss indicators as identified by Washington State Department of Ecology. See also Section 6.1 of this document.

3 Based upon GIS Resource Land and Open Space/Recreation designation.

4 Data derived utilizing Washington State public access data resources and City of Fife GIS data.

5 Data derived by aerial review conducted by Grette Associates and City of Fife and Pierce County GIS Data.

Current Land Use

Only one parcel within this reach is located within the City of Fife. The rest of the parcels are located in Pierce County. A general review of existing land use in the segment, including Pierce County indicates that land use is mostly residential, but also includes Commercial/Service, Open/Space/Recreation and Vacant. Upstream of Pacific Highway is commercial use, open space, and a single residential lot. Current zoning of this segment includes small lot residential, single family residential and regional commercial. The future land use map found in the city of Fife Comprehensive Plan indicates that zoning designations will remain similar to current zoning designations. Zoning in this segment indicates that future land use is likely to result in increasing of residential areas downstream of Pacific Highway as vacant land is developed. The zoning upstream of Pacific Highway is commercial, but future land use and environmental conditions will be dependent upon the final configuration of the planned State Route 167 extension. Restoration, enhancement, and re-configuration of reaches of Hylebos Creek in this reach and immediately upstream of the City are an important environmental component of this Project. As with Segment H1 there are no existing opportunities for public access and recreation in segment H3.

Transportation infrastructure, including portions of 12th Street East, Pacific Highway East, 65th Avenue Court East, 67th Avenue East, is located within the shoreline jurisdiction of this reach.

A storm water ditch that extends along the I-5 corridor connects with the Hylebos in the southern portion of the reach (Figure 5A).

There are no water dependent uses in this reach or formal public access, such as trails. Shoreline related/enjoyment uses within this reach include view access from 12th Street East, Pacific Highway East, 65th Avenue Court East, 67th Avenue East.

Hydrologic Function

Due to the impacts of residential and commercial development to the adjacent shoreline vegetation, arterial road crossing, as well as the channelization of the Hylebos in the southern portion of this segment, it is anticipated that overall impacts to hydrologic function within this reach are relatively higher than the other Hylebos segments within this jurisdiction. In addition, given the proximity of residential and commercial development to the shoreline it is anticipated that some form of shoreline armoring may be also be present within this segment.

Based upon the information listed above, the hydrologic function of this reach is considered to be medium-low.

Vegetation Function

As noted in the Hydrologic function section, this segment contains areas of modified vegetation related to residential and commercial development. In the northern portion of the segment, vegetation on the left bank is relatively more intact than the vegetation on the right bank. The left and right banks are equally disturbed and contain a small number of adjacent trees for the portion of the segment located to the south of Pacific Highway.

Due to the level of alteration to the vegetation, the vegetation function of this reach is considered to be medium-low.

Other Habitat Function

There are a number of critical areas in segment H3. The 100-year flood zone extends beyond up into the shoreline area of both banks. The right bank is part of larger aquifer recharge and seismic hazard areas. However, there are no wetlands or erosion and landslide hazard areas in this segment.

PHS information for this segment is similar to segment H2, except that the steep slope polygon does not extend upstream into this segment and the riparian habitat polygon ends at the downstream side of Pacific Highway.

Many of the same limiting factors from segments H1 and H2 apply to this segment. The only off-channel habitat in this segment is a large drainage ditch (Surprise Lake Stream) flowing into Hylebos Creek immediately upstream of Pacific Highway.

Based on the information provided above, the habitat function rating for this reach is medium-low.

4.7 SHORELINE FUNCTION SUMMARY

Table 15 provides a qualitative summary of relative hydrology, vegetation, and habitat function for each reach based on the detailed reach assessment provided for the specified reach in the above text, comparison to function of other reaches within the City, as well as the anticipated function of an undeveloped reach. Designations of high, medium-high, medium, medium-low, or low are assigned for each reach function followed by a brief supporting narrative. In the final column, an overall qualitative score, also based upon high/medium/low designations, is provided. The overall qualitative score is determined based upon the qualitative ratings of the three separate functions as well as the quantitative assessment provided in the specific reach assessments. In general, as is typical in urban areas, the quality of habitat, hydrologic, and vegetative function within the City is diminished by the concentrated level of development.

Table 14. Ecological Function Assessment Summary for City shorelines.

Reach (Planning Segment)	Hydrologic	Vegetation	Habitat	Qualitative Summary Function Score¹
P1	Low: This reach contains high amounts of channel modification, including the levee that extends along the entire length of the reach, as well as the impaired water quality evidenced by the 303(d) listings.	Low: This reach contains high amounts of alteration to the vegetation as well as the potential for future alteration.	Low: This reach has a minimal amount of mapped habitat. Existing shoreline habitat coincides with the levee and is subject to disturbance.	Low
P2	Medium-High: This reach provides high levels of stormwater storage capacity for the City	Medium-High: This reach contains two protected wetlands. Each wetland is primarily emergent but also contains forested areas. Both wetlands contain Tribal Land.	Medium – High: Both wetlands within this reach have been mapped as containing Priority Habitat.	Medium-high
P3	Low: This reach contains high amounts of channel modification, including the levee that extends along the entire length of the reach, as well as the impaired water quality evidenced by the 303(d) listings.	Low: This reach contains high amounts of alteration to the vegetation as well as the potential for future alteration.	Low: This reach has a minimal amount of mapped habitat. Existing shoreline habitat coincides with the levee and is subject to disturbance.	Low
H1	Medium: Shoreline vegetation within this reach has been modified, which often leads to modification of the hydrologic process. Shoreline also contains an undetermined amount of shoreline armoring.	Medium-low: Vegetation on both the right and left banks within this reach are modified as a result of residential development.	Medium-high: This segment contains a number of critical areas. However, existing impacts to hydrology and vegetation prevent a rating of “high”.	Medium

Reach (Planning Segment)	Hydrologic	Vegetation	Habitat	Qualitative Summary Function Score¹
H2	Medium-High: Segment has relatively intact vegetation and low amounts of impervious surfaces, based upon visual estimation of aerial photographs. Shoreline also contains an undetermined amount of shoreline armoring.	Medium-High: Shoreline vegetation within this reach is relatively intact, when compared to adjacent segments. Segment contains two restoration projects (Milgard and Hylebos Estuary Nature Areas)	Medium-High: This segment contains a number of critical areas. However, existing impacts to hydrology and vegetation prevent a rating of “high”.	Medium-High
H3	Medium-Low: Review of aerial photographs indicates that portions of the segment have been channelized. Shoreline also contains an undetermined amount of shoreline armoring.	Medium-Low: The majority of the vegetation within this reach has been disturbed by both residential and commercial development. However, review of aerial photography indicates that central portions of the left bank do contain tree canopy that extends over the Hylebos.	Medium-Low: This segment contains a number of critical areas. However, impacts to hydrology and vegetation function prevent higher habitat functionality.	Medium-Low

1 – Qualitative Summary Function Score provides a qualitative score (high, medium-high, medium, medium-low, low) based upon the summary of the hydrologic, vegetation, and habitat analysis contained in Section 4 of this document and summarized in the table.

5 OPPORTUNITIES FOR SHORELINE PROTECTION, RESTORATION, PUBLIC ACCESS AND USE

5.1 SHORELINE PROTECTION AND RESTORATION OPPORTUNITIES

This section of the Inventory and Characterization document describes opportunities within the City to advance the goals of shoreline protection and restoration. Shoreline protection and restoration opportunities were primarily identified by utilizing the baseline watershed processes and reach characterization and functions information provided in Sections 3 and 4 of this document. Suggestions based upon the analysis for each shoreline reach as well as general suggestions for all City shorelines area provided. It should be noted that all of the protection and recommendation opportunities identified in this section of the document will be considered by the City and associated stakeholders. The City may ultimately choose to incorporate and/or implement any or all of the restoration measures as identified in the text below based upon community visioning, stakeholder comments and guidance from the Department of Ecology. In addition, the City intends to work with adjacent jurisdictions including Pierce County and neighboring tribes in identifying collaborative shoreline restoration efforts, such as those identified in the Pierce County Shoreline Restoration Report. Further refinement of the proposed restoration goals, policies and activities will occur during Task 4.1 – *Restoration Planning* of the update process.

5.1.1 P 1

Many of the conditions in segment P1, particularly those related to salmonid habitat, are due to factors outside the jurisdiction of the City of Fife. These include upstream land use, major alterations in basin hydrology, and placement and maintenance of the levee. However, the City can identify areas for conservation and/or restoration within the shoreline area that would provide some habitat for non-aquatic species. In particular, as the City works with land owners to plan development downstream of Frank Albert Road, areas could be identified for open space corridors that connect upland and shoreline areas. Forested areas are strongly recommended for conservation, and could also be prioritized for connection to the shoreline areas by way of open space corridors. Additionally, where possible, the City could collaborate with the Corps and Pierce County River Improvement District to develop vegetation plans for the levee that complement vegetation and open space across Levee Road as well as improve water quality, habitat, and vegetation functions.

5.1.2 P 2

The majority of this reach contains open space and resource land uses. It is highly recommended that zoning be modified to reflect the existing land use. In addition, land use in the immediately adjacent areas should be planned to minimize impacts. Areas of the wetlands or their associated buffers that may have been altered due to past development are recommended for enhancement actions, including invasive species removal and native vegetation planting. The Oxbow wetland represents the greatest potential for the City to enhance salmonid habitat on the Puyallup shoreline.

5.1.3 P 3

As with segment P1, the City does not have jurisdiction over many of the factors influencing salmonid habitat function in this segment. Conservation of upland open space areas, particularly forested areas, is highly recommended, as is conservation and enhancement of wetland areas. Collaboration with the Pierce County River Improvement District to develop vegetation and habitat enhancement plans that complement each other on both sides of Levee Road also is recommended.

5.1.4 H 1

Because the entire segment is privately owned and occupied, there are essentially no opportunities for conservation and restoration without homeowner involvement or property acquisition. However, the City could explore developing an educational program to inform homeowners of actions they can take to minimize their impacts in-stream habitat or ways to enhance it with native landscaping, soft shoreline armoring techniques and invasive species removal. Non-governmental organizations (such as Friends of the Hylebos, Citizens for a Healthy Bay) familiar with outreach programs in the watershed would be useful partners in such an effort.

5.1.5 H 2

Restoration activities have been completed on both the right and left banks within the northern portion of this reach. The Milgard Nature area is located along the right bank and the Hylebos Estuary Nature area is located along the left bank. Conservation of the remaining undeveloped riparian areas on the left bank is strongly recommended. Additional property acquisition for conservation and restoration actions on the right bank to complement and enhance the riparian areas on the left bank also is recommended where possible, as is shoreline property owner outreach and education regarding actions they can take to minimize impacts and enhance habitat on their property. One opportunity for restoration is the left bank between 8th Street East and 62nd Avenue East, where an undeveloped area dominated by reed canary grass with limited riparian vegetation could be cleared and replanted with native vegetation, or even graded down to create off-channel wetland habitat. Kerwin (1999) identified off-channel habitat as a limiting factor in Hylebos Creek. Off-channel habitat with a riparian community could provide input of nutrients and a forage base for coho salmon (as well as chinook). Another opportunity for restoration is the left bank immediately downstream of 12th Street East, where there is a large amount of debris and invasive vegetation in the shoreline area.

These opportunities are typical of those in the City shoreline area on Hylebos Creek in that they would require either significant property owner cooperation or property acquisition. The City also could develop guideline for building setbacks and riparian vegetation requirements for new residential development in this segment.

5.1.6 H 3

It is strongly recommended that the City conserve remaining riparian vegetation in this segment. As with segments H1 and H2, opportunities for conservation and restoration area somewhat limited to options involving property owner involvement or property acquisition. Guidelines for building new residential development as vacant land is converted to residential areas could be used to enhance and conserve riparian areas. This is a likely scenario for the undeveloped and agricultural shoreline areas immediately upstream of 12th Street East. As this area becomes developed, riparian areas could be conserved and vegetation restored, including removal of the large stand of Japanese knotweed (*Polygonum cuspidatum*) on the left bank and its replacement with native vegetation. The eventual extension of State Route 167 may present the greatest opportunity for habitat restoration and enhancement, as well as the greatest opportunity for partnership and coordination with stakeholders working upstream of the City.

5.1.7 General Recommendations for all City Shorelines

The following recommendations are provided for the entire jurisdiction:

- Work with the Corps of Engineers and the Pierce County River Improvement district to investigate means to provide increased shoreline function along the Puyallup River without compromising flood control capacity.
- Conserve wetlands in the shoreline area through buffer maintenance. Consider off-channel habitat creation, enhancement or improvement projects for the Hylebos Creek, wherever possible.
- Carefully consider the impacts of uplands development upslope of shoreline areas, even outside of the shoreline jurisdiction.
- Ensure stormwater facilities and stormwater designs provide adequate water treatment before re-introduction to waterbodies. Explore new stormwater technologies, including low impact development and water recycling.
- Conserve riparian vegetation within the shoreline areas, wherever possible, especially where there is opportunity for large woody debris (LWD) recruitment into the adjacent streams.
- Inform shoreline property owners about shoreline habitat and the special functions associated with shoreline areas. Promote restoration or re-vegetation of riparian areas through education or incentive programs.
- Work with shoreline property owners on pile removal, removal of hardened banks, and shoreline stabilization using vegetation and removal of remnant crossings.
- Coordinate with local jurisdictions, business, and citizen action groups on large scale habitat creation or restoration projects.

5.2 PUBLIC ACCESS OPPORTUNITIES

Shoreline public access is the ability of the general public to reach and touch the water and the ability to view the water and the shoreline from upland locations. Public access facilities include public parks, boat launches, trails, improved street ends and overlooks. On Fife shorelines, public access to the Puyallup is provided by N. Levee Road adjacent to the Puyallup as well as informal areas of direct access created by an adjacent trail as well as breaks in the adjacent vegetation. Public access to the Hylebos is limited due to adjacent residential and commercial development.

As the majority of the parcels adjacent to the shoreline are not owned by the city, potential new public access opportunities to Fife's shoreline area are limited and would likely require obtaining new shoreline properties. The City of Fife may choose to work with adjacent jurisdictions, such as Pierce County to explore future public access opportunities.

5.3 SHORELINE USE ANALYSIS AND IDENTIFICATION OF POTENTIAL CONFLICTS

Planned shoreline use for the City of Fife includes Industrial, Mixed Medium Density Residential/Commercial, Medium Density Residential, Low Density Single Family Residential, Small Lot Single Family Residential, and Mixed Commercial High Density Residential (City of Fife 2009). There are a substantial number of vacant, agricultural, and/or undeveloped properties that are zoned for other uses such as commercial or industrial. Future development is likely to involve the conversion of existing agricultural and residential use parcels to industrial and commercial uses.

As identified in the shoreline characterization and function portion of this document (Section 4), the levee system adjacent to the Puyallup River as well as the lack of navigability within the Hylebos result in a reduced opportunity for water dependant activities within the City. At this time, only limited water dependent recreational activities, such as fishing along the Puyallup and Hylebos Creek are available.

6 DATA GAPS

This section of the Inventory and Characterization describes data gaps or limitations identified during document development. Identification of data gaps uncovered during the Shoreline Master Program Update is a necessary part of the Inventory and Characterization process pursuant to WAC 173-26-201(3)(c)(viii). These data gaps generally represent elements of the report where the analysis may be limited, relevant data cannot be found, and/or the City will continue to obtain information beyond the completion of this document. This section is not intended to provide an exhaustive list of all of the items the City should address. However, the items listed within this section are provided to serve as the initial development of possible directions the City may wish to pursue to facilitate future code updates and/or amendments to the Shoreline Master Program.

6.1 IDENTIFIED GAPS

Regional Information

As noted in Section 2 of this document, Pierce County is conducting its SMP update concurrent with the City effort, and will prepare a county-wide assessment of regional conditions including watershed processes and shoreline functions. Additionally, Ecology is preparing analyses of watershed processes for Puget Sound marine shorelines that will become available in 2010. This information should be utilized for this update process, as it becomes available, as well as for future updates.

