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Marysville Watershed Planning
Basin Assessment and Prioritization

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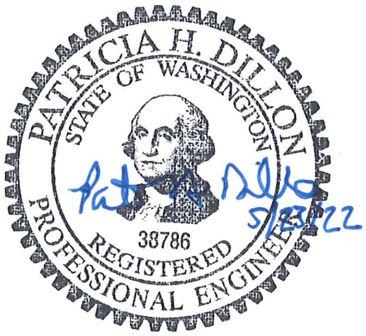

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EXECUTIVE SUMMARY

The Stormwater Problem

Stormwater is rain water that flows off of hard surfaces like roads, parking lots, lawns, and rooftops. As water flows across ground surfaces it collects pollution. Pollution from our cars like oil, tire particles, brake dust, metals, pesticides from yards, and garbage on the edge of the road are found in stormwater. In older developments, the stormwater flows into drains then through underground pipes to the nearest creek. New developments are required to build stormwater treatment facilities to clean stormwater before it reaches the creek. The following summary describes a planning project that will help clean stormwater and protect streams in Marysville.

Project Introduction

In 2020, the City of Marysville (City) started a watershed planning project. The first phase of the work is documented in the report titled, Marysville Watershed Planning Basin Assessment and Prioritization. The report describes stream conditions inside city boundaries, and ranks areas for stormwater retrofits to improve stream water quality. The final phase will develop a Stormwater Management Action Plan (SMAP) describing the stormwater retrofits.

STORMWATER RETROFITS

Stormwater retrofits are **improvements to the stormwater system** that add treatment in developed areas that **were not treated before**.

The watershed planning project will create a strategic plan to reduce pollution from getting into local streams. It will help the City to:

- Target stormwater retrofit projects that will quickly provide benefits to areas with the most potential for restoration;
- Construct stormwater retrofits now rather than waiting for redevelopment;
- Make sure tax dollars are spent in a fair and equitable manner; and
- Involve the public in decision making activities, like approving stormwater retrofits and programs.

Stormwater Management in Marysville

The City manages a stormwater system with over 280 miles of pipes and ditches and nearly 1,000 stormwater facilities. Stormwater drains into 50 miles of streams. The main watersheds include **Quilceda Creek** (shown in green on the map in Figure ES-1), **Allen Creek** (yellow), and **Ebey Slough** in the Snohomish River estuary (blue). The larger watersheds were divided into 24 subbasins based on

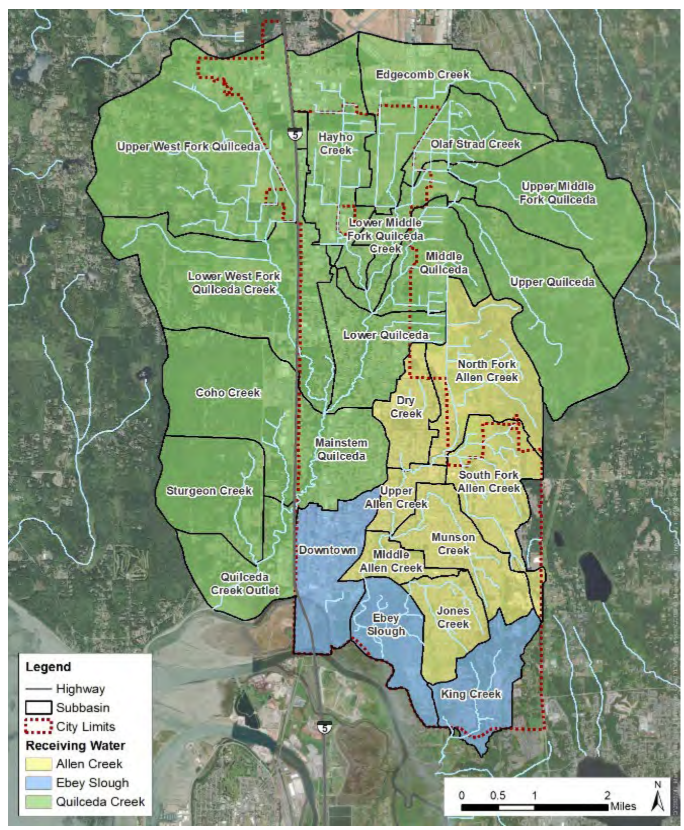


Figure ES-1. Marysville Subbasins

the smaller creeks (named for the creeks in that subbasin), shown in Figure ES-1. Some of the subbasins extend outside the city limits.

Project Approach

Existing data were reviewed from multiple sources, including mapping, stream monitoring, and hydrologic modeling. The data described land use conditions, existing stormwater treatment, soils and geology, water quality, and fish species. The data were used to decide if conditions in the streams are healthy or damaged. Data related to environmental justice and social equity was also evaluated. The review considered whether certain groups (minority, low-income, tribal, or indigenous populations) could experience a disproportionate environmental harm or risk in certain areas of the City.

The data analysis determined where water quality or ecological concerns exist and where new projects could provide the most benefit to streams. Following guidance from the Washington Department of Ecology (Ecology), the data was used to score each subbasin. The scores show the level of environmental importance and level of human impact in each subbasin.

Project Outcomes

The subbasin scores were then used prioritize the subbasins for action. Initial results were presented to local stakeholders (City staff, Ecology, Snohomish County, local non-profit groups, and the Tulalip Tribes) as part of a public process. After the staff discussions and input from stakeholders, the City decided to prioritize areas with a high level of environmental importance that have also been impacted by development.

Figure ES-2. Basins prioritized for restoration-based actions

Five subbasins were identified as having high environmental importance: Middle Allen Creek, Lower Quilceda Creek, Munson Creek, Hayho Creek, and Middle Quilceda Creek. Three of these—listed in Figure ES-2—were then chosen as the focus for initial retrofit and stormwater action planning. These subbasins were selected because they do not have good stormwater treatment, have potential project sites owned by the City, and offer chances to improve stream quality. The City will also target the Downtown basin for water quality programs to address higher environmental risks. The City plans to focus the upcoming Stormwater Management Action Plan (SMAP) on these priority areas.

TABLE OF CONTENTS

LIST OF TABLES IN TEXT

LIST OF FIGURES IN TEXT

APPENDICES

1 INTRODUCTION

The deleterious influence of urbanization on small streams has been extensively documented over the past several decades and is of particular interest and concern in western Washington due to impacts on endangered salmonids. The transition of a watershed from its natural forested state to a predominantly urban condition encompasses removal of vegetation and canopy, compaction of soils, creation of impervious surfaces, introduction of pollutants, and alteration of natural drainage networks. Managing the impacts of runoff from urban areas (i.e., “stormwater”) on natural systems has become a major focus of the Washington State Department of Ecology (Ecology), with regulations continually evolving to protect and restore stream hydrology, water quality, and ecological function.

The City of Marysville (City) manages stormwater within the city limits, encompassing runoff from approximately 20 square miles and including 50 miles of streams. The City’s municipal separate storm sewer system (MS4) consists of approximately 288 miles of pipes and ditches and nearly 1,000 stormwater facilities. As a condition of its NPDES Phase 2 municipal stormwater permit, the City is required to perform a citywide watershed assessment, prioritize watersheds for retrofits and other stormwater management actions, and develop a Stormwater Management Action Plan (SMAP) for a priority watershed. This report documents the receiving waters assessment and basin prioritization process.

2 RECEIVING WATERS ASSESSMENT

The City of Marysville includes portions of the Quilceda and Allen Creek watersheds, as well as areas that drain directly to Ebey Slough in the Snohomish River estuary (Figure 2.1). Runoff from headwater areas of Quilceda Creek enters the city from the west and northeast; the north fork of Allen Creek also drains areas outside the city. Quilceda Creek outlets to Ebey Slough downstream of the city limits, and inflows from the Coho Creek and Sturgeon Creek tributaries enter the mainstem downstream of the city limits.