Land Cover/Impervious Surfaces

The overall level of impervious surface for the City of Fife is estimated to be 44%, as derived from external GIS resources including the National Oceanic and Atmospheric Administration and the Washington State Department of Ecology. However, this document is not able to provide quantitative data regarding the percent or acreage of impervious land cover for each reach, which is the common metric utilized for obtaining baseline land cover information, based on the level of information currently available.

Site Specific Critical Area Information

As noted within some of the reach assessments within Section 4 of this document, site specific studies may yield information regarding critical areas that are currently unknown and unmapped.

Shoreline Indicators

The Washington State Department of Ecology has identified several quantifiable shoreline indicators that are intended for use to demonstrate no net loss during future update processes. These potential no net loss indicators include: loss of forest cover (preferred measurement acres converted), shoreline stabilization (linear length), shoreline vegetation (linear measurement or percent cover), permanently protected areas in acres, Docks/overwater structures (square footage), road lengths in feet within 200 feet of waterbody, number of road crossings of water

bodies, water quality list 303(d) listing, linear feet of levees/docks, and floodplain area (acres allowed to flood – as determined by lack of structures). Unfortunately, due to the lack of digitized information as well as the limitation of the update to existing data, the majority of these parameters could not be quantified for this update process.

FEMA flood maps

The currently available flood map information was utilized by the City of Fife during this Inventory and Characterization process. However, FEMA is in the process of revising the maps that designate flood areas within the City of Fife. These maps once adopted would change the extent of the shoreline jurisdiction within the city and amendments to the Shoreline Master Program in Fife would be required. It is anticipated that these maps will be made available to the City in time for the next Shoreline Master Program Update.

6.2 RECOMMENDATIONS TO ADDRESS DATA GAPS

The City of Fife has shoreline information in several formats; GIS, hard copy maps, photographs and project reports. The bulleted items provided below are suggestions that the City may choose to pursue to facilitate future update processes:

- Digitize all existing paper maps for use in GIS, if possible, and update content during digitization.
- Complete an impervious surface analysis for the City, and digitize the results.
- Complete a detailed wetland inventory, both within the shoreline area and in the City at large to improve critical areas management and provide information for comprehensive planning; digitize the results.
- Log wetlands delineations from shoreline permit applications into a central file for reference, and if possible, digitize wetland data.
- Coordinate with other local jurisdictions and interest groups (i.e., Friends of the Hylebos), to share data regarding salmon habitat, distribution and use of both Hylebos Creek and the Puyallup River.

CITY OF FIFE SHORELINE MASTER PROGRAM UPDATE

TASK 2.1 – INVENTORY

PREPARED FOR:



CITY OF FIFE
COMMUNITY DEVELOPMENT
5411 23RD STREET EAST
FIFE, WASHINGTON 98424

PREPARED BY:

GRETTE ASSOCIATES, LLC
2102 NORTH 30TH SUITE A
TACOMA, WASHINGTON 98403
(253) 573-9300

151 SOUTH WORTHEN, SUITE 101
WENATCHEE, WASHINGTON 98801
(509) 663-6300



This document has been generated to address Task 2.1 – Inventory of the Shoreline Master Program Update process for the City of Fife. Plans, studies, inventories, geographic information systems (GIS) data, and other data resources were reviewed for information pertinent to the update process and to the requirements outlined within WAC 173-26-201(3)(c). The inventory information provided below is divided into four data types. The first three data types are outlined by the Washington State Department of Ecology within the *Shoreline Planners Toolbox*³. The fourth data type has been added to identify specific City of Fife planning documents.

Integrated reports, catalogs, multi-feature data sets, and internet mapping sites

Northwest Salmon Recovery Planning <http://www.nwfsc.noaa.gov/trt/index.cfm>

Pierce County's work on the Hylebos-Brown basin: Hylebos-Browns-Dash Pt Basin Plans | Surface Water Management | Public Works and Utilities | Pierce County, WA

Zulauf, A.S. *Soil Survey of Pierce County Area, Washington*. United States Department of Agriculture, Soil Conservation Service in cooperation with Washington State Department of Natural Resources, and Washington State university, Agriculture Research Center. Washington, District of Columbia. 1979.

Maps, imagery, and information sources

City of Fife, Critical Areas Map set

http://www.cityoffife.org/?p=city_departments&a=community_development&b=critical_areas_mapset

N.O.A.A. Coastal Change Analysis Program Regional Land Cover. <http://www.csc.noaa.gov/digitalcoast/data/ccapregional/>

N.O.A.A. Damage Assessment, Remediation, and Restoration Program <http://www.darrp.noaa.gov/northwest/cbay/restore.html>

N.O.A.A. Natural Resource Damage Assessment and Restoration http://www.cbrestoration.noaa.gov/hylebos_offchannel.html

USGS, [Determination of Upstream Boundary Points on Western Washington Streams and Rivers under the Requirements of the Shoreline Management Act](#) Water-Resources Investigation Report 96-4208.

USGS Stream Stats. <http://water.usgs.gov/osw/streamstats/Washington.html>

³ The *Shoreline Planners Toolbox* is a guidance website provided by the Washington State Department of Ecology that is intended for use as a reference guide during the Shoreline Master Program Update Process. This site can be accessed on the internet at the following site address:
<http://www.ecy.wa.gov/programs/sea/shorelines/smp/toolbox.html>

Trust for Public Land. Public Access Regional Maps. http://www.tpl.org/tier3_cd.cfm?content_item_id=19981&folder_id=262

Washington Department of Archaeology & Historic Preservation. <https://fortress.wa.gov/dahp/wisaard/>

Washington Department of Ecology BEACH Program. Public Access Information. <http://www.ecy.wa.gov/programs/eap/beach/>

Washington State Department of Ecology Section 303d Listed water body. <http://apps.ecy.wa.gov/website/wq303d/viewer.htm>

Washington State Department of Ecology Toxics Clean-up Program <http://www.ecy.wa.gov/programs/tcp/sites/SiteLists.htm>

Washington State Department of Ecology, [Western Washington Land Cover Change Analysis](http://www.ecy.wa.gov/services/gis/data/landcover/basins.htm). <http://www.ecy.wa.gov/services/gis/data/landcover/basins.htm>

Washington State Parks. 2006. Washington State Accessible Outdoor Recreation Guide - North Puget Sound Region. <http://www.parks.wa.gov/adarec/detail.asp?region=NPS#12> .

WRIA 10 – White – Puyallup River Basin Map Appendix <http://www.scc.wa.gov/index.php/273-WRIA-10-White-Puyallup-River-Basin/View-category.html>

References for scientific texts, journal articles, technical reports, and research papers

Bolton, Susan and Jeff Shellberg. *White Paper: Ecological Issues in Floodplains and Riparian Corridors*. July 11, 2001.

Correll, Dave. *Vegetated Stream Riparian Zones: Their Effects on Stream Nutrients, Sediments, and Toxic Substances*, April 2003. <http://www.unl.edu/nac/riparianbibliography.htm>

Catalog of Washington Streams and Salmon Utilization, Volume 1, Puget Sound Region. 1975.

ESA Adolphson, *Pierce County Shoreline Master Program Update Draft Shoreline Inventory and Characterization Report*. October 2007.

ESA Adolphson, *Final Draft: Tacoma Shoreline Inventory and Characterization Report*. December 2007.

Kerwin, J. *Salmon Habitat Limiting Factors Report for the Puyallup River Basin (Water Resource Inventory Area 10)*. Washington Conservation Commission, Olympia, Washington. 1999.

Stanley, S., J. Brown, and S. Grigsby. *Protecting Aquatic Ecosystems: A Guide for Puget Sound Planners to Understand Watershed Processes*. Washington State Department of Ecology, Publication #05-06-013, Olympia, Washington. 2005. <http://www.ecy.wa.gov/biblio/0506027.html>

Trust for Public Land, *Conservation Priorities: An assessment of freshwater habitat for Puget Sound Salmon*. November 2000.

Washington State Department of Ecology, *Draft SMP Handbook, Chapter 7 Shoreline Inventory and Characterization*. 2010.

City Planning Documents

AHBL, *City of Fife Draft Shoreline Master Program*. 2005.

City of Fife, *City of Fife Comprehensive Plan*. 2005.

City of Fife, *City of Fife City-Wide Comprehensive Stormwater Management Plan, Final Report*. 2002

City of Fife, *Shoreline Management Plan*. 1974.

Grette Associates, *Draft City of Fife Shoreline Inventory*, 2004.

CITY OF FIFE
SHORELINE MASTER PROGRAM UPDATE

INVENTORY AND CHARACTERIZATION FIGURES

Fife Jurisdiction Assembly

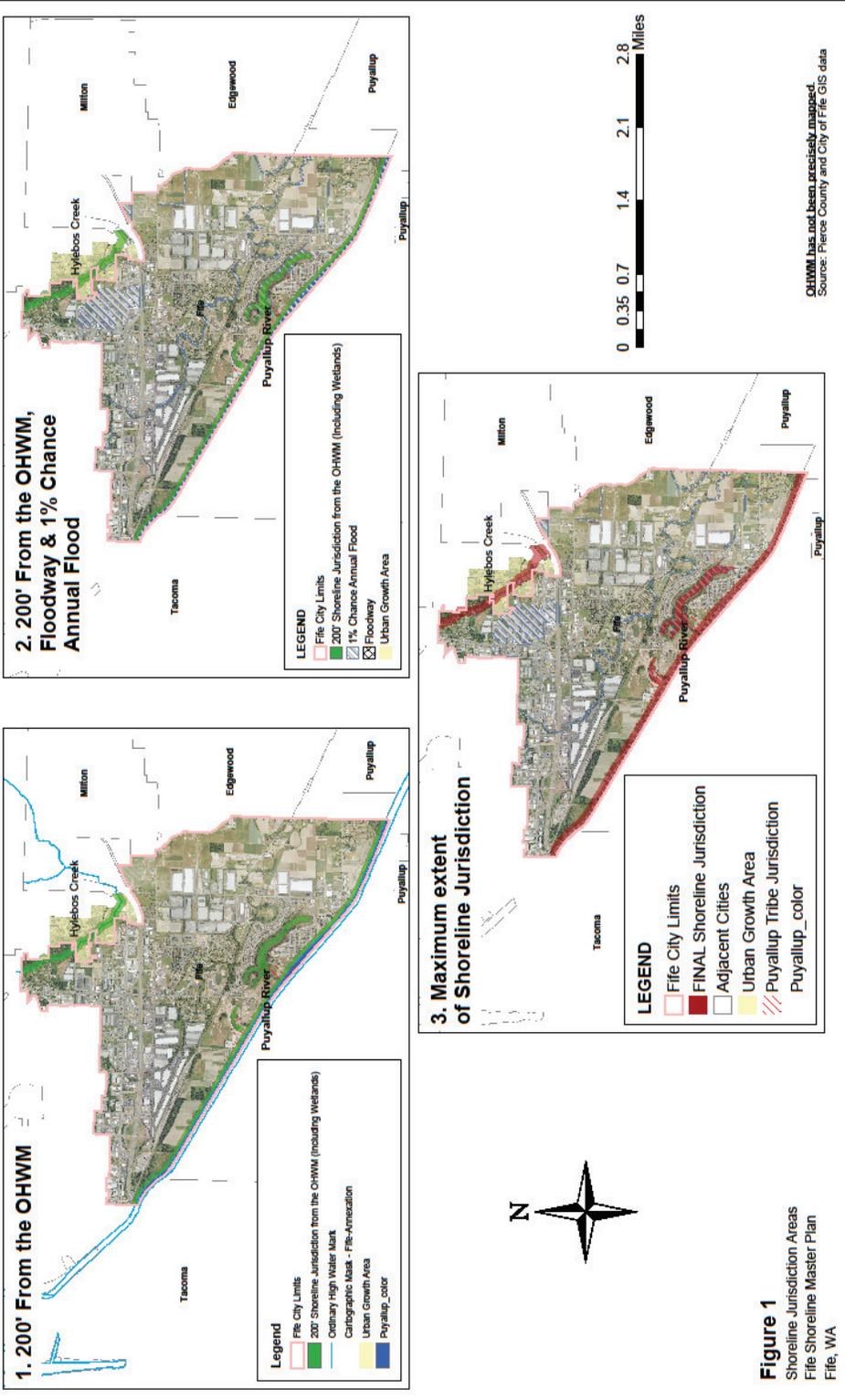
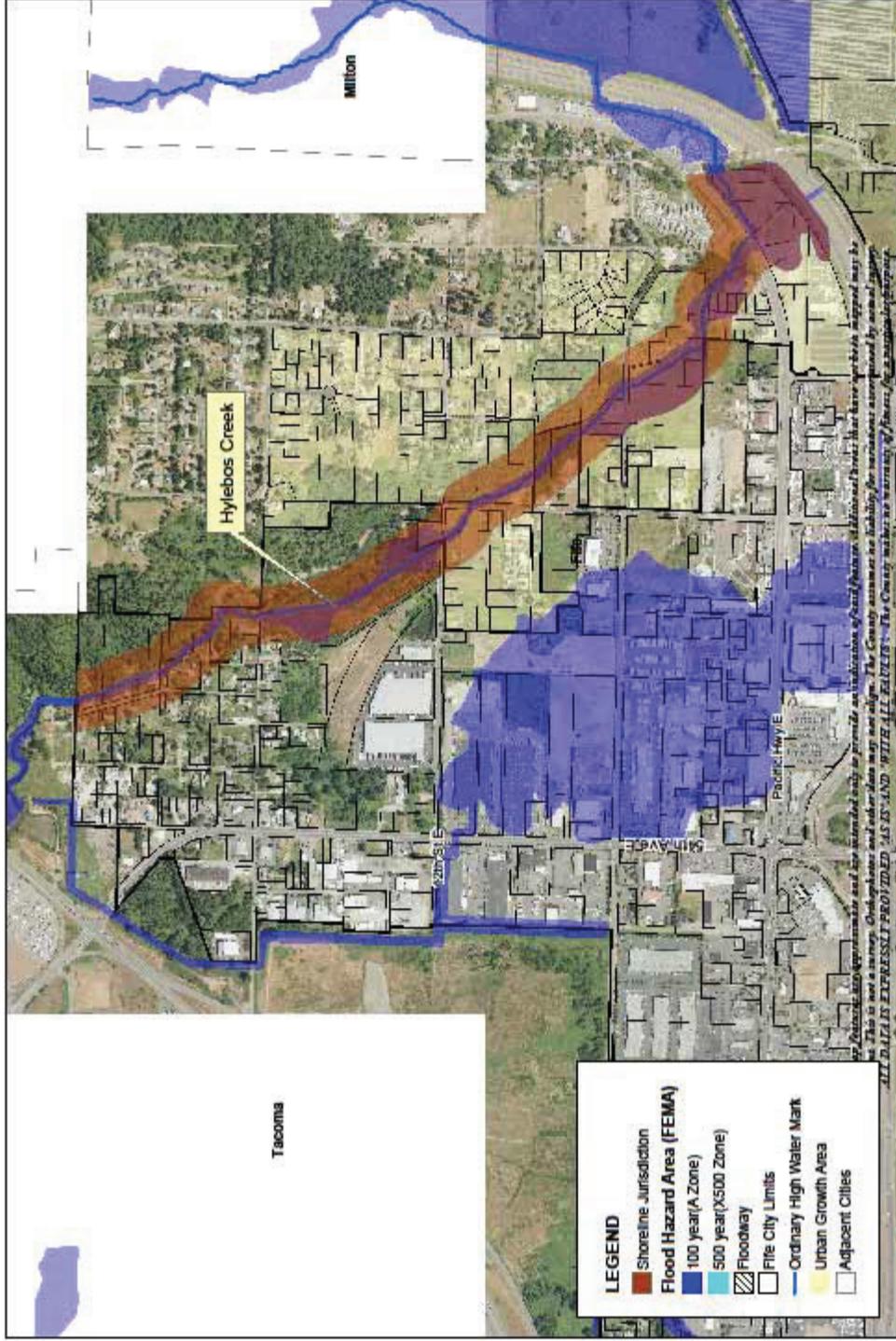
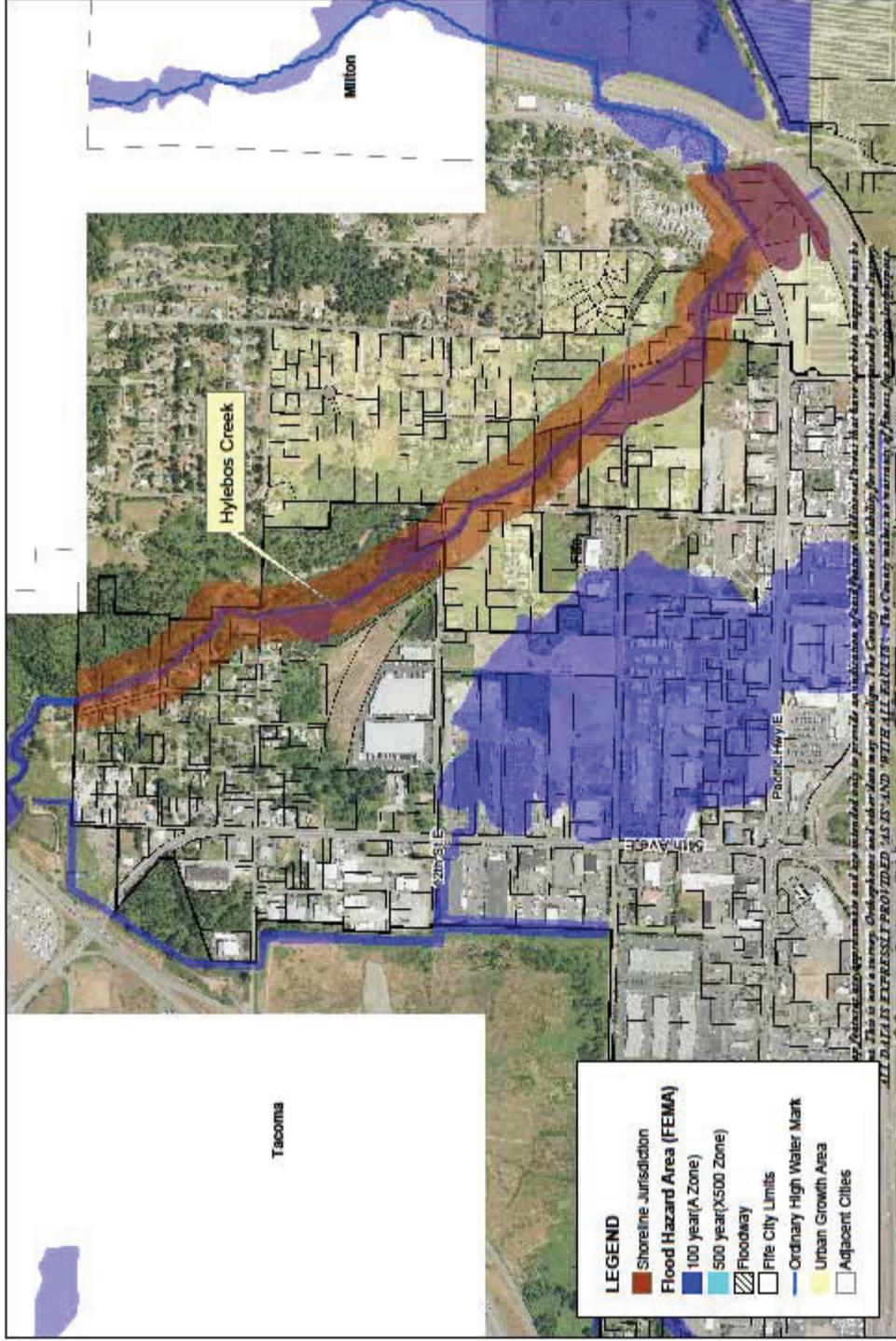


Figure 1
Shoreline Jurisdiction Areas
Fife Shoreline Master Plan
Fife, WA





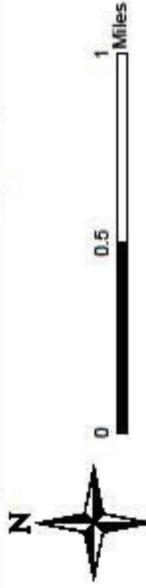
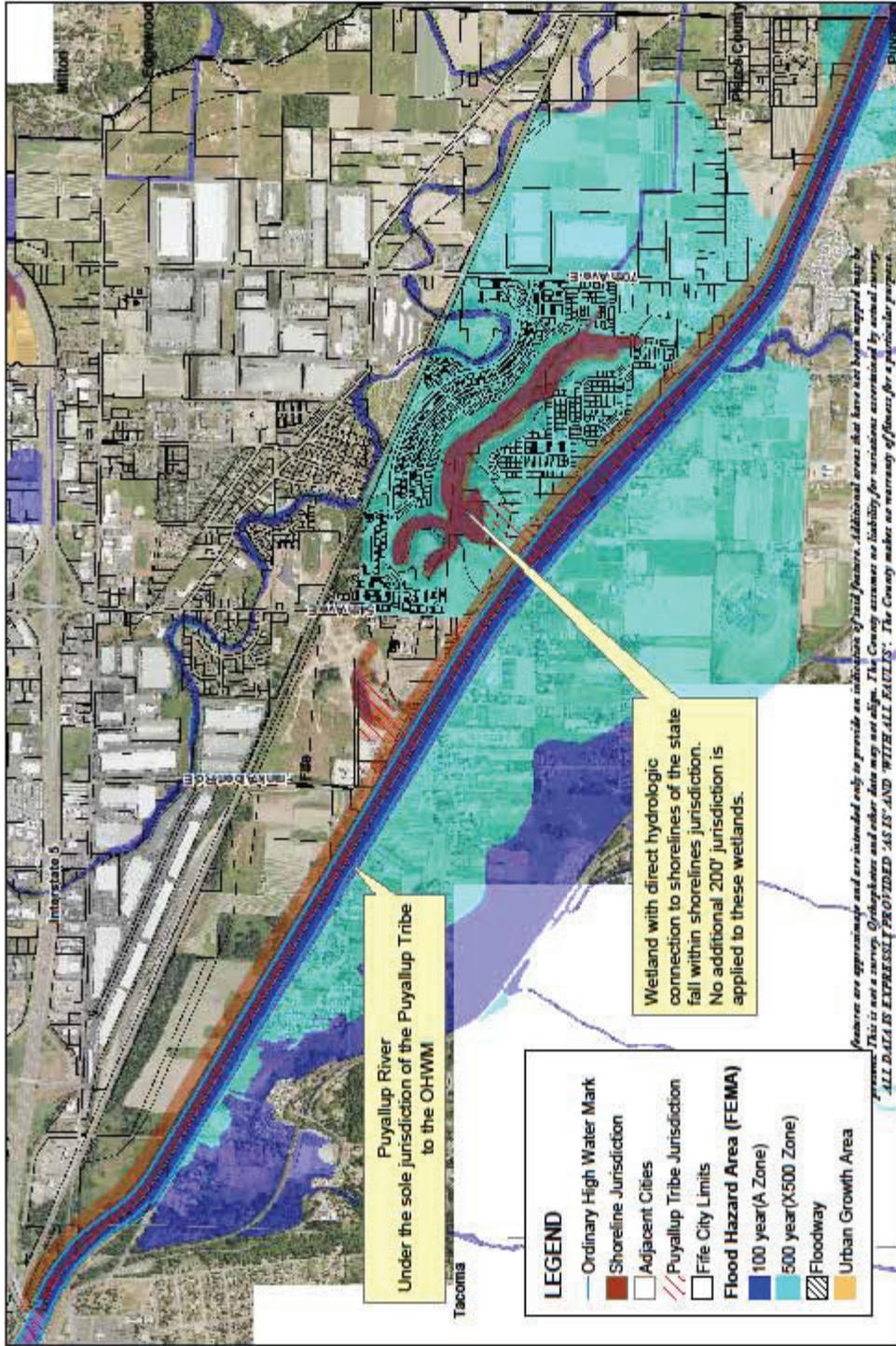


FIGURE 1B
Shoreline Jurisdiction Areas
Fife Shoreline Master Plan
Fife, WA

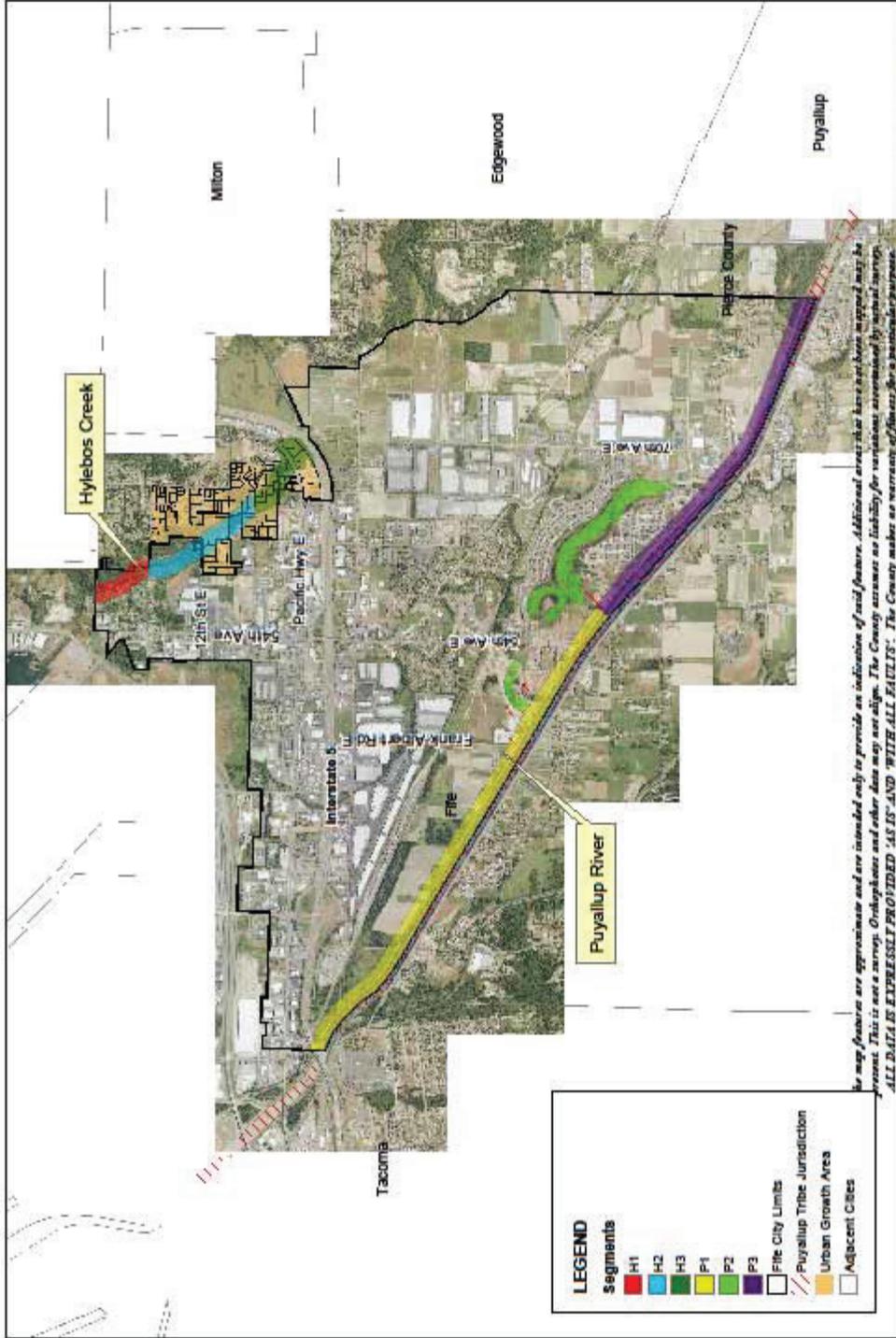
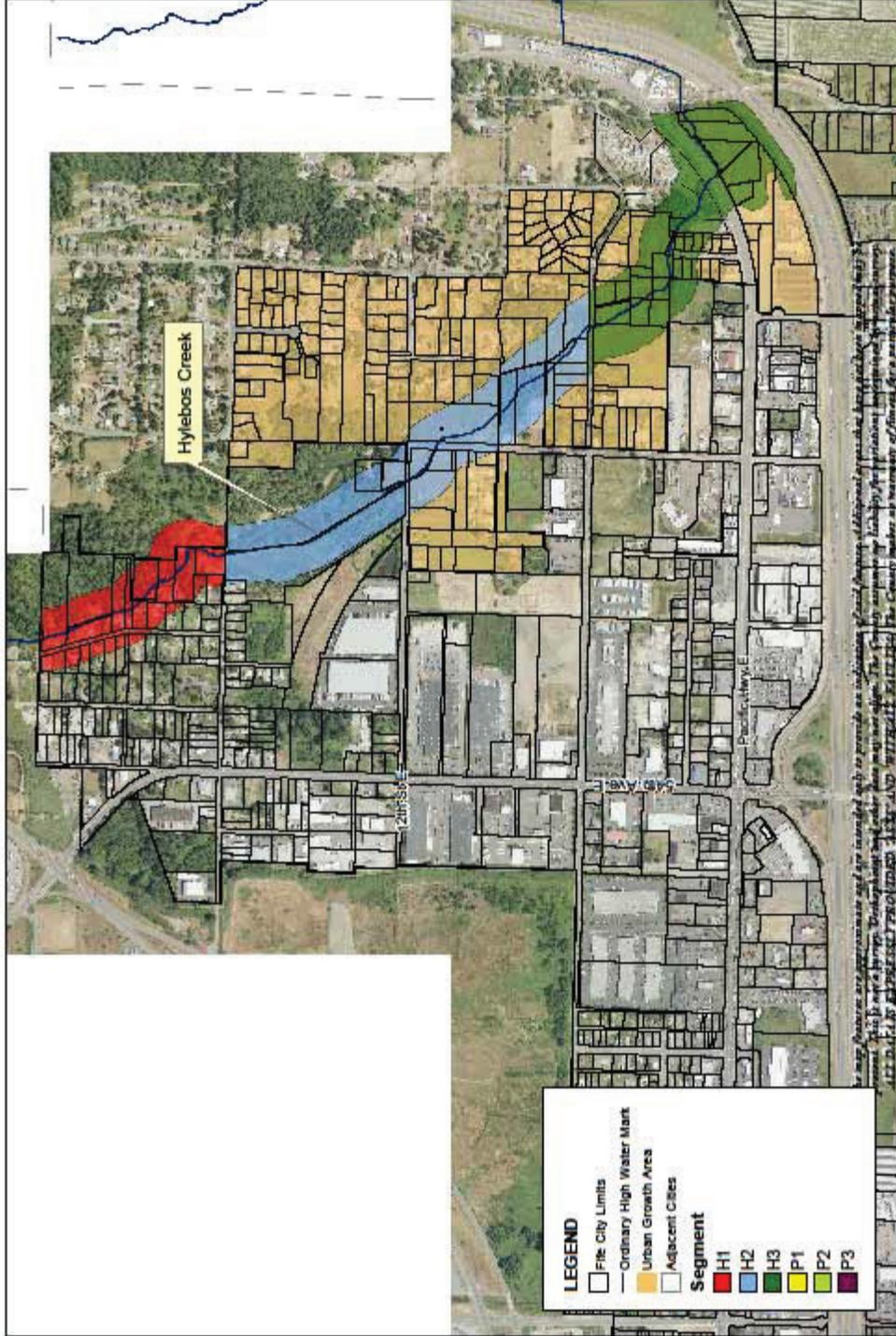