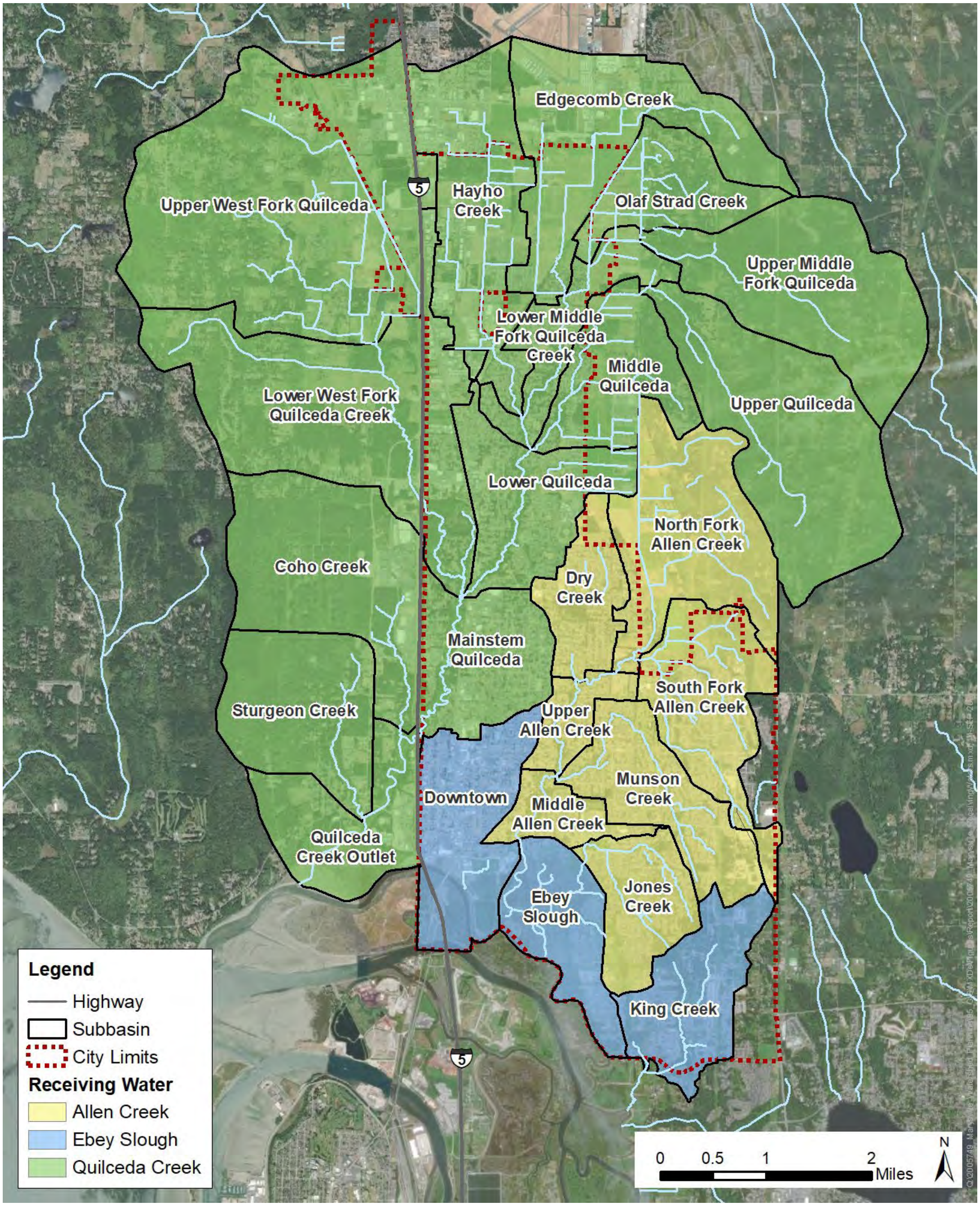


Figure 2.1 Marysville Subbasins and Receiving Waters

Runoff from two small areas along the eastern boundary of the city flows to the Lake Stevens/Catherine Creek drainage; due to their small size, these areas were not considered in the assessment or planning aspects of this study.

2.1 Planning Unit Delineation

The major receiving water basins were broken up into 24 smaller subbasins or planning units, as shown in Figure 2.1. Previous basin delineations by Snohomish County for watershed modeling were combined and modified based on the mapped stormwater network and updated topography. As mentioned above, several of the subbasins are wholly outside city limits. These areas will be excluded from basin prioritization and stormwater planning but are included in the receiving water assessment for completeness. Table 2.1 summarizes the drainage area and in-city area for the 24 subbasins.

Table 2.1 Planning Unit Areas

Receiving Water	Subbasin/Planning Unit	Area (ac)	Percent in City (%)
Allen Creek	Dry Creek	617	88%
Allen Creek	Jones Creek	733	100%
Allen Creek	Middle Allen Creek	365	100%
Allen Creek	Munson Creek	1,015	100%
Allen Creek	North Fork Allen Creek	1,596	9%
Allen Creek	South Fork Allen Creek	1,176	82%
Allen Creek	Upper Allen Creek	329	100%
Ebey Slough	Downtown	1,186	99%
Ebey Slough	Ebey Slough	811	99%
Ebey Slough	King Creek	953	94%
Quilceda Creek	Coho Creek	1,840	0%
Quilceda Creek	Edgecomb Creek	1,792	32%
Quilceda Creek	Hayho Creek	1,664	63%
Quilceda Creek	Lower Middle Fork Quilceda	674	77%
Quilceda Creek	Lower Quilceda	1,114	88%
Quilceda Creek	Lower West Fork Quilceda	2,863	24%
Quilceda Creek	Mainstem Quilceda	1,015	96%
Quilceda Creek	Middle Quilceda	964	23%
Quilceda Creek	Olaf Strad Creek	770	5%
Quilceda Creek	Quilceda Creek Outlet	998	0%
Quilceda Creek	Sturgeon Creek	1,298	0%
Quilceda Creek	Upper Middle Fork Quilceda	1,854	0%
Quilceda Creek	Upper Quilceda	2,199	0%
Quilceda Creek	Upper West Fork Quilceda	4,078	22%

2.2 Data Review and Development

To assess receiving water conditions, the planning team compiled available geographic, monitoring, and modeling data. Available information included water quality and biological monitoring data, hydrologic modeling, Puget Sound Watershed Characterization assessments, stormwater facilities and ages, and geospatial data including hydrography, geology, land use, and land cover. Appendix A summarizes the data sources used for the assessment.

Most of the GIS data used for subbasin characterization were provided by the City. These data sets included:

- Hydrography, including streams and wetlands
- Stormwater system mapping, including stormwater facilities and attributes
- Land cover mapping (including impervious and forest cover categories; see description below)
- Zoning

City GIS data were supplemented by LiDAR topography, surface geology, and aerial photos obtained from public data sources. The team also used baseline data to develop supplemental datasets mapping infiltration capacity and levels of stormwater treatment. Brief summaries of the data development are provided below.

- **Stormwater Treatment Level.** The team used facility ages to estimate the likely effectiveness of water quality and flow control treatment provided by existing stormwater facilities. Due to changes in stormwater regulations, newer facilities are significantly more protective of downstream flow and water quality than older ones. Using available design or construction dates provided by the City, facilities were classified as providing significant (2010 or later, consistent with current standards, including LID), moderate (1998-2010, subject to flow duration control), or limited (pre flow duration standard) treatment compared to current standards. Approximate drainage areas to each facility (or group of similarly-aged facilities) were delineated to provide citywide coverage. Areas with no mapped facilities and undeveloped areas, which don't require stormwater treatment, were also separated out.

- **Infiltration Potential.** Infiltration feasibility was evaluated by overlaying GIS data layers known to influence the infiltration potential. Four factors and associated GIS data were used: surficial geology, surface slope, proximity to landslide hazards, and depth to groundwater. Both shallow and deep infiltration assessments were conducted to support identification of potential infiltration project sites during the project planning and design phase. Shallow infiltration areas within the city limits and permeable soil types outside the limits of the detailed infiltration analysis were used to characterize groundwater recharge areas. Detailed documentation of the infiltration assessment is included as Appendix B.

- **Land Cover Analysis.** City staff analyzed 2017 aerial photography using ArcGISPro to determine existing landcover within the city. Cover type categories included water, impervious surface, forest, and mixed vegetation. The process started by creating sample shapes representing the different classes. Then the imagery classification tool was run using a supervised object-based image classification. The image classification needed to be refined and rerun several times. The final image classification was then manually edited to fix larger errors.

- **Runoff Models.** Existing HSPF runoff models and basinwide land use mapping for the Quilceda and Allen Creek watersheds were obtained from Snohomish County. The models were used to evaluate hydrologic metrics linked to stream ecology at the outlets for each planning area. No runoff modeling was available for the King Creek subbasin.

The team also reviewed available water quality and benthic index of biotic integrity (B-IBI) monitoring data to evaluate instream conditions. Where sufficient sampling data were available, water quality data were compared to state standards for temperature, pH, dissolved oxygen, dissolved metals, and bacteria.

Gap Analysis

The data obtained and developed for this project, as described above, is sufficient for basin assessment and prioritization that will be performed as part of this project. The Permit emphasizes use of available data for these activities, and the available data and spatial coverage is sufficient to characterize areas within the City of Marysville, and in some cases the full receiving watersheds. Collection of additional data was thus not determined to be necessary.

2.3 Basin Characterization

The available data were reviewed and analyzed to characterize existing land use, stormwater treatment, water quality, and ecological conditions in each subbasin and receiving water. Key characteristics are presented in Table 2.2 and Table 2.3 and illustrated via the maps at the end of this section. Appendix B includes individual characterization tables for each subbasin.

Table 2.2 compares development-related characteristics – land cover and stormwater treatment – for areas within the city limits. Analysis was limited to in-city areas due to availability of land cover and stormwater system data and reflects characteristics within the area managed by the City. These characteristics are not necessarily representative of basin area outside the limits; for example, the Upper West Fork Quilceda basin is considerably less developed outside of the Marysville limits.

Table 2.3 compares water quality and ecologic metrics from available data within each subbasin. Water quality was assessed based on constituents listed on the 303(d) and 305(b) reports and based on available monitoring data relative to water quality standards. Available data (sites and constituents) varied from subbasin to subbasin, so a qualitative assessment of overall water quality was made. If a station met the state standard for a parameter then it “passed” for that parameter. If it failed to meet the standard then it got a “fail” for that parameter. Station pass/fail rankings were then aggregated by subbasin to come up with a coarse ranking amongst the basins. Subbasins that had all “pass” ratings were “good”. Subbasins where every station or all but one failed the standards that we had data for were rated “poor”. Other subbasins with a mix of “pass” and “fail” and were rated “fair”. In Table 2.3, blank entries denote a lack of data for that subbasin.

Ecological conditions were assessed based on fish use, relative hydrologic conditions based on the high pulse count (HPC) metric calculated from modeled flows, and available B-IBI scores. HPC is an indicator of flow "flashiness", which generally increases in developed watersheds and is often linked to stream erosion and channel instability. Studies in the Puget Sound region (e.g. DeGasperi et al., 2009) have found correlations between HPC and other hydrologic metrics and stream B-IBI scores. The HPC metric is specifically linked to alluvial stream response, so is not meaningful for subbasins without streams or where streams are heavily tidally influenced (like the Downtown and Ebey Slough subbasins, for example). Flows simulated using existing hydrologic models were used to compute the HPC metric for existing and forested conditions for the stream at the outlet of each subbasin. Results are presented qualitatively in Table 2.3 due to limitations in the models that would reduce the accuracy of the numerical values. For example, existing stormwater treatment is not consistently represented in the model, so there may be inconsistencies between subbasins in accounting for flow control effects. Also, since it is a stream-based metric, HPC integrates influences from the entire upstream drainage area, not just the local subbasin.

Table 2.2 Land Use/Land Cover Characteristics

Subbasin	Area (ac)	Percent in City	Land Cover (in-City) Impervious %	Land Cover (in-City) Forest %	Land Cover (in-City) Undeveloped %	Stormwater Treatment (in-City) Significant (%)	Stormwater Treatment (in-City) Moderate (%)	Stormwater Treatment (in-City) Limited (%)	Stormwater Treatment (in-City) Possibly Untreated (%)
Allen Creek									
Dry Creek	617	88%	42%	10%	6%	0%	44%	50%	0%
Jones Creek	733	100%	36%	18%	6%	1%	13%	68%	11%
Middle Allen Creek	365	100%	45%	16%	14%	3%	16%	65%	3%
Munson Creek	1,015	100%	37%	18%	0%	8%	35%	36%	0%
North Fork Allen Creek	1,596	9%	35%	8%	10%	0%	29%	61%	0%
South Fork Allen Creek	1,176	82%	31%	21%	18%	14%	33%	35%	0%
Upper Allen Creek	329	100%	41%	21%	8%	3%	2%	67%	19%
Ebey Slough									
Downtown	1,186	99%	50%	8%	0%	11%	23%	30%	36%
Ebey Slough/Lower Allen	811	99%	16%	7%	55%	14%	18%	6%	7%
King Creek	953	94%	24%	29%	0%	13%	53%	4%	30%
Quilceda Creek									
Coho Creek	1,840	0%	No in-City area.			No in-City area.			
Edgecomb Creek	1,792	32%	12%	2%	0%	2%	8%	0%	90%
Hayho Creek	1,664	63%	26%	7%	0%	4%	42%	0%	54%
Lower Middle Fork Quilceda	674	77%	36%	13%	0%	2%	3%	15%	80%
Lower Quilceda	1,114	88%	42%	9%	5%	6%	35%	12%	42%
Lower West Fork Quilceda	2,863	24%	40%	17%	21%	2%	49%	0%	28%
Mainstem Quilceda	1,015	96%	49%	10%	6%	4%	16%	68%	6%
Middle Quilceda	964	23%	35%	23%	0%	0%	40%	22%	39%
Olaf Strad Creek	770	5%	9%	1%	0%	0%	0%	0%	100%
Quilceda Creek Outlet	998	0%	No in-City area.			No in-City area.			
Sturgeon Creek	1,298	0%	No in-City area.			No in-City area.			
Upper Middle Fork Quilceda	1,854	0%	No in-City area.			No in-City area.			
Upper Quilceda	2,199	0%	No in-City area.			No in-City area.			
Upper West Fork Quilceda	4,078	22%	32%	6%	0%	14%	27%	7%	57%

Table 2.3 Water Quality and Ecological Characteristics

Subbasin	Area (ac)	Percent in City	Water Quality: 303d Listings	Water Quality: Relative WQ vs standards	Ecological Conditions: Fish Use	Ecological Conditions: Relative Hydrology (HPC)	Ecological Conditions: B-IBI
Allen Creek							
Dry Creek	617	88%			No	Poor	
Jones Creek	733	100%	1		Yes	Poor	
Middle Allen Creek	365	100%	3		Yes	Fair	
Munson Creek	1,015	100%		Fair	Yes	Poor	
North Fork Allen Creek	1,596	9%	2	Poor	Yes	Good	Poor (1)
South Fork Allen Creek	1,176	82%	1		Yes	Fair-Good	
Upper Allen Creek	329	100%	1		Yes	Fair-Good	
Ebey Slough							
Downtown	1,186	99%			No	n/a	
Ebey Slough/Lower Allen	811	99%	3	Fair	Yes	n/a	
King Creek	953	94%			Yes	n/a	
Quilceda Creek							
Coho Creek	1,840	0%	0		Yes	Good	
Edgecomb Creek	1,792	32%	1		Yes	Fair	
Hayho Creek	1,664	63%			Yes	Poor	
Lower Middle Fork Quilceda	674	77%	1		Yes	Fair	Very Poor (1)
Lower Quilceda	1,114	88%	2		Yes	Good	
Lower West Fork Quilceda	2,863	24%	3	Fair	Yes	Good	Poor (1)
Mainstem Quilceda	1,015	96%	2	Good	Yes	Good	
Middle Quilceda	964	23%	1		Yes	Good	
Olaf Strad Creek	770	5%			Yes	Good	
Quilceda Creek Outlet	998	0%	0	Fair	Yes	n/a	
Sturgeon Creek	1,298	0%	0		Yes	Good	
Upper Middle Fork Quilceda	1,854	0%	1	Good	Yes	Good	
Upper Quilceda	2,199	0%	0	Good	Yes	Good	Fair-Good (3)
Upper West Fork Quilceda	4,078	22%	3	Poor	Yes	Good	