FIGURE 2
 Study Segments
 Fire Shoreline Master Plan
 Puyallup, WA



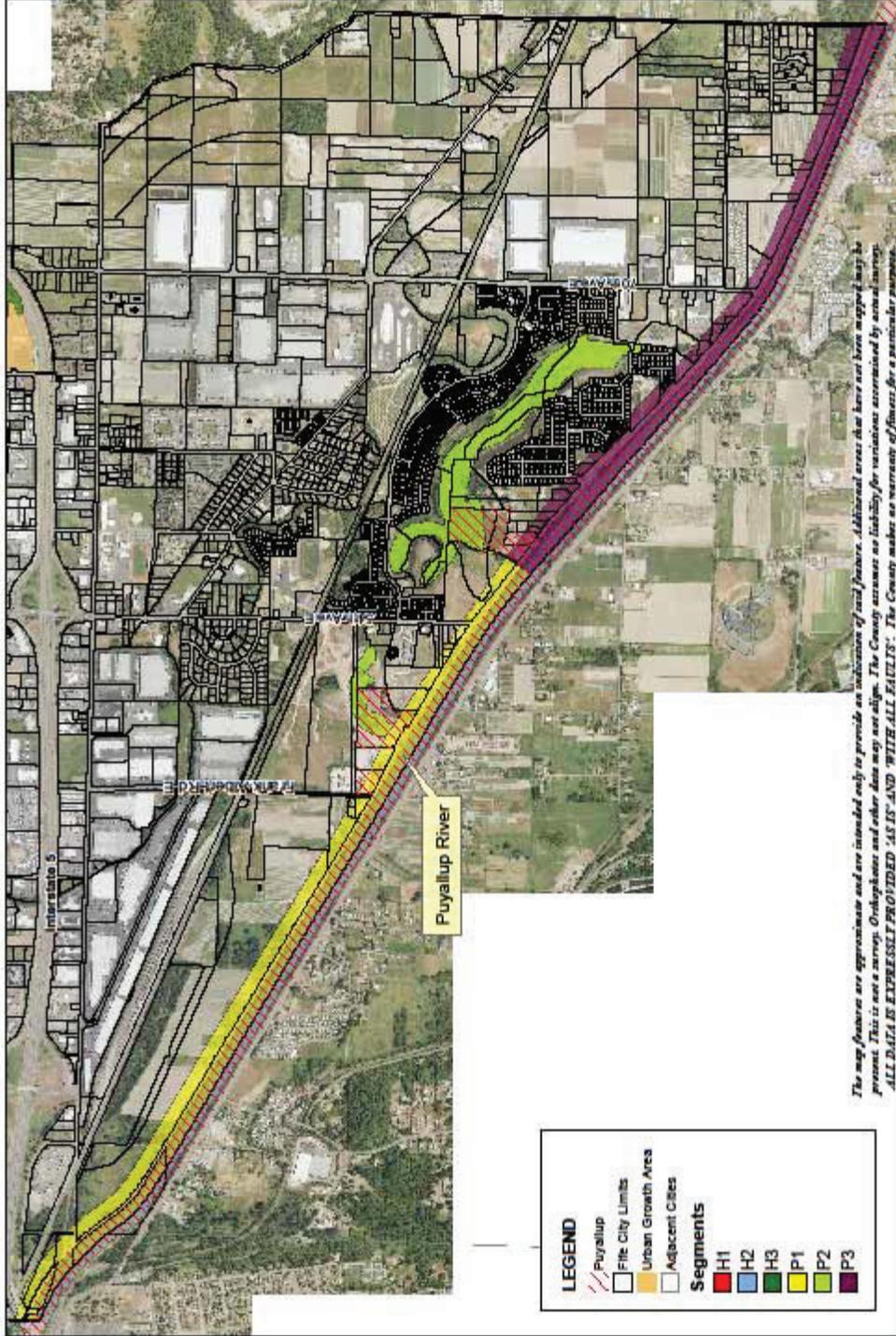


FIGURE 2B
 Study Segments -Puyallup Segment
 Fife Shoreline Master Plan
 Fife, WA

5-1-10 Community Development
 C:\M\ has not been precisely mapped.

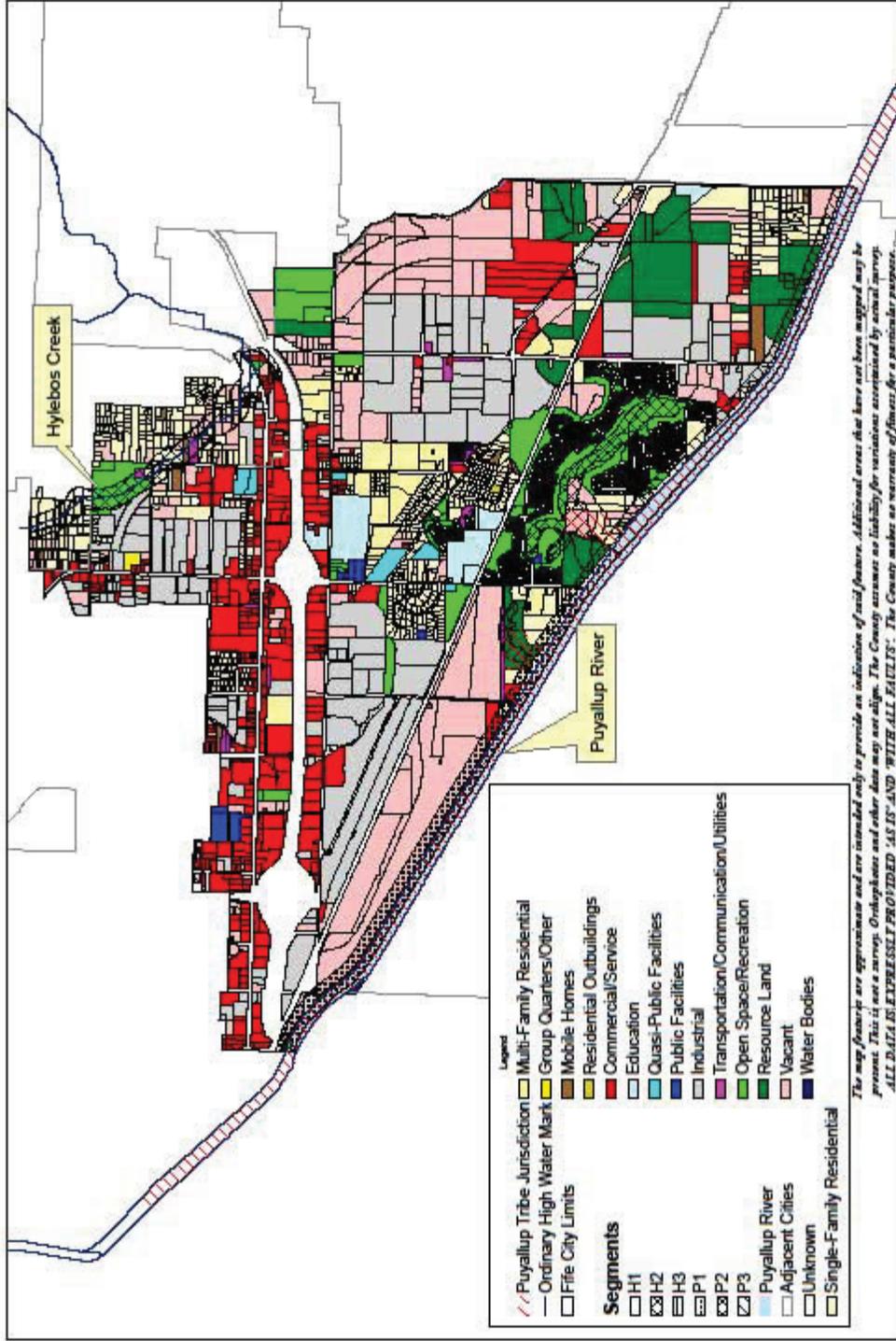


FIGURE 3
 Existing Land Use
 Fife Shoreline Master Plan
 Fife, WA

5/1/10 Community Development
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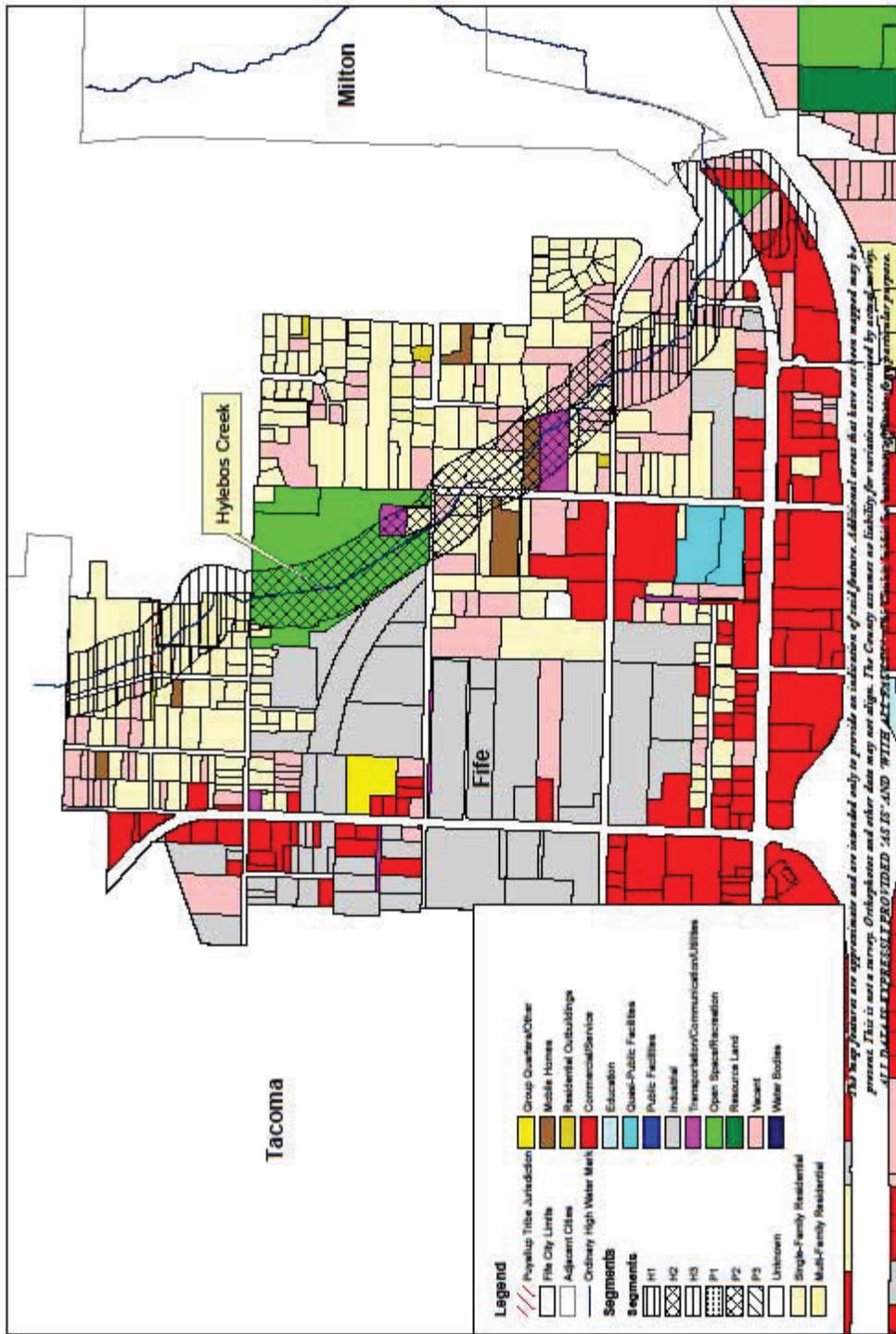
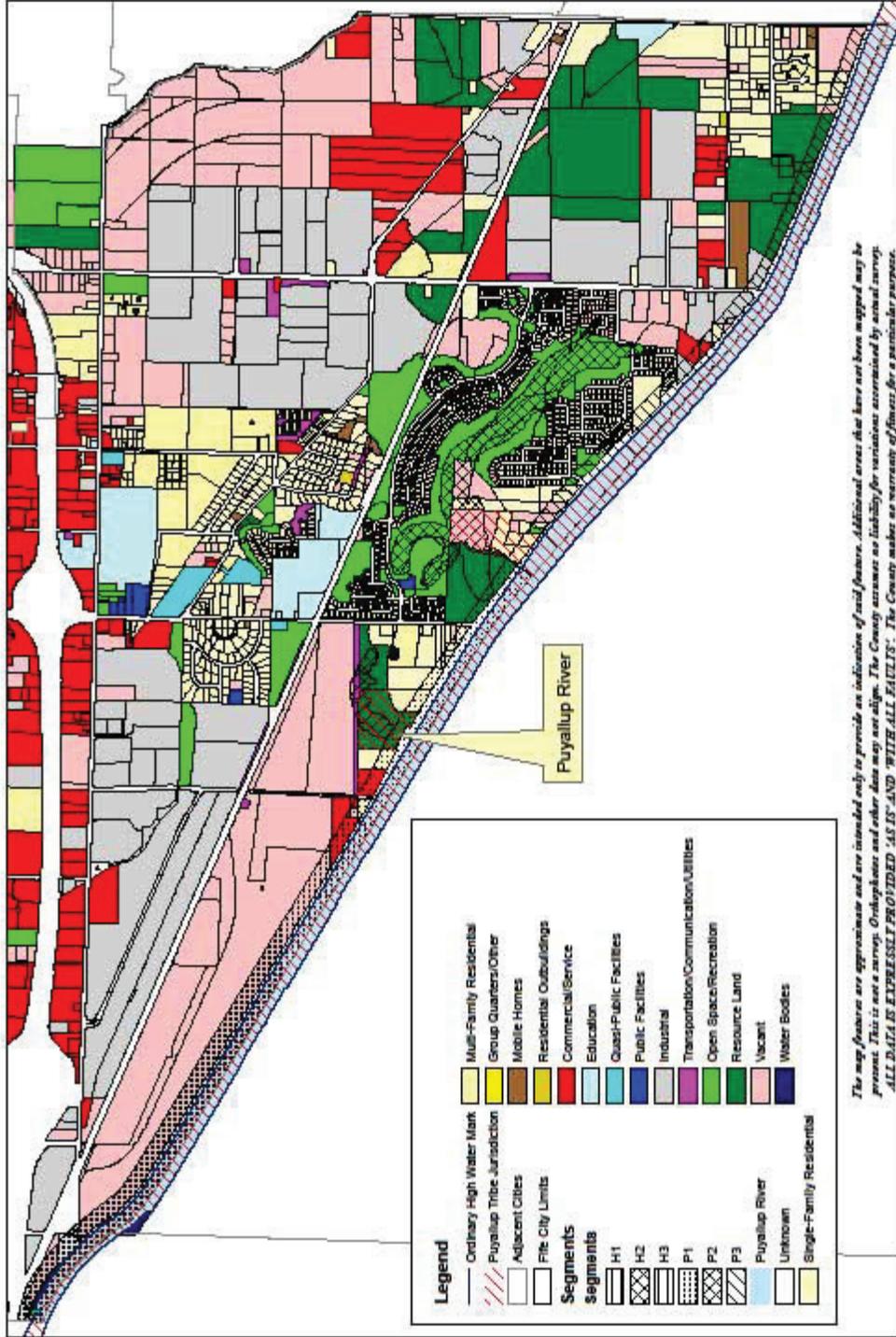


FIGURE 3A
 Existing Land Use -Hylebos Segment
 Fife Shoreline Master Plan
 Fife, WA



Source: Pierce County and City of Fife GIS data



FIGURE 3B
 Existing Land Use -Puyallup Segment
 Fife Shoreline Master Plan
 Fife, WA

5/7/10 Community Development
 CDM
 CDM has not been publicly released.

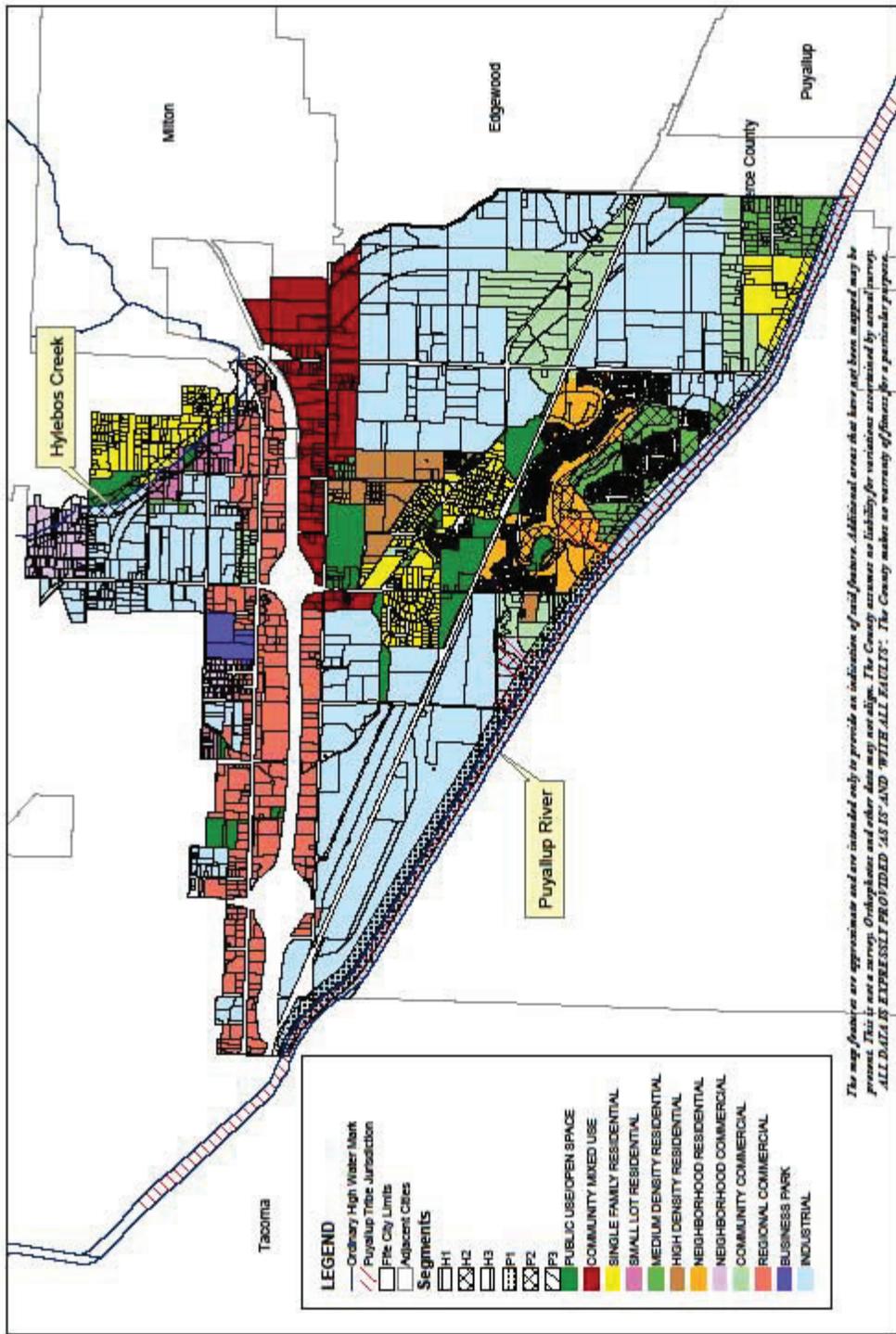
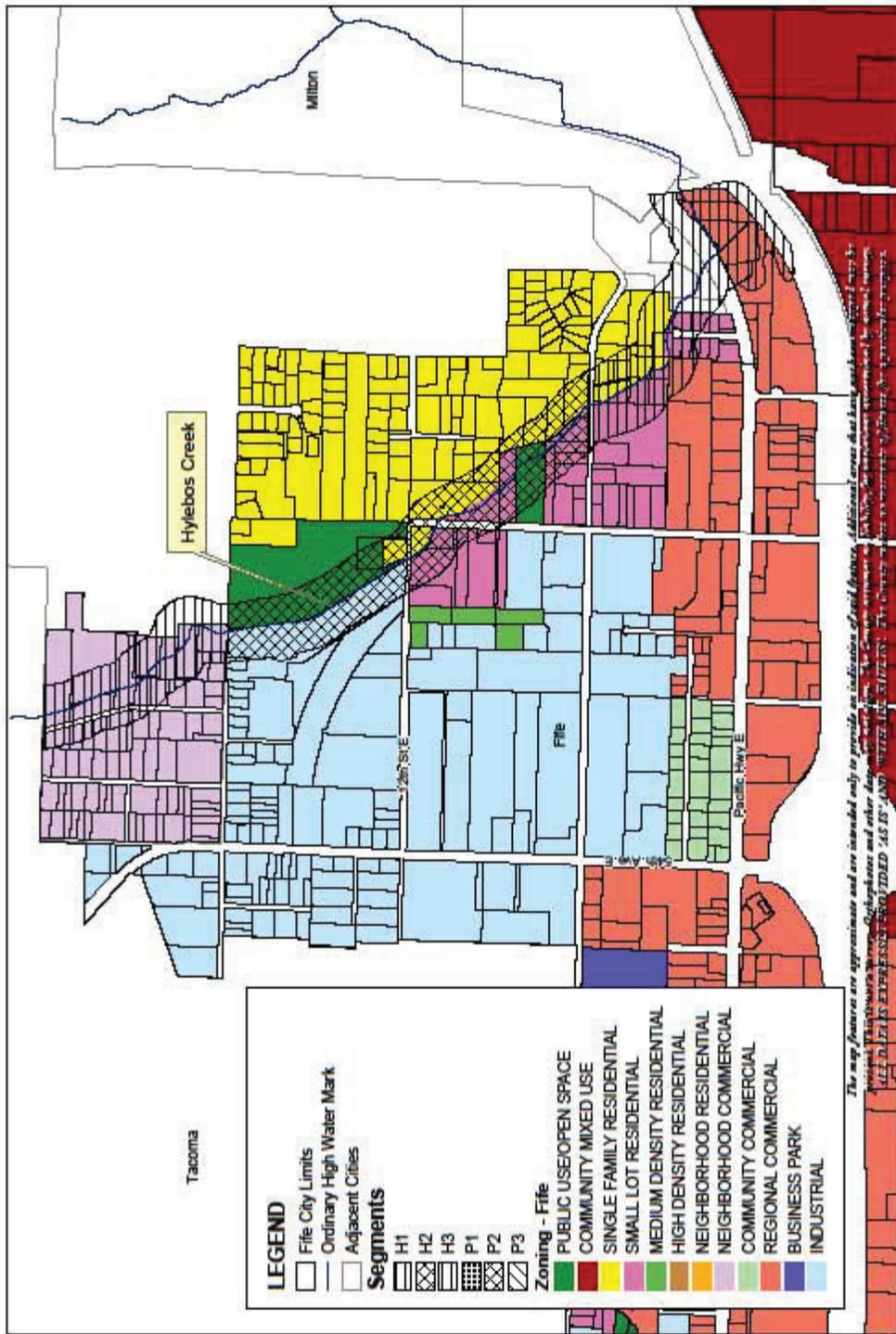


FIGURE 4
Existing Zoning
Fife Shoreline Master Plan
Fife, WA



Source: Pierce County and City of Fife GIS data



FIGURE 4A
 Existing Zoning - Hylebos Segment
 Fife Shoreline Master Plan
 Fife, WA

5-7-10 Community Development
 GIS
 OTHM has not been precisely mapped.



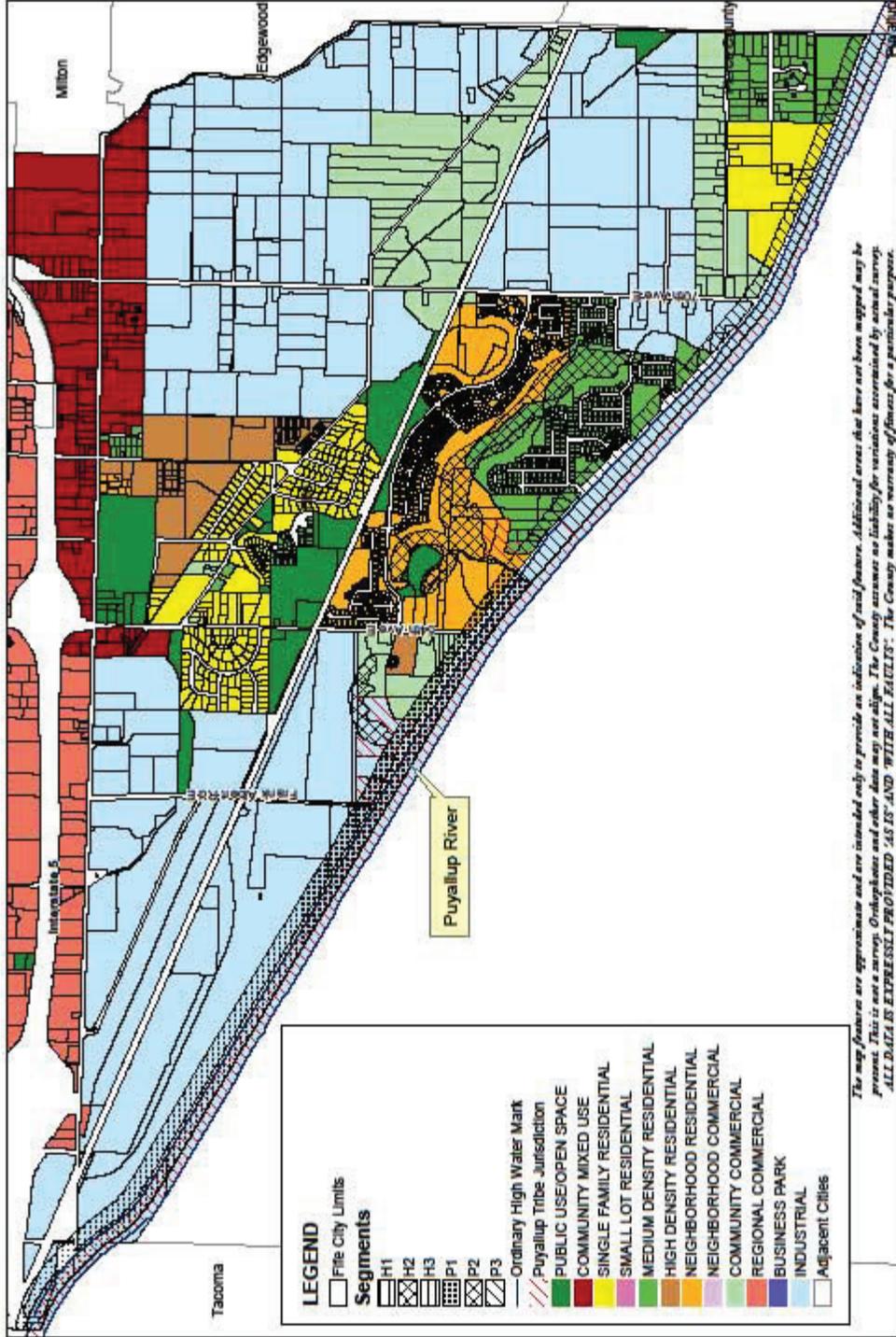
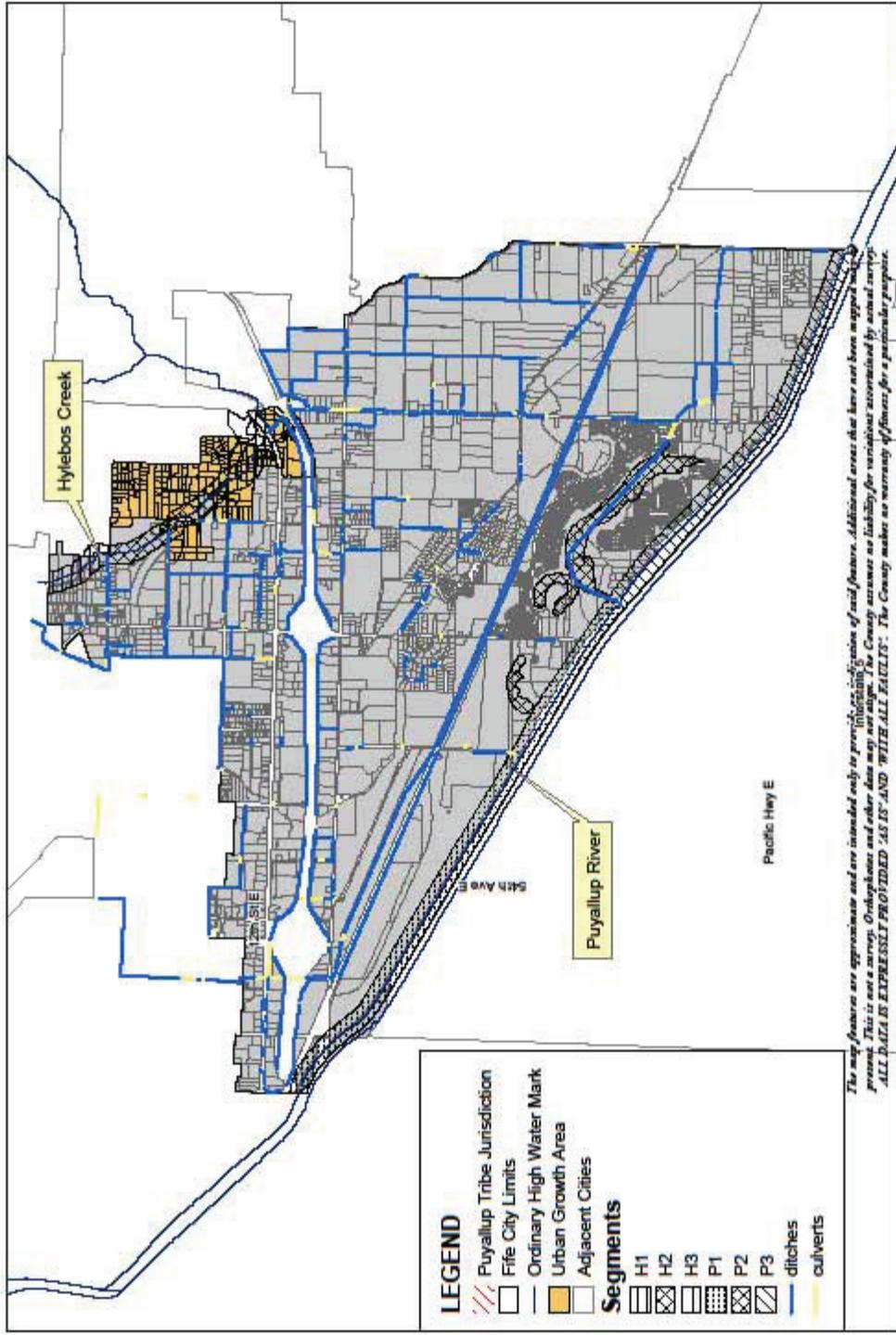


FIGURE 4B
 Existing Zoning -Puyallup Segment
 Fife Shoreline Master Plan
 Fife, WA