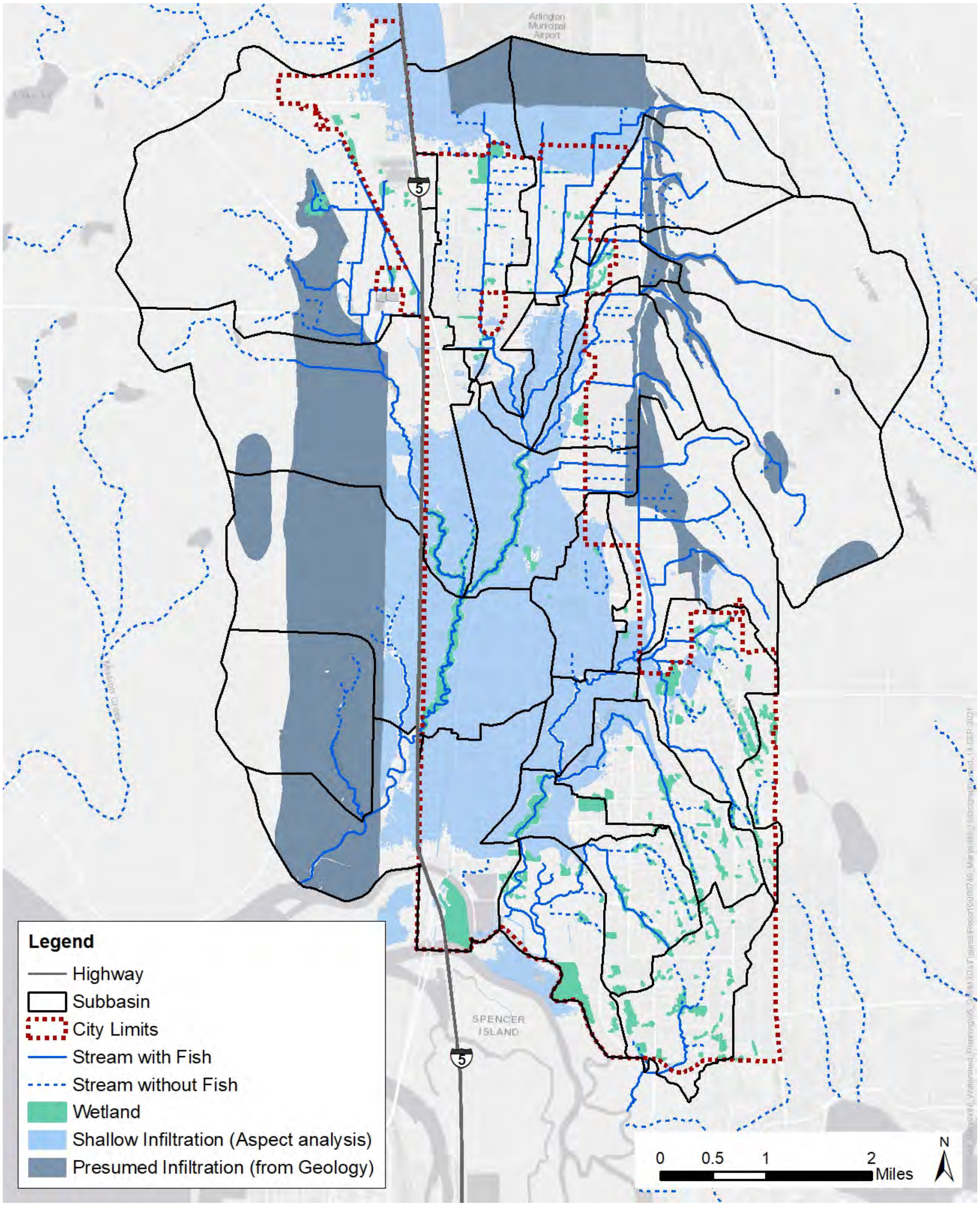


Figure 2.2 Hydrography

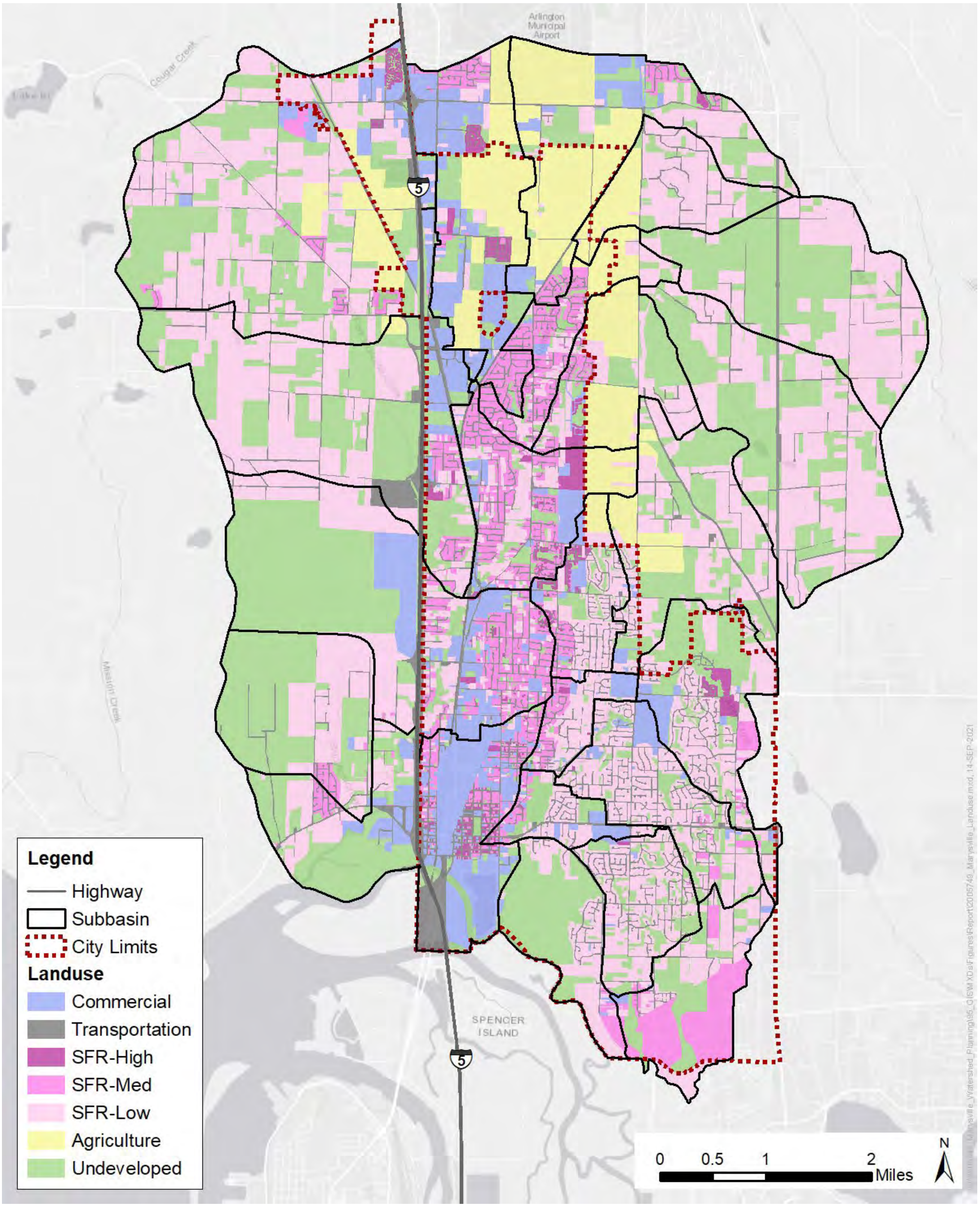


Figure 2.3 Existing Land Use

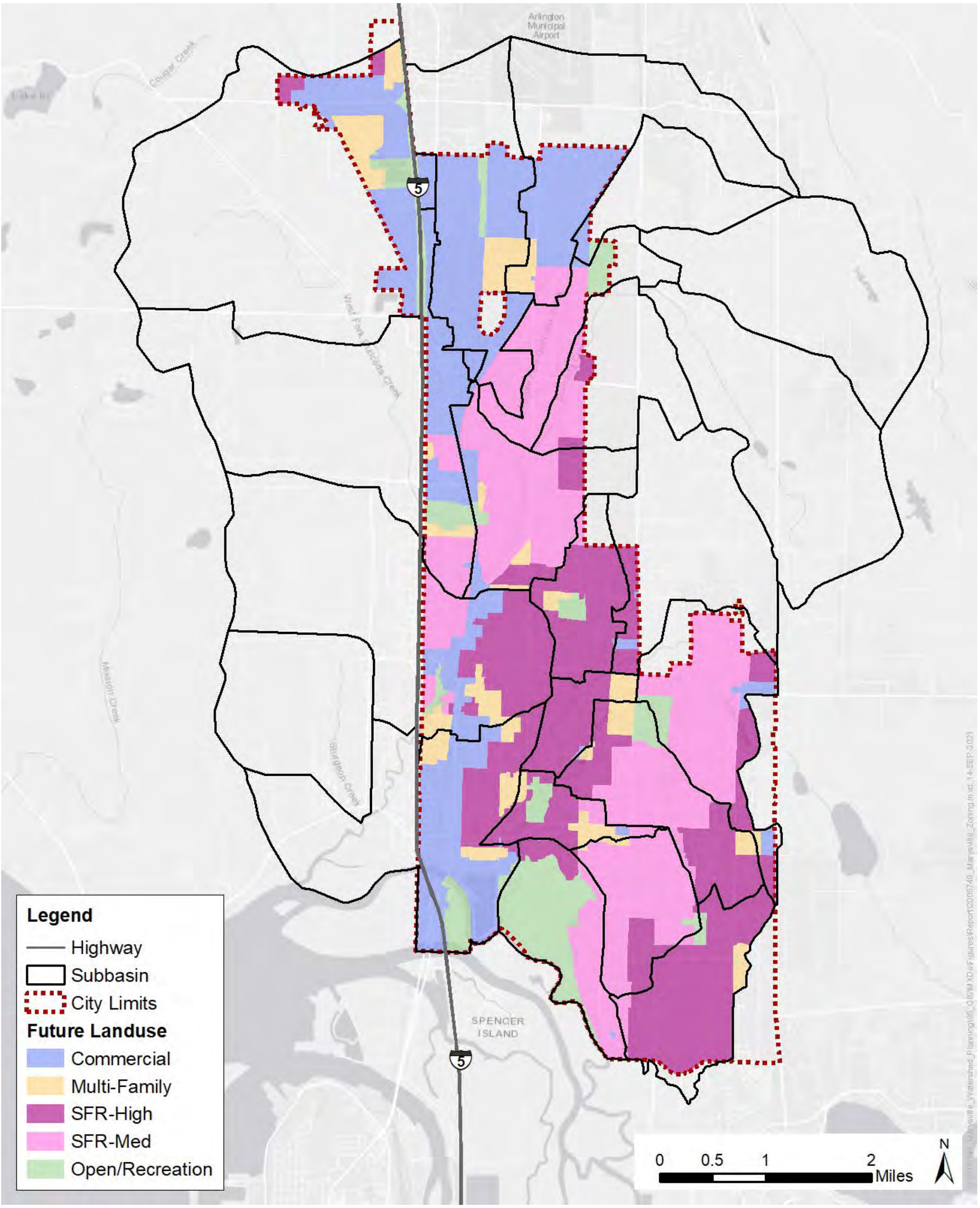


Figure 2.4 City of Marysville Zoning

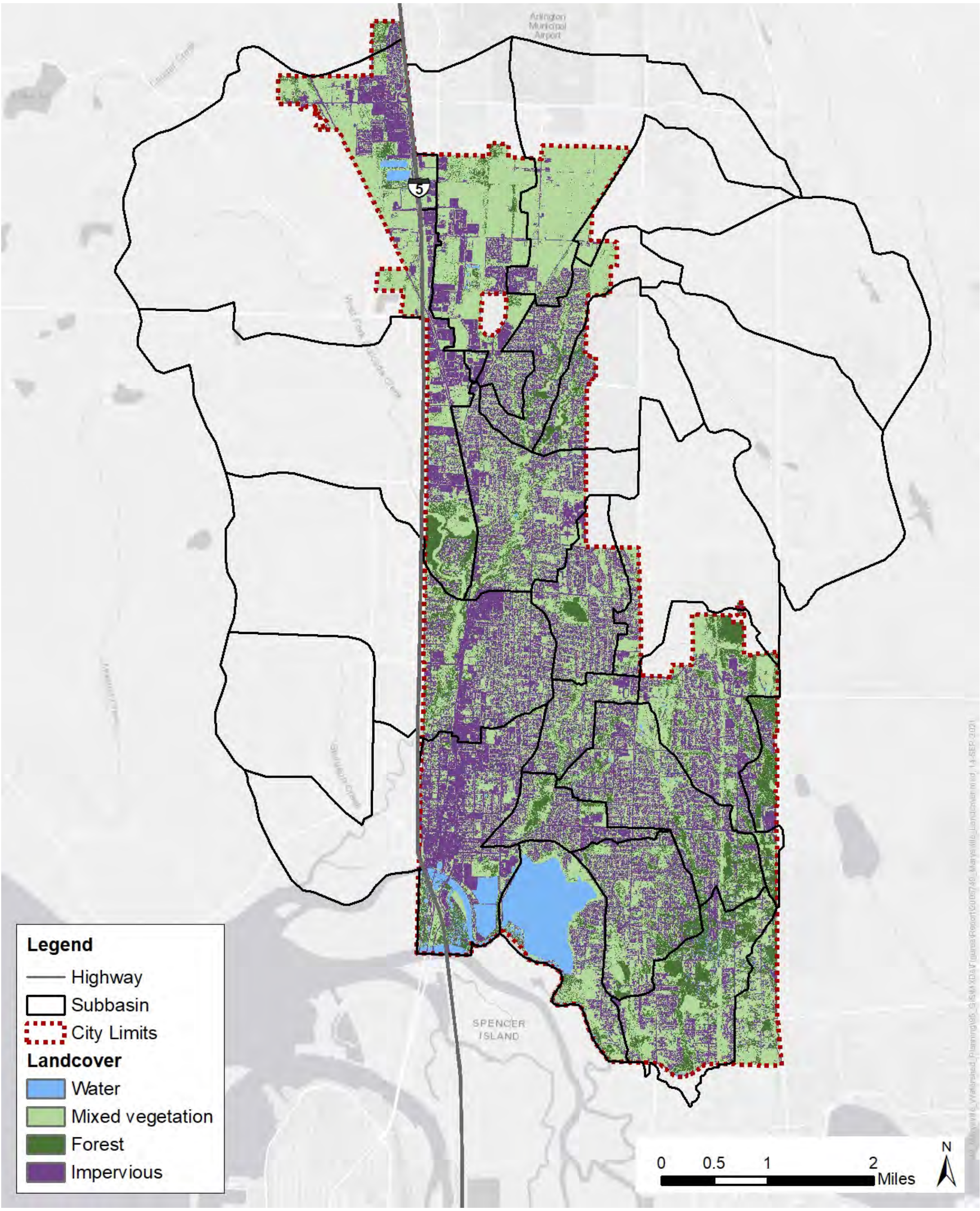


Figure 2.5 City Marysville Land Cover

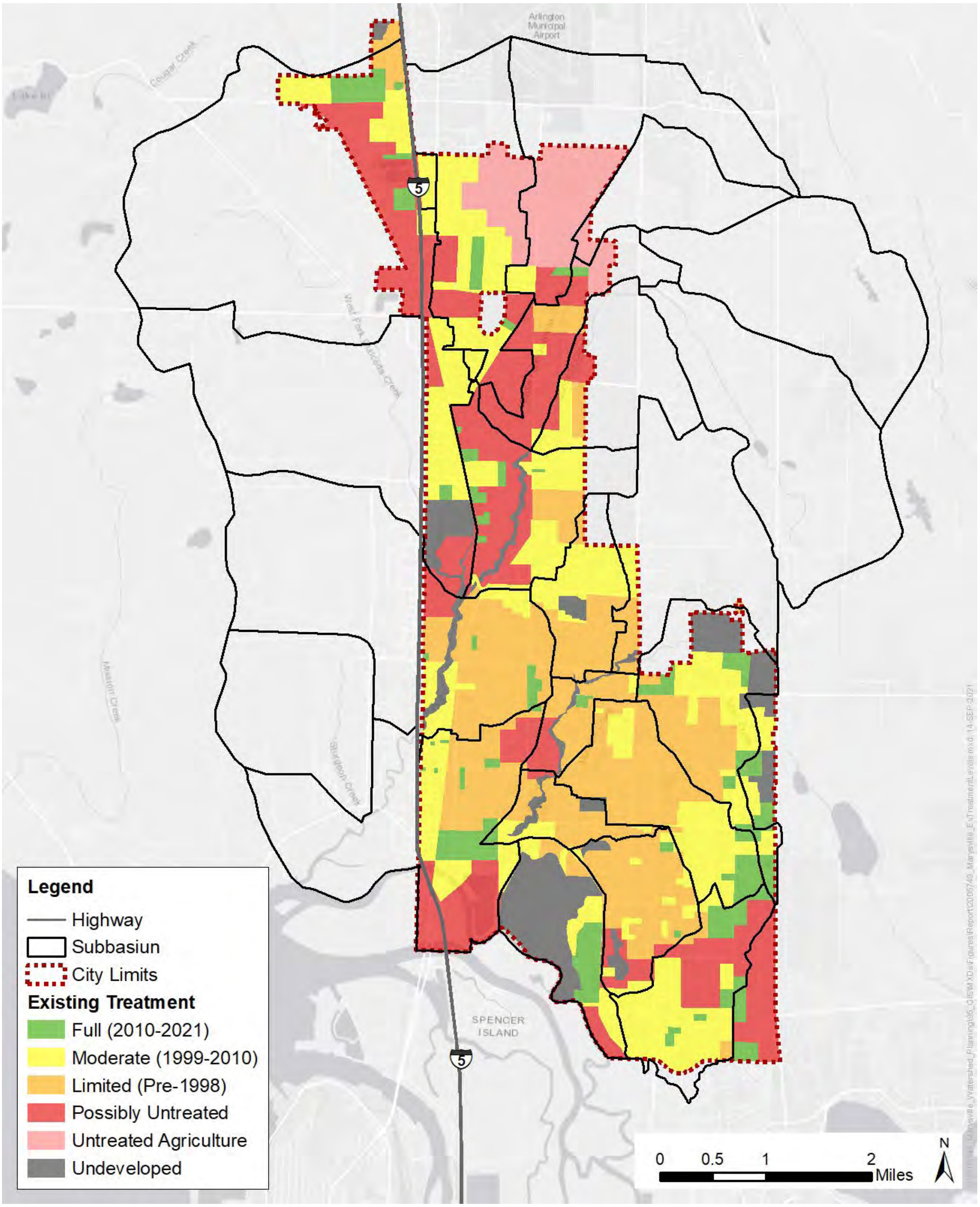


Figure 2.6 City of Marysville Stormwater Treatment Levels

2.4 Stormwater Management Influence

Ecology's SMAP guidance (2019) allows for exclusion of watershed areas where stormwater management actions cannot be implemented or where actions would provide minimal improvement to water quality.

Subbasins located completely outside the boundaries of Marysville were excluded from prioritization, due to lack of jurisdiction to implement retrofits or programs outside city limits. This criterion eliminates five of the 24 planning subbasins (Upper Quilceda, Upper Middle Fork Quilceda, Coho Creek, Sturgeon Creek, and Quilceda Creek Outlet). Six additional subbasins have less than 50 percent of their area within city limits. These subbasins were included in the basin prioritization process, though actions within City jurisdiction would likely have limited ability to impact overall basin conditions.

Ecology guidance provides a provision for excluding areas with both "low expected hydrologic impacts" and "low expected pollutant loadings." Portions of the Downtown and Ebey Slough subbasins are flow control exempt and would meet the low hydrologic impacts criterion, but none of the subbasins meet both criteria.

3 BASIN PRIORITIZATION

3.1 Method and Process

Consistent with Ecology guidance, the City is following a prioritization framework developed by Ecology as part of the Puget Sound Characterization study and documented in the *Building Cities in the Rain* watershed prioritization guidance (Dept. of Commerce, 2016). The framework (Figure 3.1) uses level of importance and level of degradation to define the types of actions appropriate for protection and/or restoration of beneficial uses.