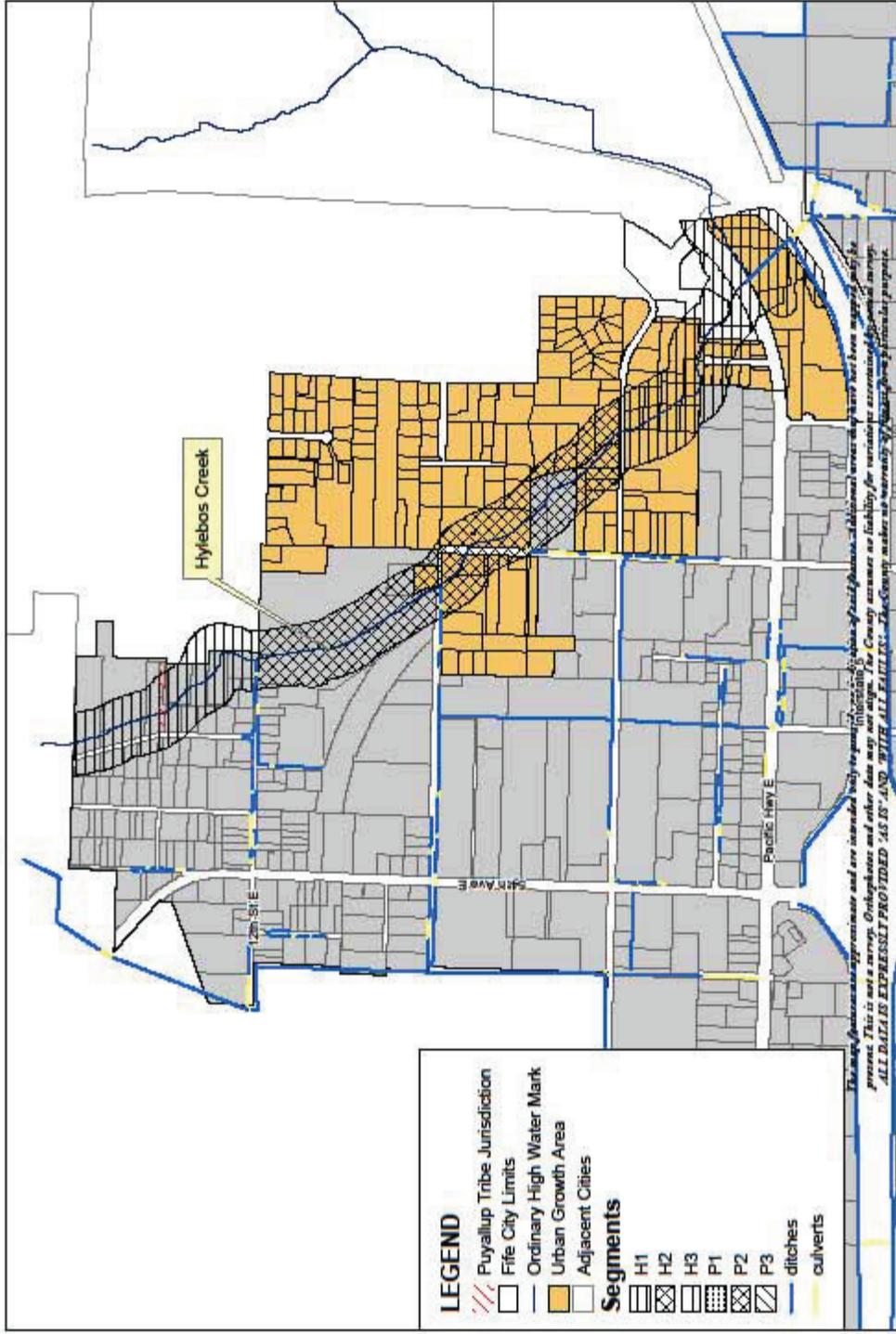


Source: Pierce County and City of Fife GIS data

FIGURE 5
 Storm Water
 Fife Shoreline Master Plan
 Fife, WA

5-1-10 Community Development
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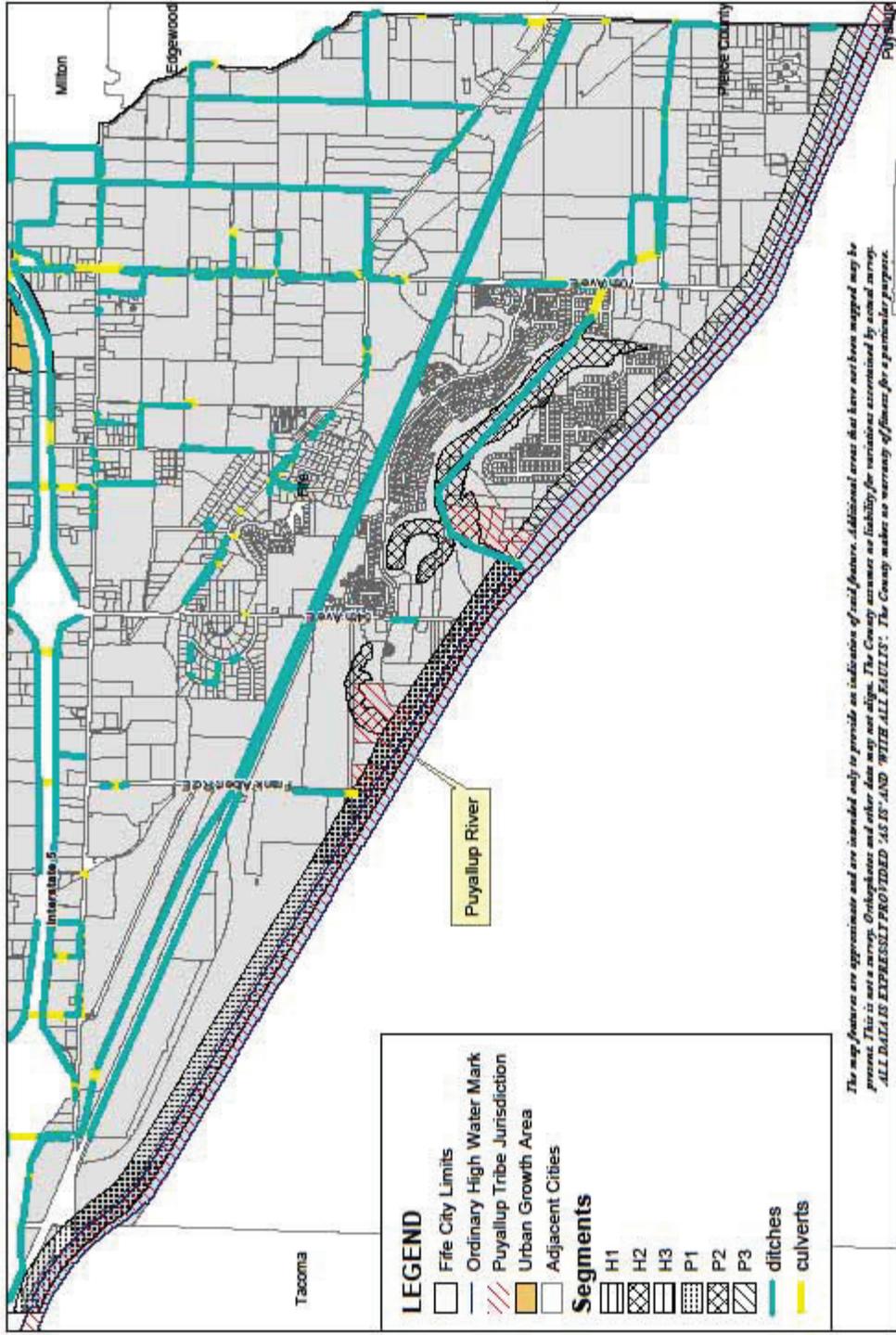


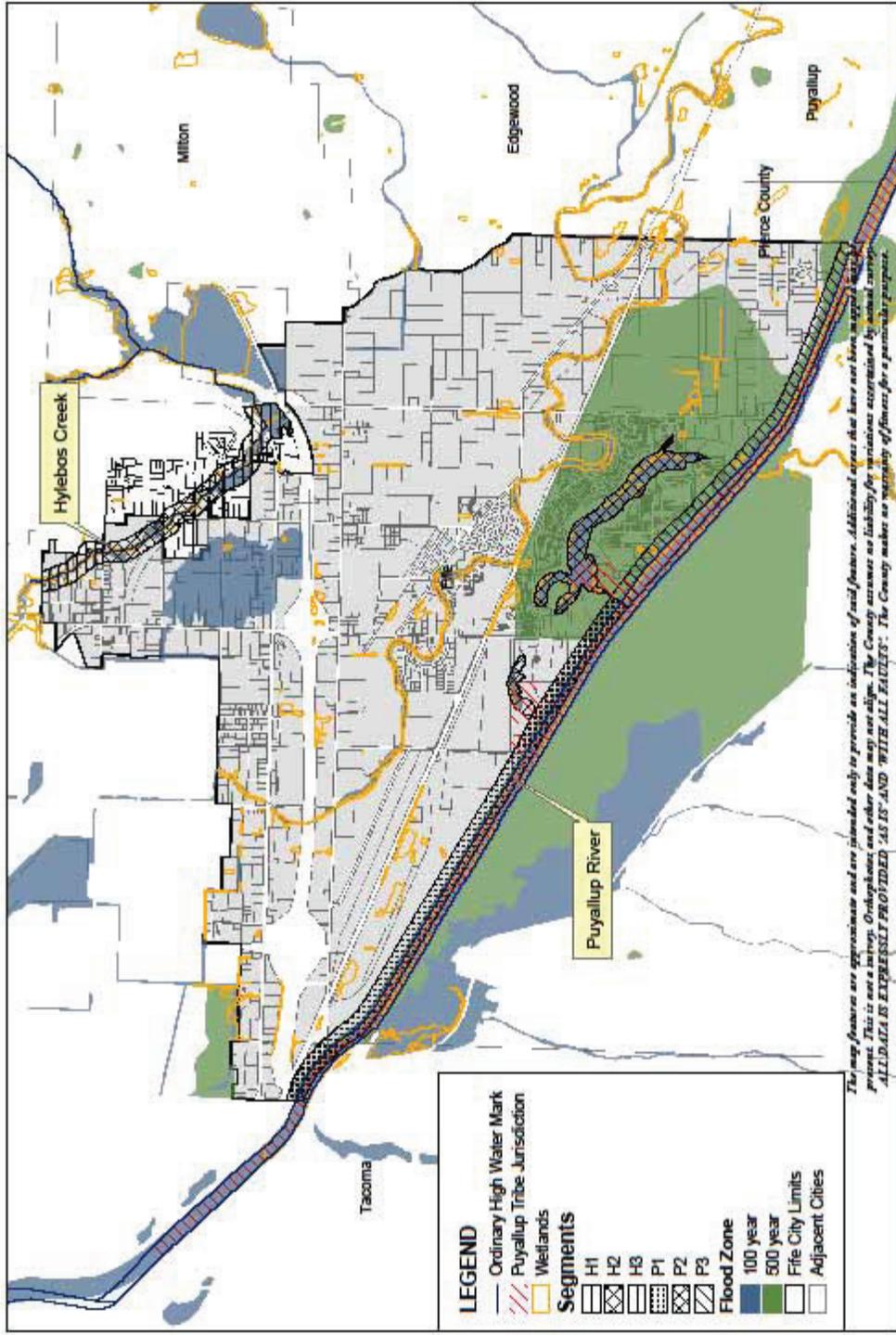
Source: Pierce County and City of Fife GIS data

FIGURE 5A
 Storm Water -Hylebos Segment
 Fife Shoreline Master Plan
 Fife, WA



© 2018 Community Development
 CDDMM has not been precisely mapped.





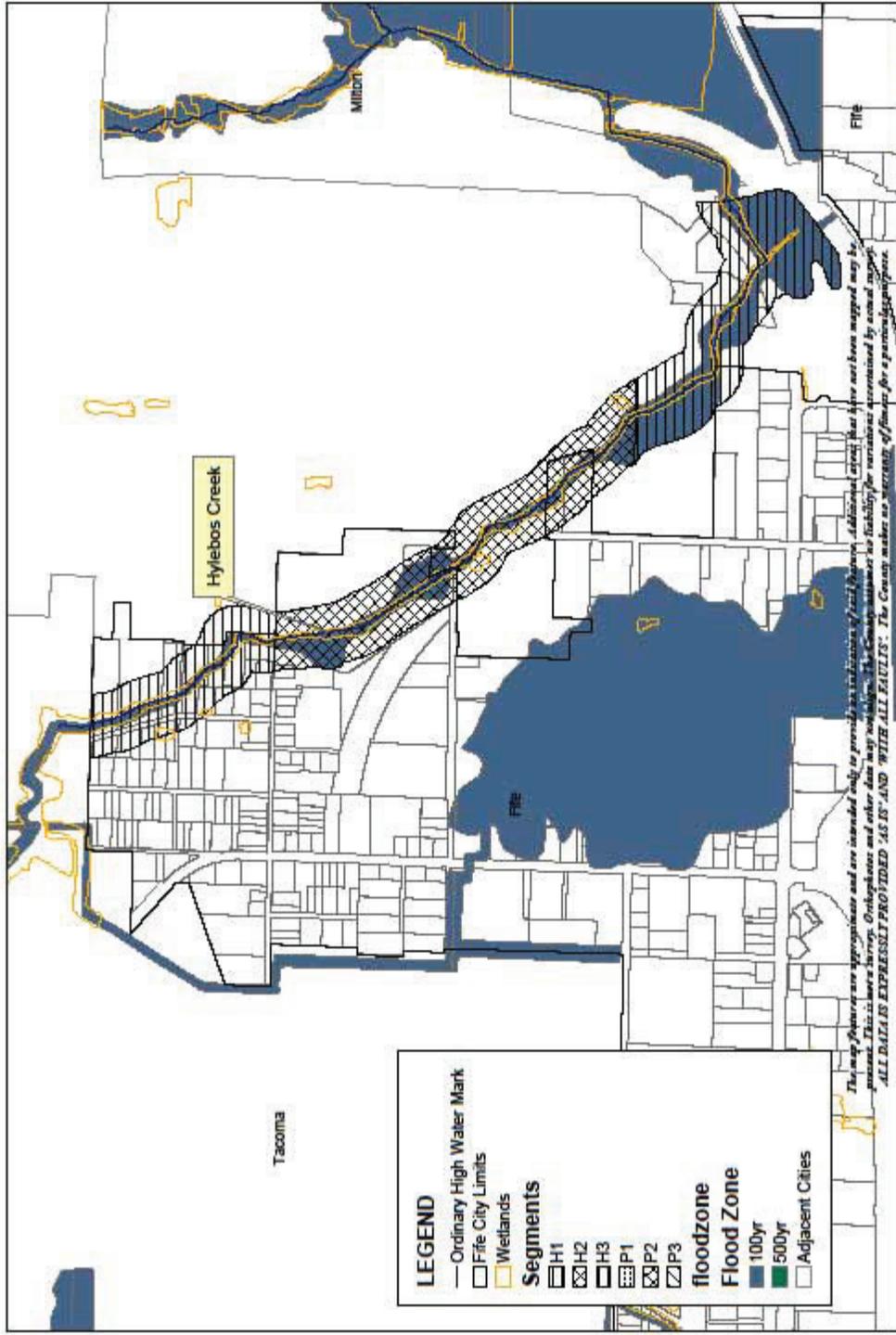
Source: Pierce County and City of Fife GIS data

FIGURE 6

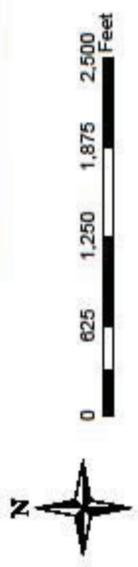
Critical Areas
 Fife Shoreline Master Plan
 Fife, WA



5-1-10 Community Development
 CRMM has not been precisely mapped.



Source: Pierce County and City of Fife GIS data



5-1-10 Community Development
 CRMM has not been precisely mapped.

FIGURE 6A
 Critical Areas -Hylebos Segment
 Fife Shoreline Master Plan
 Fife, WA

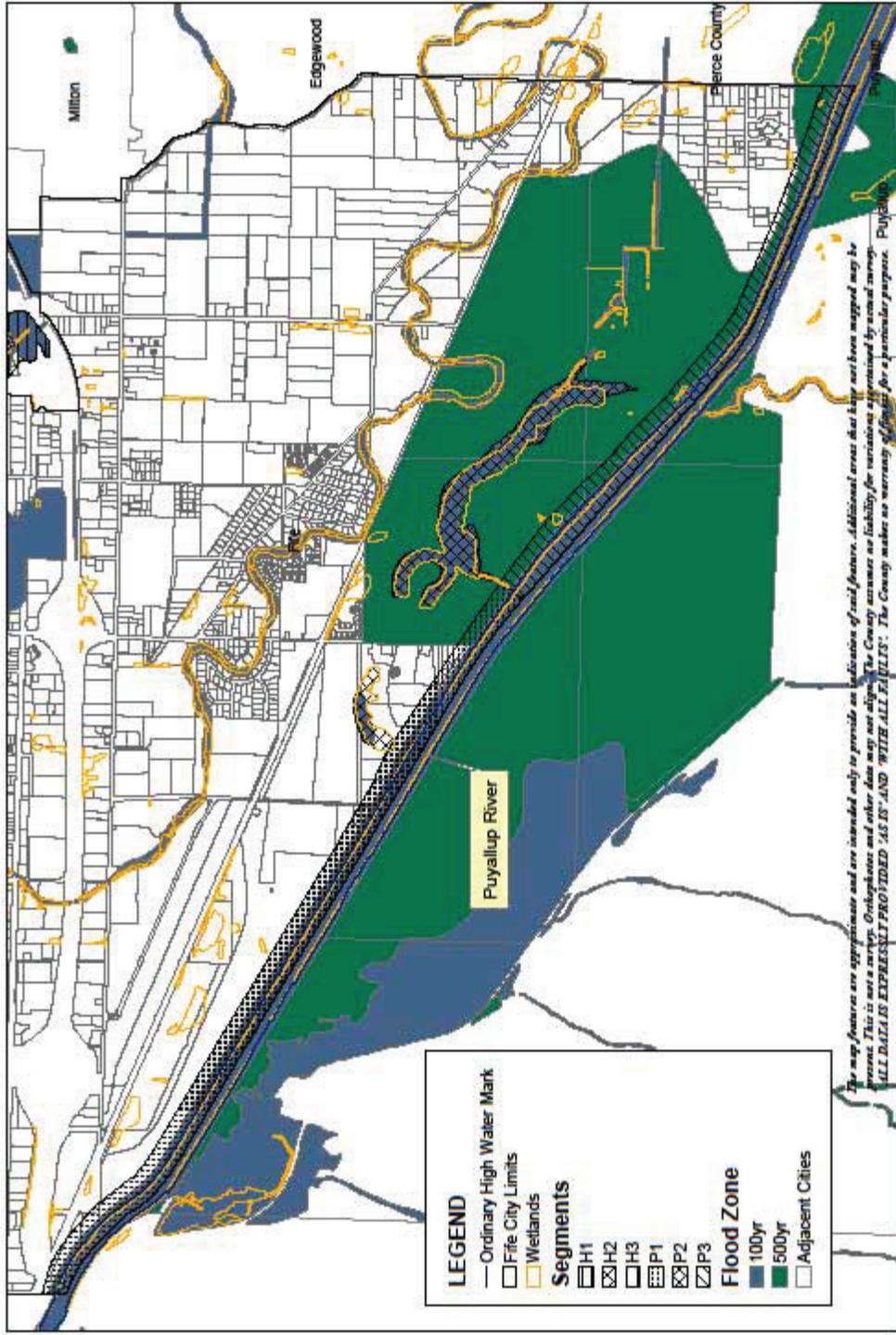


FIGURE 6B
 Critical Areas -Puyallup Segment
 Fife Shoreline Master Plan
 Fife, WA

Source: Pierce County and City of Fife GIS data

0 1,000 2,000 4,000 6,000 8,000 Feet

5-1-10 Community Development
 CDDMM has not been precisely mapped.

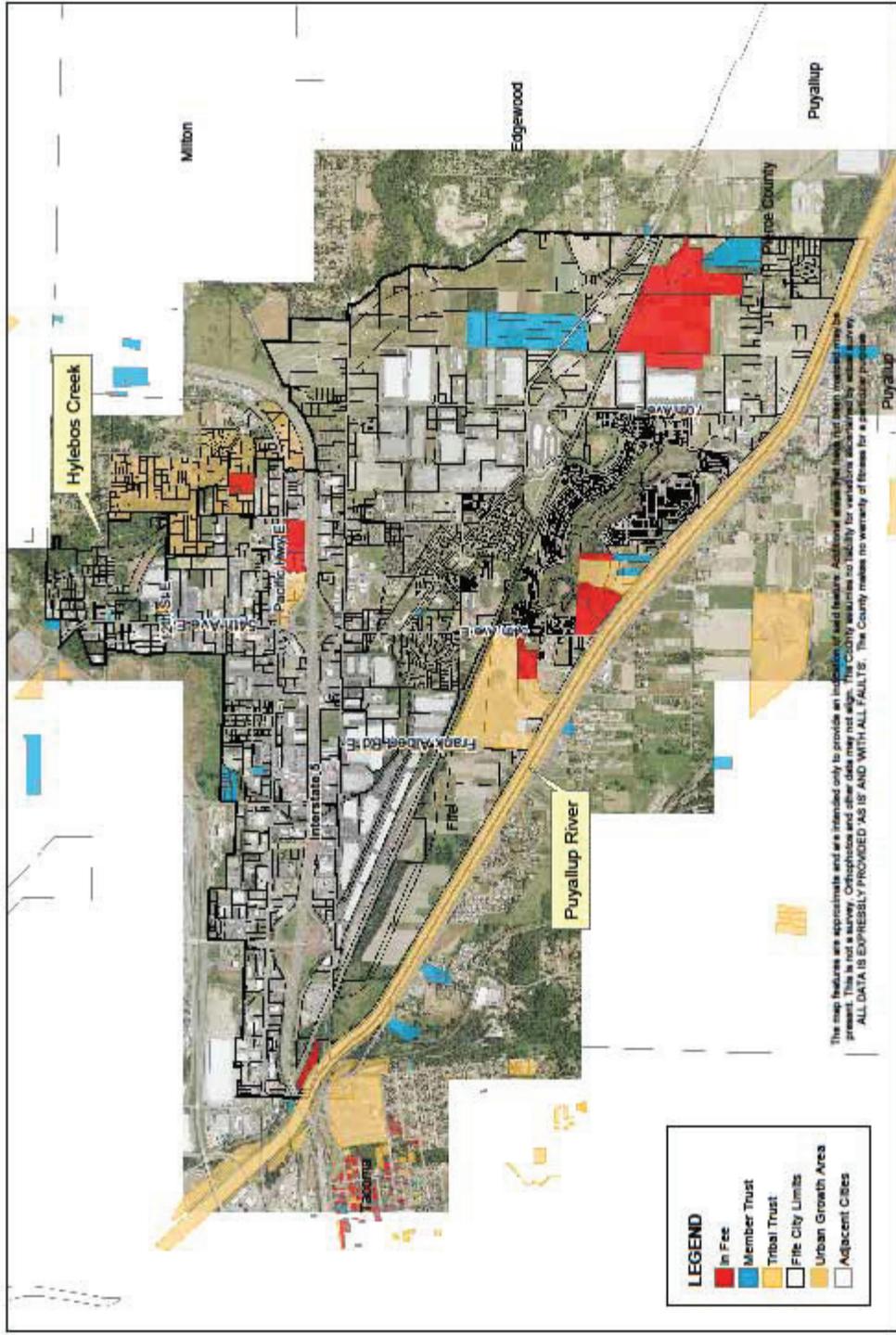


FIGURE 7
 Tribal Properties
 Fife Shoreline Master Plan
 Fife, WA

Tribal Trust property is solely governed by the Puyallup Tribe and the City of Fife has no jurisdiction over those areas per.

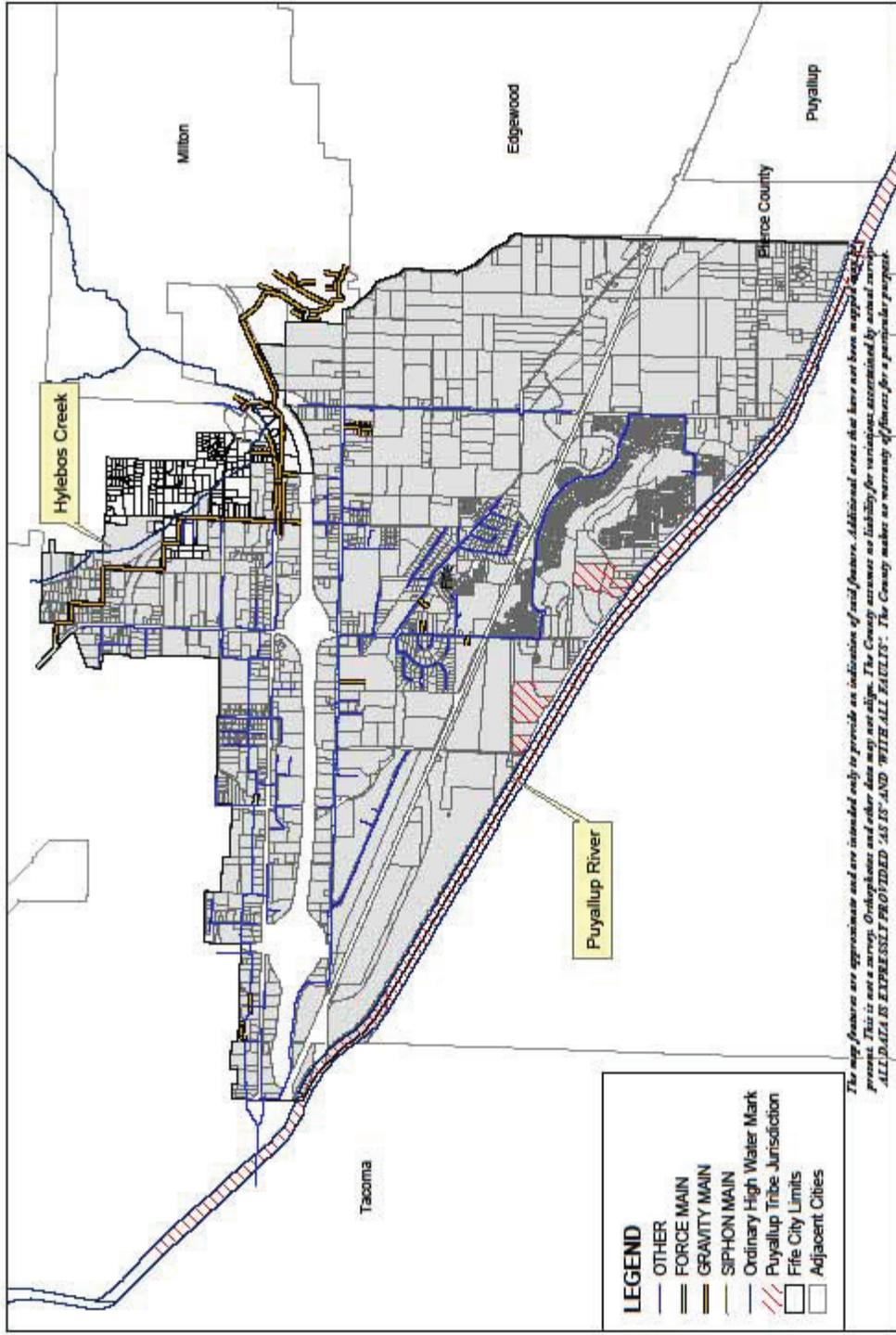


FIGURE 8
 Sewer Lines
 Fife Shoreline Master Plan
 Fife, WA

0 2,000 4,000 6,000 8,000 Feet

5-1-10 Community Development
 CDDMM has not been precisely mapped.

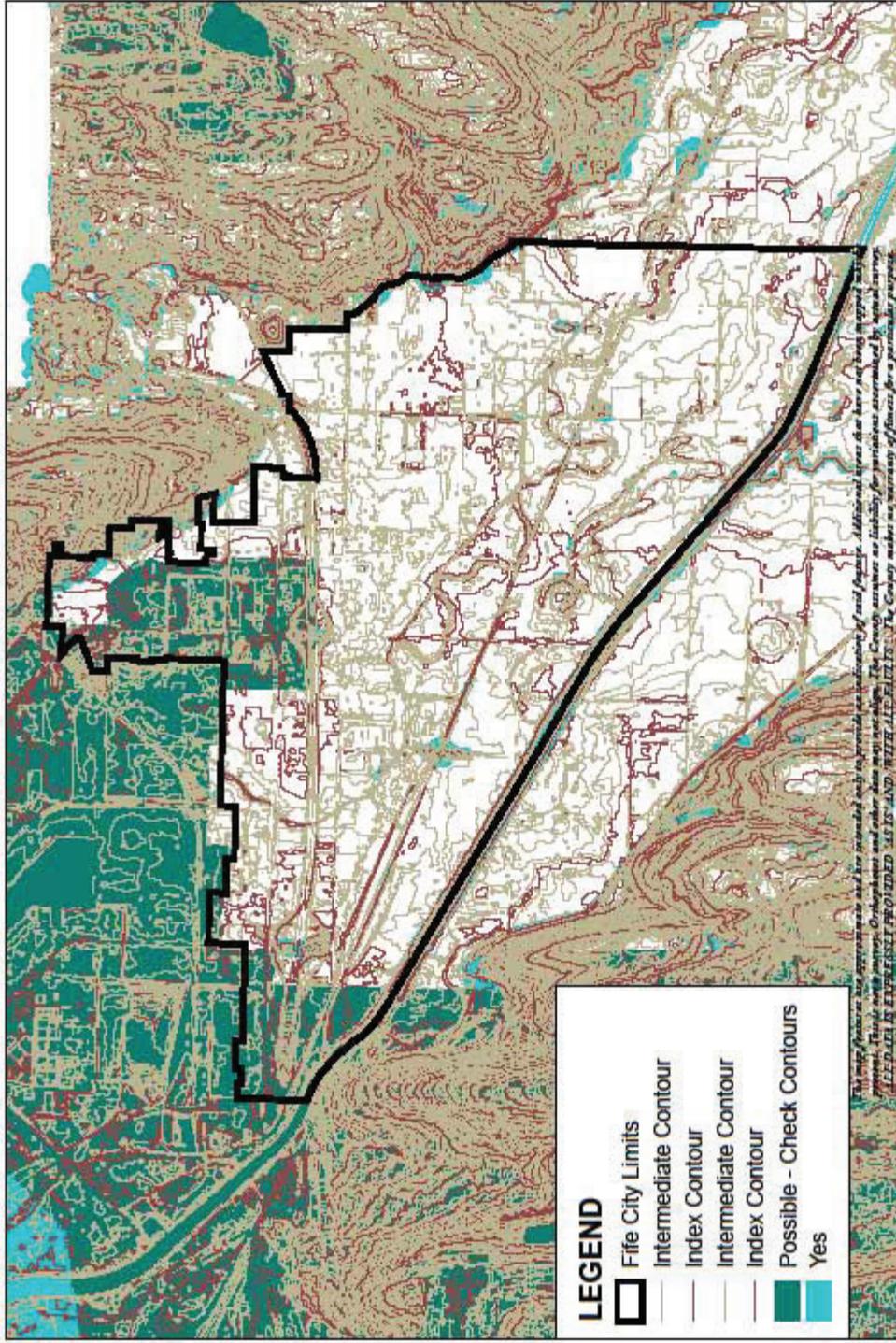
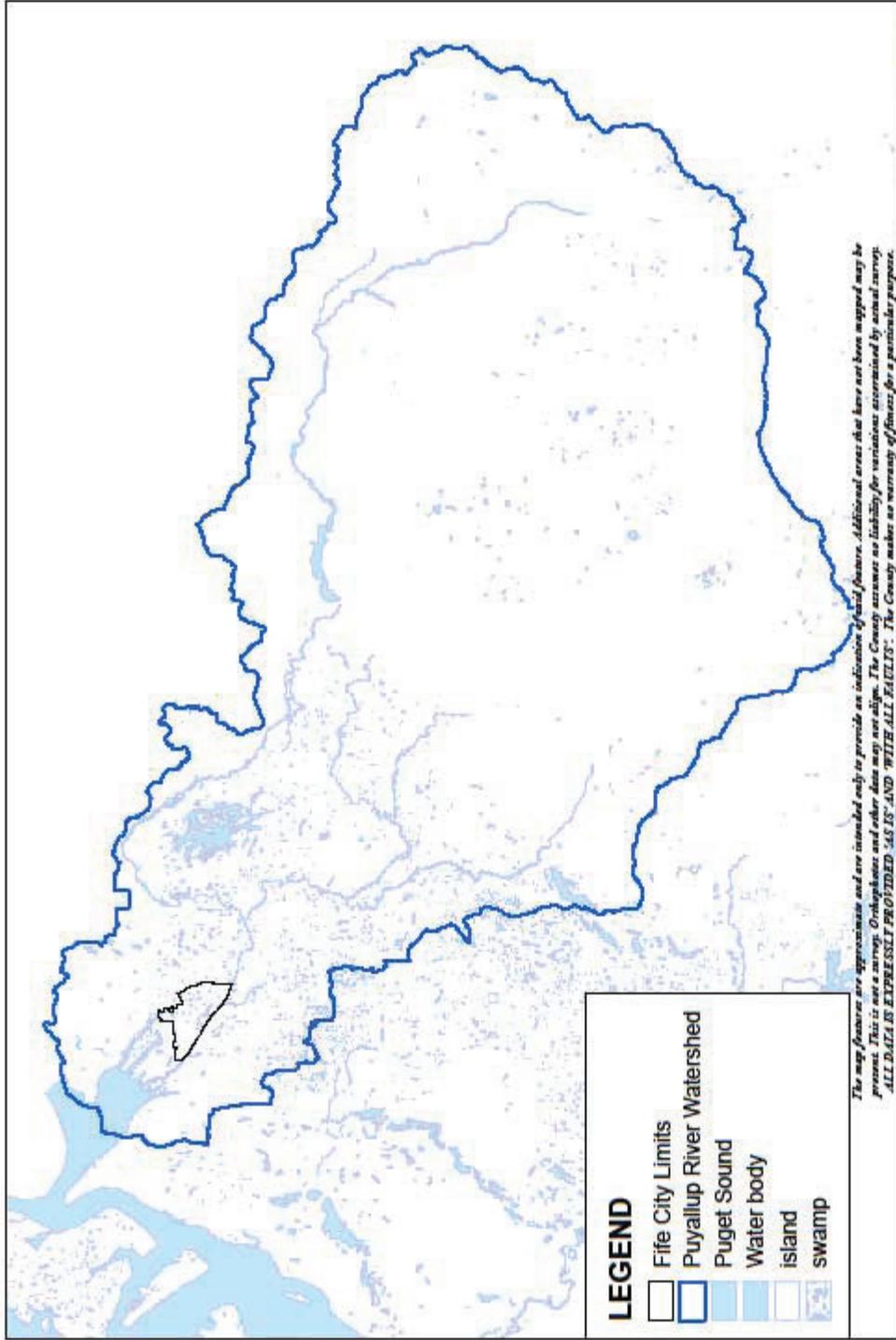