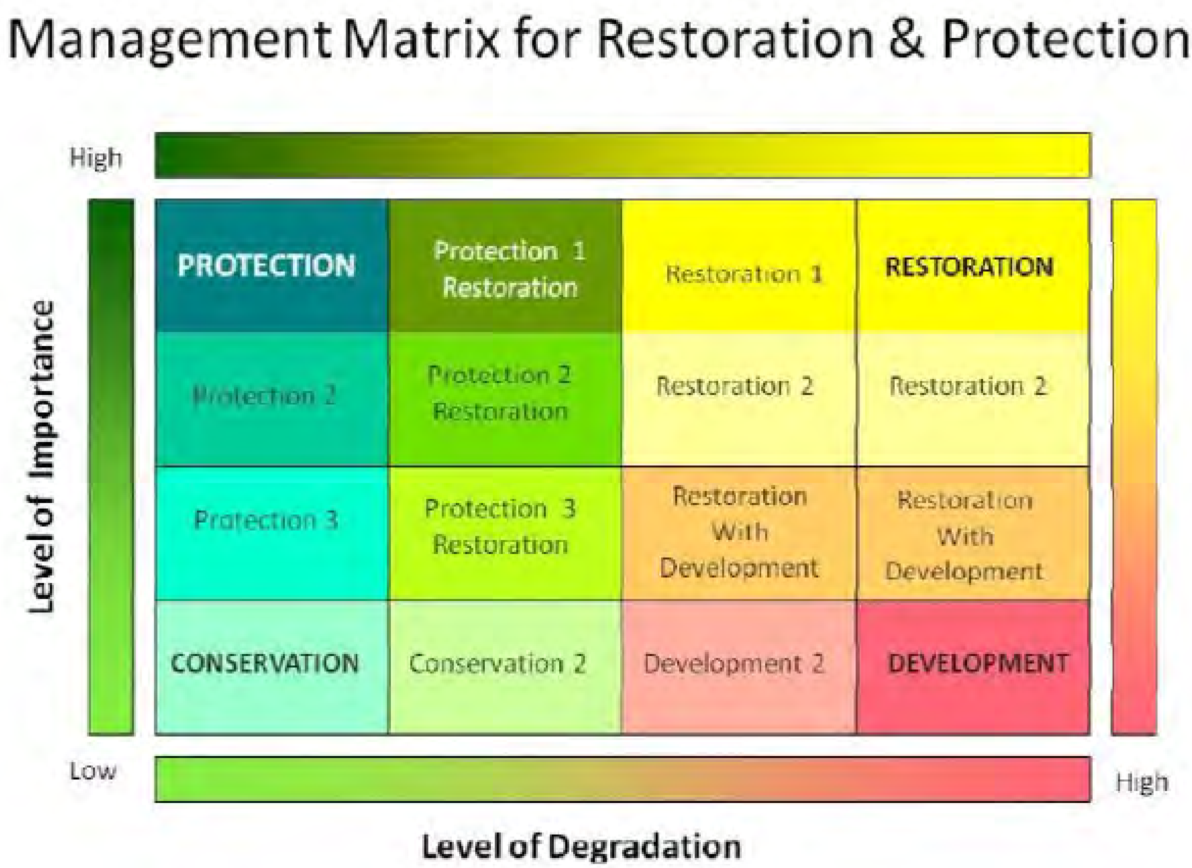


Figure 3.1 Puget Sound Characterization Stormwater Management Framework (Source: Dept. of Commerce, 2016)

A GIS-based screening process was used to characterize each subbasin planning unit in terms of its relative resource value (or importance for natural processes and aquatic species) and level of degradation from existing development and other human impacts. The GIS data and other information collected as part of the Receiving Waters Assessment were used to rank the subbasins in terms of 13 individual metrics related to importance (i.e., resource value) or level of watershed degradation. Metrics based on land cover, zoning, and wetland data were calculated only for the portion of each subbasin within Marysville city limits due to data extents; other metrics incorporate data for the full subbasin area. Values for each metric were assigned a score from zero to three, and scores were summed to provide a relative comparison of each subbasin on the “Importance” and “Degradation” axes.

The City also completed an assessment identifying areas of the city where minority, low-income, tribal, or indigenous populations could potentially experience a disproportionate environmental harm or risk. Both location-based environmental hazards and socio-economic stressors may act cumulatively to affect health and contribute to persistent environmental health disparities.

Importance Metrics

These metrics represent basin conditions that preserve natural processes and support healthy streams and aquatic species. Higher scores indicate greater resource value and importance for watershed function. Ranges were developed based on experience and scientific understanding of impact thresholds (e.g. Booth et al, 2002) and to distribute values for Marysville subbasins over the range.

Forest Land Cover: Percent of in-city subbasin area with forest land cover. Forest cover is indicative of undisturbed (or less disturbed) landscape. Forested areas produce a hydrologic response with less surface runoff and higher baseflows—conditions that are correlated with stable stream channels and higher ecological function. (In-city)

Percent Forest Cover	Scoring
0 - 10%	0
10% - 30%	1
30% - 65%	2
> 65%	3

Wetlands: Measure of the extent and quality of wetlands based on the Washington Department of Ecology wetland rating system. Calculated as the product of the wetland area score and a wetland rating factor based on the area-weighted average of the wetland rating for delineated in-city wetlands in the subbasin. Wetlands provide aquatic habitat, water quality benefits, and natural flow buffering. (In-city)

Percent Wetland Area	Scoring
No wetlands	0
0 - 1%	1
1% - 5%	2
>5%	3

Average Wetland Rating	Rating Factor
3 - 4	0.5
2 - 3	0.8
1 - 2	1

Riparian Forest: Percent of in-city riparian corridor (200-foot buffer on either side of stream) within each subbasin with forest land cover. Riparian canopy cover provides nutrient inputs, wood recruitment, and shading critical to maintaining fish-friendly stream temperatures. (In-city)

Percent Riparian Forest	Scoring
0 - 10%	0
10% - 30%	1
30% - 65%	2
> 65%	3

Potential Habitat: Total stream length in the basin used as proxy for potential aquatic habitat. Habitat assessments are available for some streams but not consistently throughout the city, so habitat quality is not included. (Subbasin-wide)

Stream Length (km)	Scoring
0 - 1	0
1 - 2	1
2 - 6	2
> 6	3

Fish Use: Scoring based on observed fish use and supported species. Listed chinook, steelhead, and bull trout are present in parts of the basin. (Subbasin-wide)

Fish Use	Scoring
No Fish Use/Unknown	0
Non-listed Species	1
Listed Salmonids	2
Multiple Listed Species	3

Groundwater Recharge: Percent of subbasin area with surface infiltration potential. Preservation of groundwater recharge is important to maintaining summer baseflows in streams. (Subbasin-wide)

Percent Recharge Area	Scoring
0 - 10%	0
10% - 25%	1
25% - 40%	2
> 40%	3

Table 3.1 lists the importance scores for each metric by subbasin. The aggregate importance score, determined from a weighted average of the individual scores, was used to assign a position on the Importance axis in the prioritization matrix. All metrics were weighted evenly, so the value is the arithmetic average of the individual scores. Figure 3.2 illustrates the relative importance of each subbasin (only portions within the city boundary shown). Subbasins entirely outside Marysville city limits were excluded due to lack of stormwater management influence. Subbasins shaded in green were calculated as having the highest relative value while the subbasins shaded in red were lowest.

Table 3.1 Subbasin Importance Scoring

Subbasin	Forest Cover	Wetland Area	Riparian Forest	Potential Habitat	Fish Use	Groundwater Recharge	Aggregate Score
Dry Creek	0	1.0	0	2	0	3	**1.00**
Jones Creek	1	1.7	1	2	1	0	**1.12**
Middle Allen	1	2.0	2	1	2	3	**1.83**
Munson Creek	1	1.9	1	3	2	1	**1.65**
NF Allen†	0	1.0	1	3	2	1	**1.33**
SF Allen	1	1.3	1	3	1	0	**1.21**
Upper Allen	1	1.0	1	2	2	3	**1.67**
Downtown	0	2.4	1	0	0	3	**1.06**
Ebey Slough	0	2.2	0	3	2	0	**1.20**
King Creek	1	1.9	2	2	1	0	**1.31**
Edgecomb Creek†	0	1.0	0	3	2	3	**1.50**
Hayho Creek	0	2.0	1	3	3	2	**1.83**
Lower MF Quilceda	1	1.0	1	3	3	3	**2.00**
Lower Quilceda	0	2.3	1	3	3	3	**2.06**
Lower WF Quilceda†	1	2.4	2	3	3	3	**2.40**
Mainstem Quilceda	1	1.7	1	2	3	3	**1.95**
Middle Quilceda†	1	2.0	2	3	3	2	**2.17**
Olaf Strad†	0	1.0	0	3	1	1	**1.00**
Upper WF Quilceda†	0	1.2	1	3	1	1	**1.20**

†Less than 50% of watershed within city limits. No scoring for subbasins entirely outside city limits.