FIGURE 10
Contours & Hazard Areas
Fife Shoreline Master Plan
Fife, WA



5-1-10 Community Development
CDDMM has not been precisely mapped.

Source: Pierce County and City of Fife GIS data

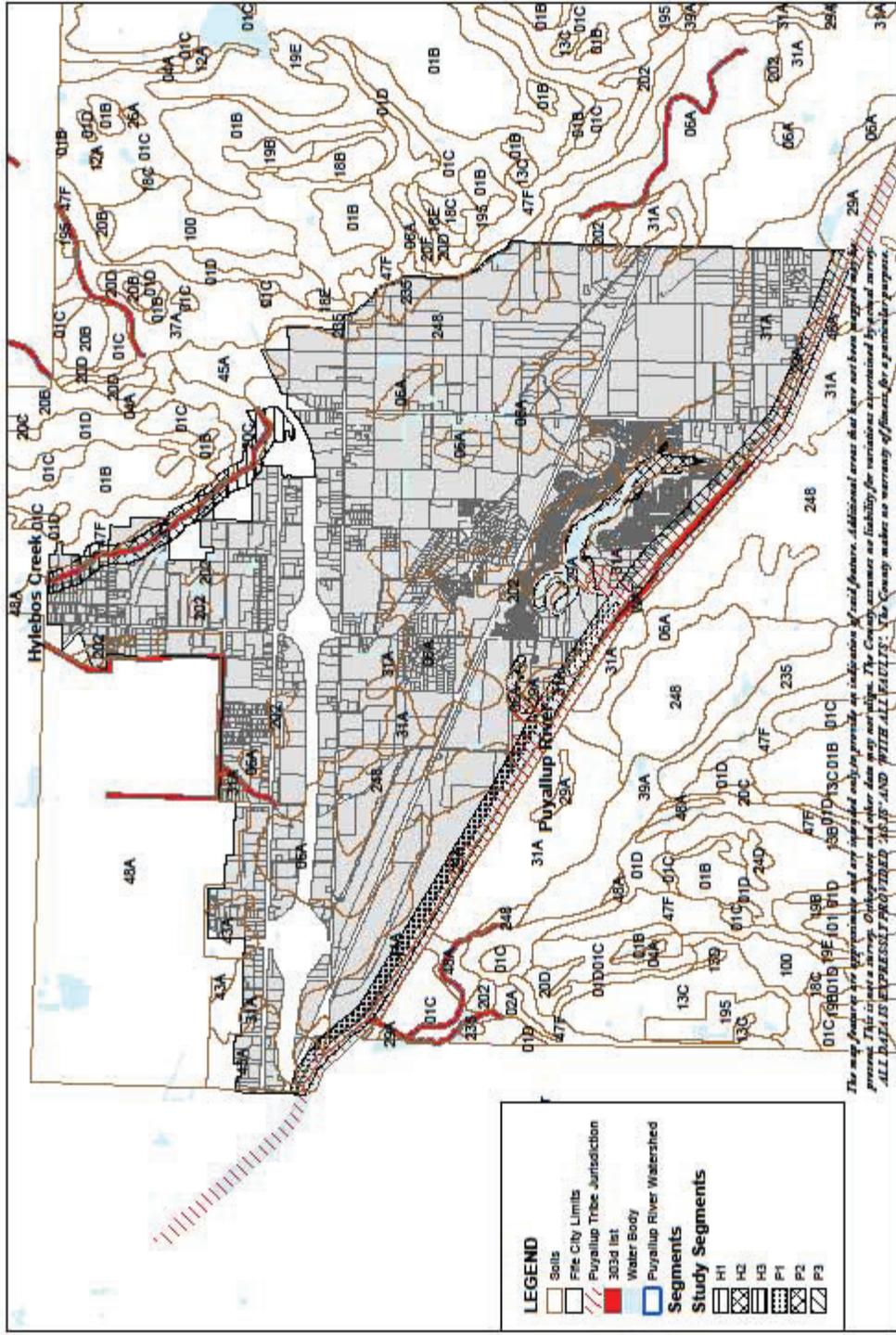


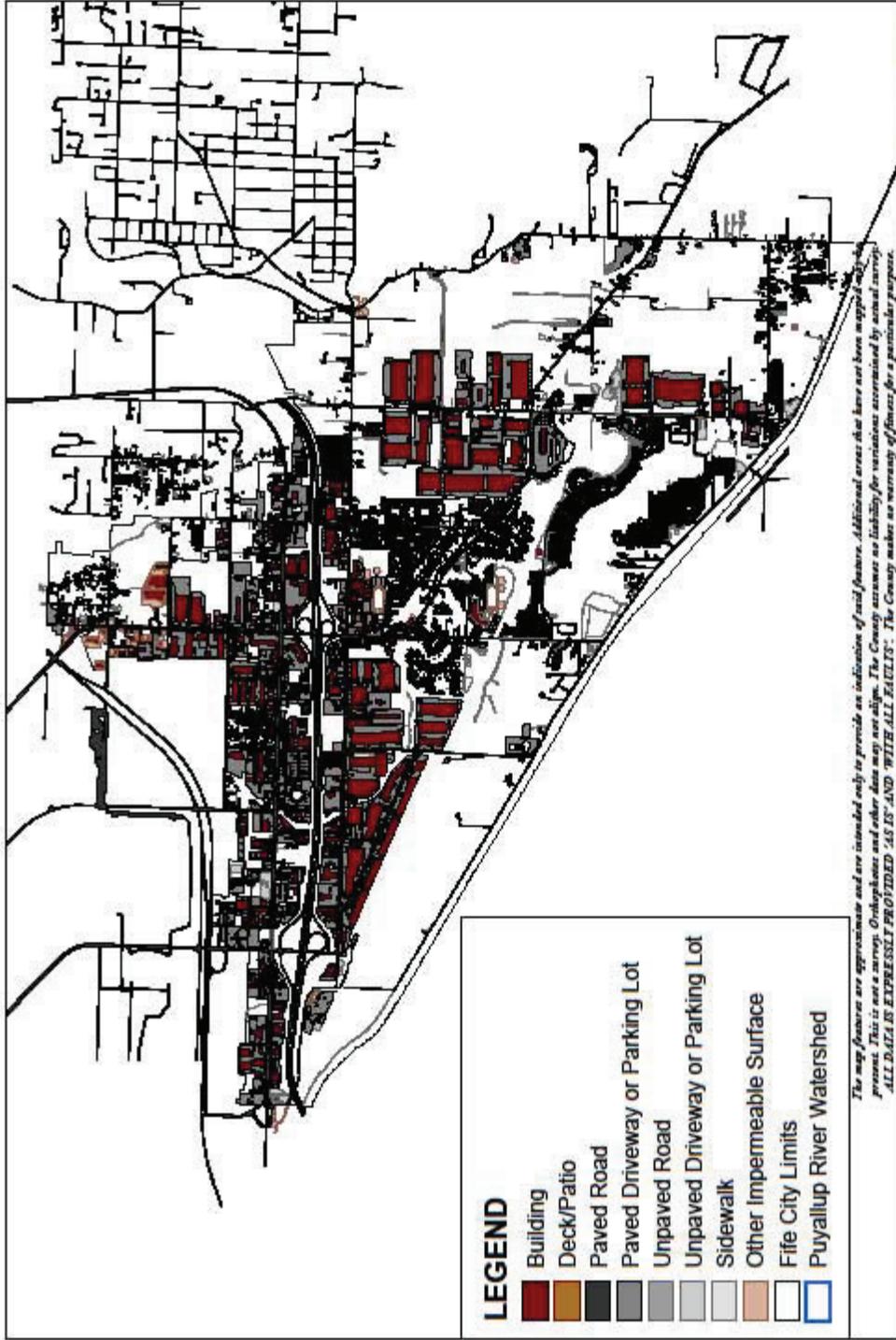
Source: Pierce County and City of Fife GIS data



FIGURE 11
 Puyallup River Watershed
 Fife Shoreline Master Plan
 Fife, WA

© 2018 Community Development
 CDDM has not been precisely mapped.





Source: Pierce County and City of Fife GIS data



FIGURE 13
 Impervious Surface
 Fife Shoreline Master Plan
 Fife, WA

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 CDDMM has not been precisely mapped.

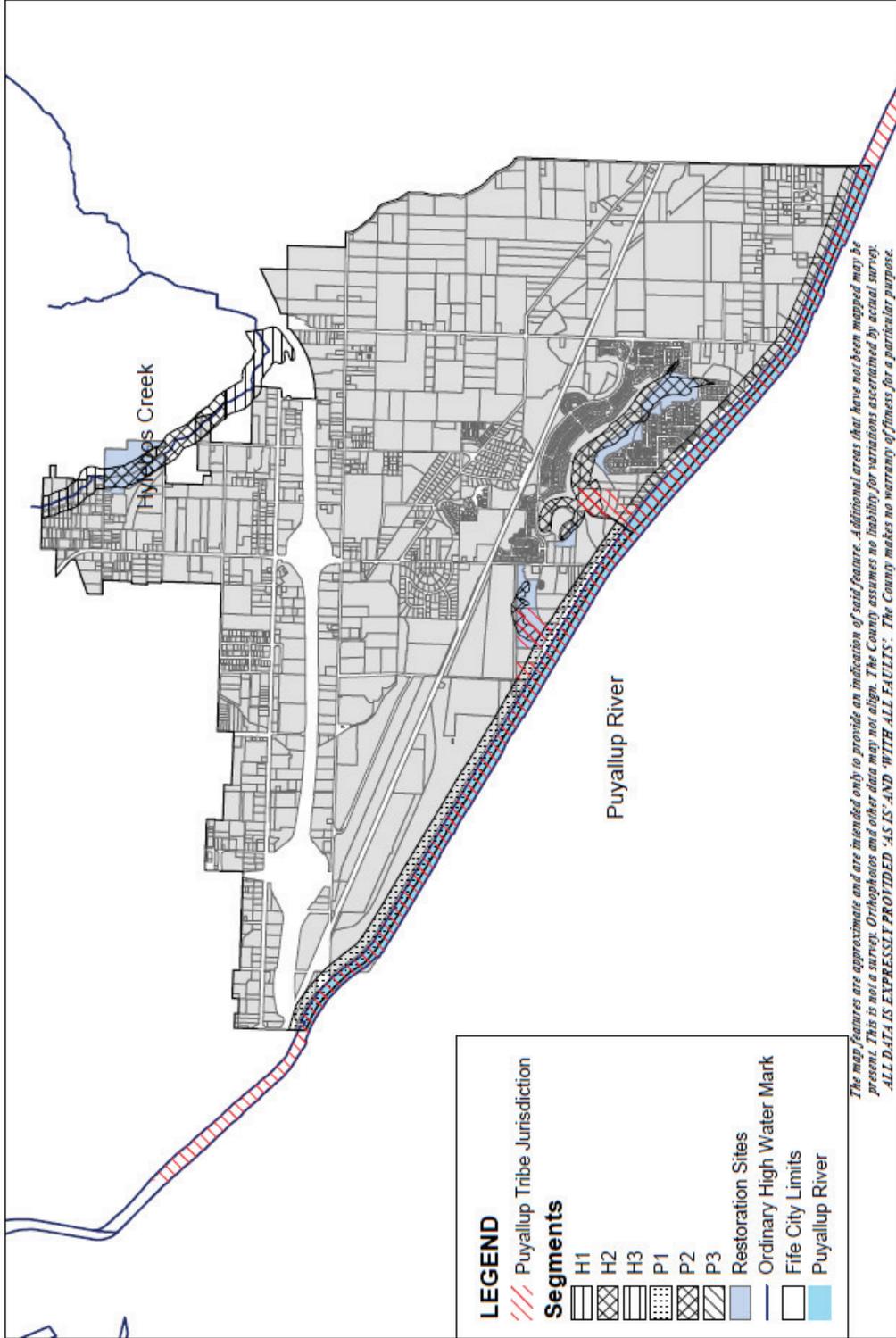


FIGURE 14 Restoration Sites Fife Shoreline Master Plan Fife, WA



6.3-10 Community Development
 CAP
 CHWM has not been precisely mapped.

Source: Pierce County and City of Fife GIS data