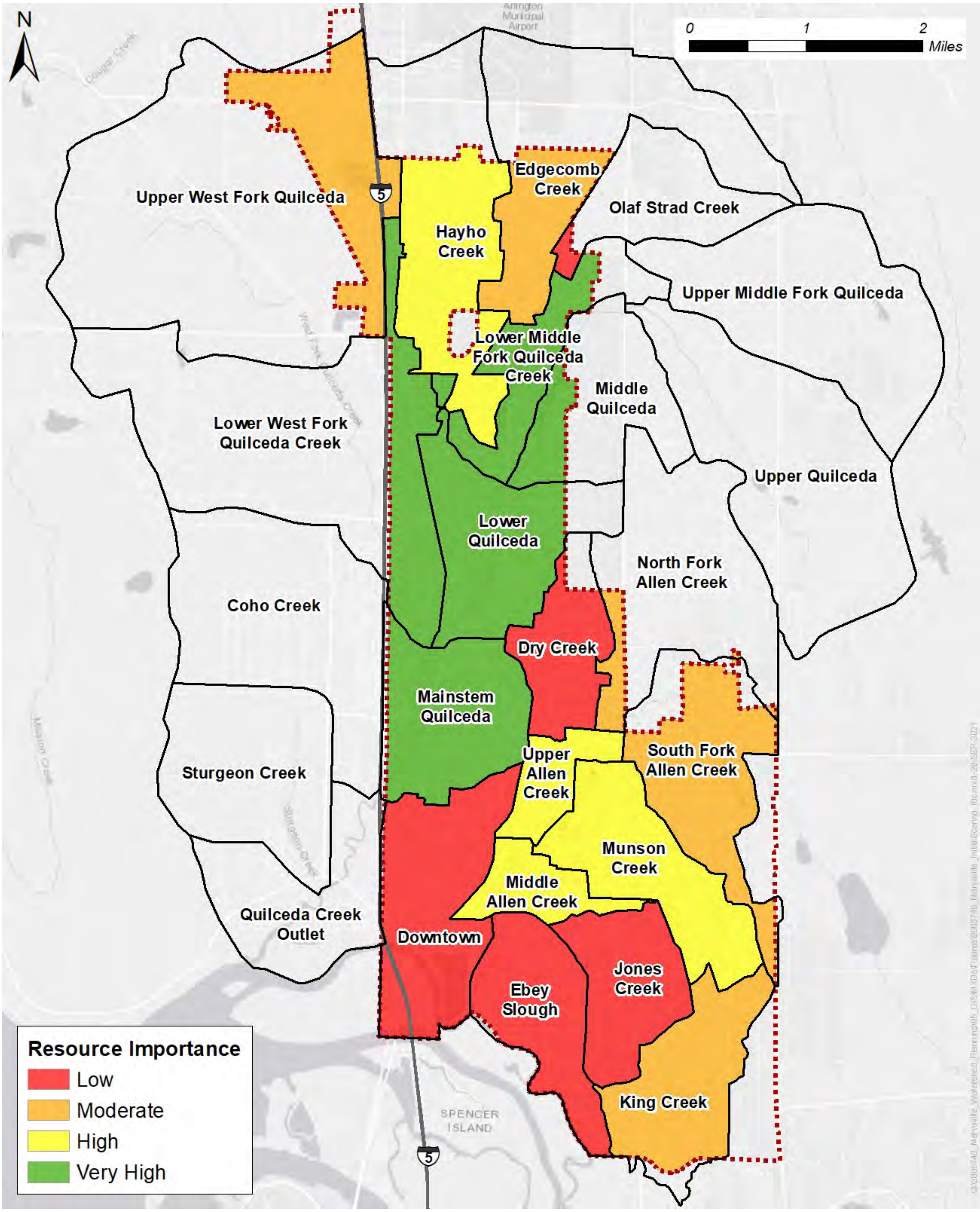


Figure 3.2 Relative Importance by Subbasin

Degradation Metrics

These metrics represent basin conditions that disturb natural processes and are linked with negative impacts on streams and aquatic species. Higher scores indicate greater level of degradation. Ranges were developed based on experience and scientific understanding of impact thresholds (e.g. Booth et al, 2002) and to distribute values for Marysville subbasins over the range.

Impervious Surface: Percent of in-city subbasin area with impervious land cover. Higher runoff from impervious surfaces increases peak flows and stormflow volumes in streams, which leads to erosion and channel instability that disrupt habitat and stream biology. (In-city)

Percent Impervious Surface	Scoring
0 - 10%	0
10% - 20%	1
20% - 40%	2
> 40%	3

Land Use: Dominant existing land use calculated as a weighted score based on percent of each category in the subbasin. Denser, higher traffic land uses generate increased stormwater runoff and pollutant loads. (Subbasin-wide)

Land Use Type	Scoring
Undeveloped	0
Agriculture Residential – Low	1
Residential – Medium	2
Residential – High Commercial Transportation	3

Existing Stormwater Treatment: Relative effectiveness of existing stormwater treatment based on facility age. Calculated as a weighted score of the treatment effectiveness for in-city areas mapped as part of the Receiving Waters Assessment. Current stormwater regulations (including LID and flow duration control) provide much higher levels of protection to streams than earlier standards. (In-city)

Existing Treatment	Scoring
Undeveloped	0
Significant (2010 or later)	1
Limited (1998-2010)	2
None (Pre-1998 or untreated)	3

Water Quality Impairment: Level of current water quality impairment based on sampling data, where available, and 303d listings for streams in the subbasin. Level 4 or 5 status on Ecology's 303d list indicates significant impairment for that water quality constituent, requiring mitigation actions. Scoring is based on the number of constituents listed at Level 4 or Level 5 or failing to meet state water quality standards. (Subbasin-wide)

Impaired WQ Constituents	Scoring
None	0
1	1
2	2
>2	3

Hydrologic Impairment: Impact of existing development on hydrologic regime, as indicated by the High Pulse Count (HPC) flashiness metric calculated from hydrologic modeling. The HPC is among a suite of metrics that have been demonstrated to correlate to B-IBI in western Washington streams. The score is based on the ratio between simulated current and forested (predevelopment) conditions HPCs. (Subbasin-wide)

HPC Ratio	Scoring
<1.5 (Current HPC < 10)	0
<1.5 (Current HPC ≥ 10)	1
1.5 - 2	2
≥2	3

Road Crossings: Number of road crossings per mile of stream in each subbasin, computed by intersecting street and stream networks. Road crossings disrupt a stream's riparian corridor and increase efficiency of runoff delivery to the stream, which increases peak flows. Culverts at many crossings may also be undersized and limit fish passage for certain species and life stages. (Subbasin-wide)

Road Crossings per Stream Mile	Scoring
< 0	0
1 - 2	1
2 - 4	2
> 4	3

Future Development: Measure of potential impact of development or redevelopment on water quality. Since new development requires higher levels of stormwater treatment than many existing land uses, development may not consistently produce further degradation, so both intensity and extent of development were considered as part of the scoring metric. Calculated for in-city areas as the sum of future development intensity (weighted score based on difference in relative intensity between zoned and existing land uses) and future stormwater treatment (negative score based on percent of basin area expected to redevelop). A 50 percent multiplier was applied to the treatment area score to avoid over-weighting potential treatment benefits of development. Thus, a subbasin expected to have moderate increase in land use intensity affecting 70% of the (in-city) basin area would receive a Future Development score of 1.0 (=2 + 0.5*(-2)). (In-city)

Development Intensity Increase	Scoring
None/Minimal	0
Low	1
Moderate	2
High	3

Development Treatment Area	Scoring
>75%	-3
60-75%	-2
40-60%	-1
<40%	0

Table 3.2 lists the degradation scores for each metric by subbasin. The aggregate degradation score, determined from a weighted average of the individual scores, was used to assign a position on the Degradation axis in the prioritization matrix. All degradation metrics were weighted evenly, so the value is the arithmetic average of the individual scores. Figure 3.3 illustrates the relative importance of each subbasin (only portions within the city boundary shown). Subbasins entirely outside Marysville city limits were excluded due to lack of stormwater management influence. Subbasins shaded in green were calculated as having the lowest relative degradation while the subbasins shaded in red were highest.

Table 3.2 Subbasin Degradation Scoring

Subbasin	Impervious Surface	Land Use	Future Develop-ment	Existing Treat-ment	WQ Impair	Hydro Impair	Road xings	Aggregate Score
Dry Creek	3	1.5	0.0	2.4	0	3	2	**1.69**
Jones Creek	2	1.1	-0.5	2.7	1	3	3	**1.75**
Middle Allen	3	1.5	0.5	2.4	3	2	2	**2.06**
Munson Creek	2	1.3	-0.5	2.4	2	3	3	**1.90**
NF Allen†	2	0.8	0.0	2.4	3	0	1	**1.31**
SF Allen	2	1.1	-0.5	1.9	1	1	1	**1.07**
Upper Allen	3	1.8	0.0	2.7	1	1	0	**1.35**
Downtown	3	2.6	1.0	2.6	0		2	**1.87**
Ebey Slough	1	0.6	0.0	0.9	2		1	**0.91**
King Creek	2	1.3	-0.5	2.2	0		1	**1.00**
Edgecomb Creek†	1	1.1	1.5	2.9	1	2	1	**1.50**
Hayho Creek	2	1.7	1.0	2.5	0	3	1	**1.60**
Lower MF Quilceda	2	1.6	0.0	2.9	1	2	1	**1.50**
Lower Quilceda	3	1.8	1.0	2.4	2	0	2	**1.74**
Lower WF Quilceda†	2	1.0	1.0	1.8	2	0	0	**1.12**
Mainstem Quilceda	3	2.0	0.5	2.6	0	0	2	**1.44**
Middle Quilceda†	2	1.0	0.5	2.6	1	0	0	**1.01**
Olaf Strad†	0	1.0	2.0	3.0	0	0	0	**0.86**
Upper WF Quilceda†	2	0.9	1.0	2.4	3	0	1	**1.48**

†Less than 50% of watershed within city limits. No scoring for subbasins entirely outside city limits.

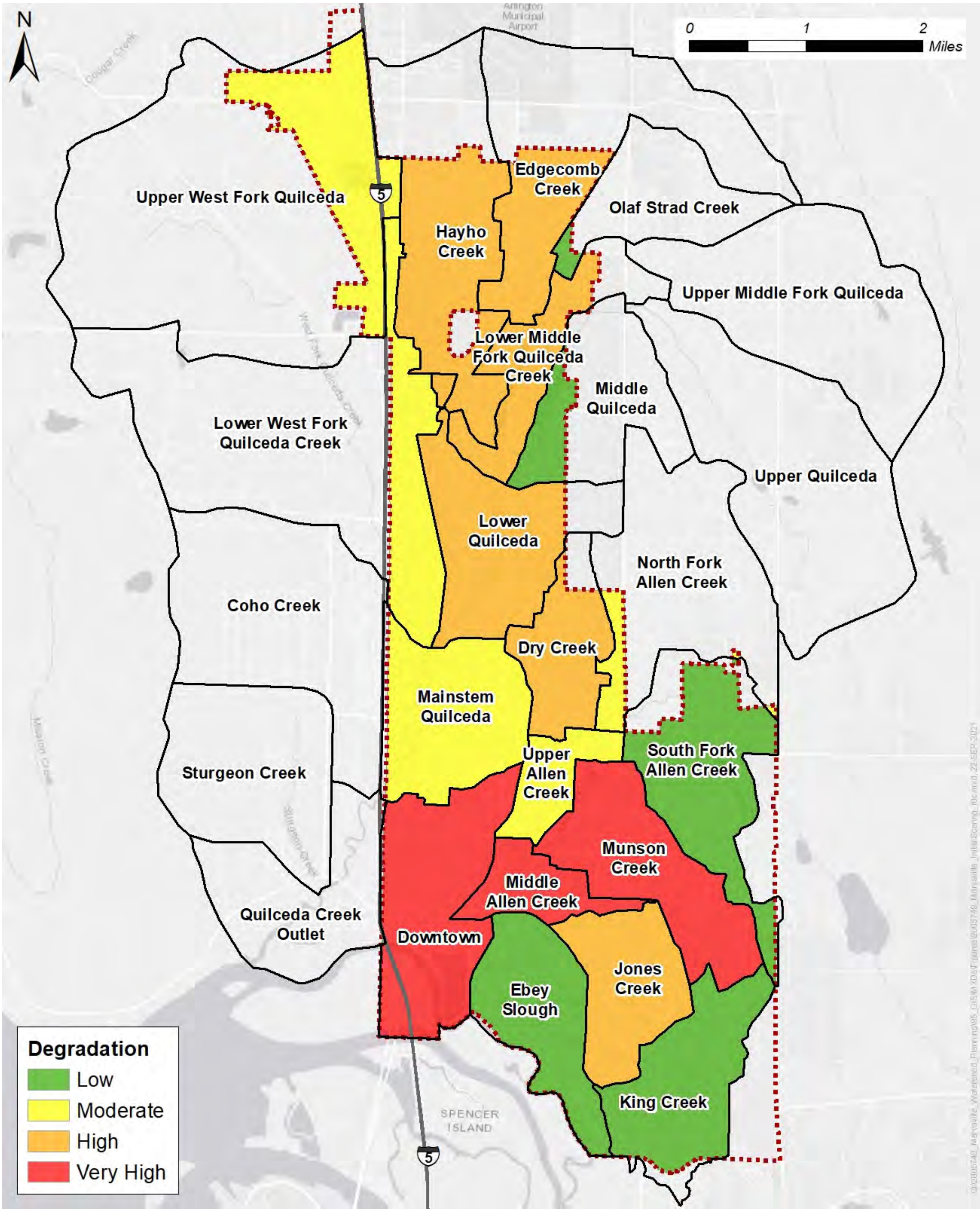


Figure 3.3 Relative Degradation by Subbasin

Disproportionate Environmental Risk

The City evaluated several sources of data to identify populations that may experience disproportionate environmental harms or risks and/or geographic areas of the City that may pose environmental hazards. Sources included the US Census Bureau data, Marysville School District data, Ecology's What's In My Neighborhood Toxic Cleanup Site map, the EPA EJSCREEN-Environmental Justice Screening and Mapping Tool, and Washington State Department of Health Environmental Health Disparities Map. The complete environmental justice review is provided in Appendix D.

The tabular race and ethnicity data available indicate that Marysville is generally becoming more diverse than it was previously.

The map based data indicates that the Downtown neighborhood is likely experiencing a higher risk for environmental harms than other areas of the City. Many of these risks factors are already being addressed by the City. The 2016 Stormwater Comprehensive Plan included several stormwater retrofit projects in this neighborhood. Most of the projects have been completed or are under construction currently, including a facility that will treat stormwater from 463 acres of Downtown. The neighborhood has also been a focus for our Executive and Community Development Departments. Studies, planning documents and projects have been completed to address environmental justice, through traffic revisions, increased walkability corridors, stormwater projects, park improvements and contaminated site cleanup. With the extensive work that has already been done in the Downtown neighborhood the stormwater retrofit opportunities have been exhausted. Prioritizing Downtown for further stormwater retrofits based on the risk of environment harms is not necessary. However, programmatic opportunities to reduce environmental risks in the Downtown neighborhood are still available.

3.2 Basin Priority Ranking

Subbasin degradation and value scores (from Table 3.2 and Table 3.1, respectively) were plotted on the management matrix as shown below in Figure 3.4. (Gray dots designate subbasins with less than 50 percent of their area within city limits.) The basins falling into the "Restoration" corner will require a large effort to restore natural processes and achieve significant water quality benefits but also have a high ecosystem value. Basins in the "Protection" corner have a high ecological importance and low degradation. These basins have not been heavily impacted by development and may be target areas for programmatic actions or code revisions to protect existing resources. "Conservation" basins are areas with a low ecological importance but also low degradation. These would require a much lower level of action, mainly to maintain existing conditions. The basins in the "Development" corner have a low ecological importance and significant existing human impact. Significant efforts to achieve water quality benefits may not be warranted by the lower resource value, and development should continue to be directed to these areas.

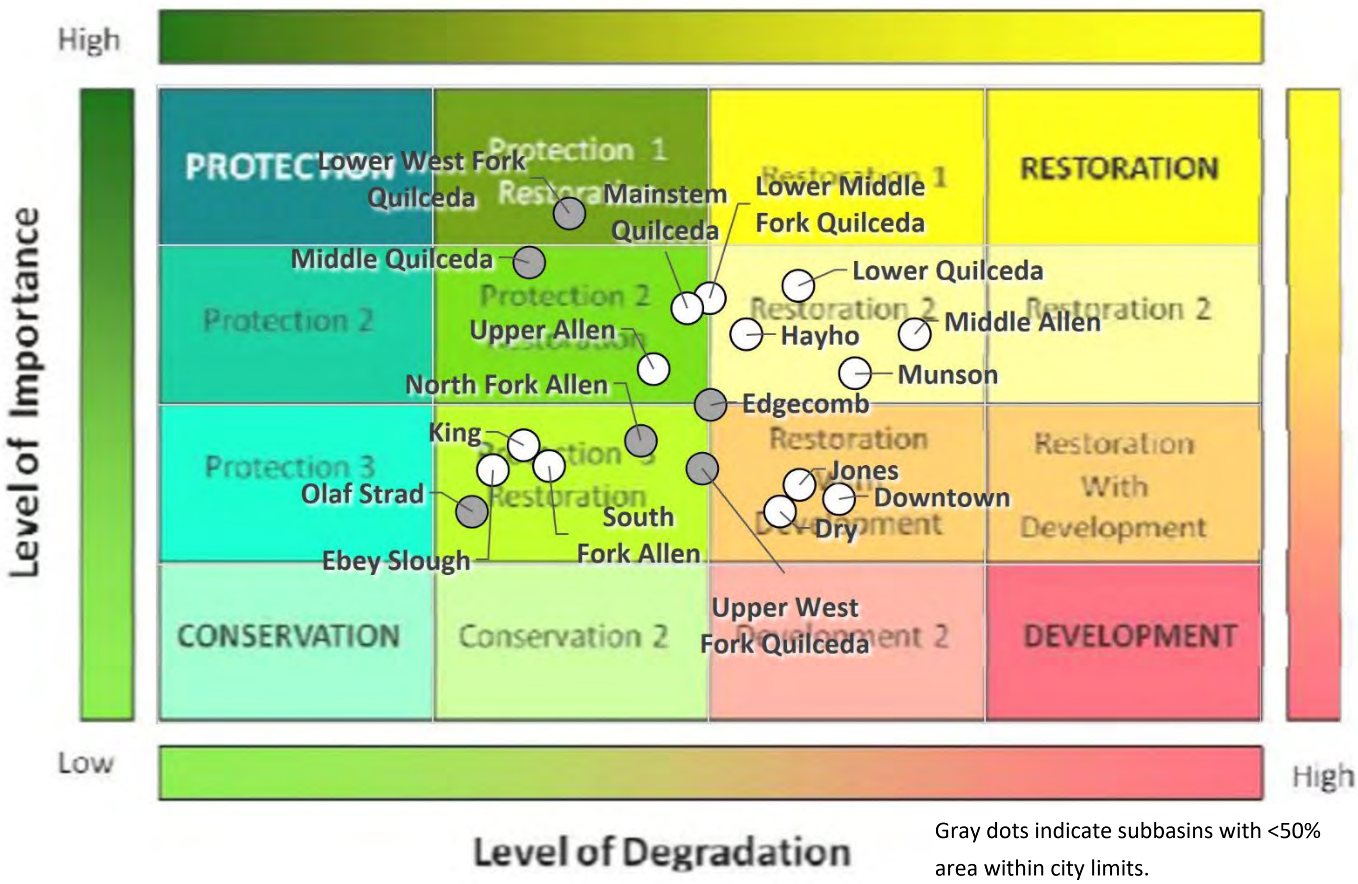


Figure 3.4 Subbasin Prioritization Matrix

Outreach

Results of the subbasin assessment and initial prioritization were presented to local stakeholders as part of a public process. Comments and input were received from City staff, Ecology, Snohomish County and the Tulalip Tribes. The input was incorporated into the GIS analysis and score weighting before proceeding with selection of target subbasins for stormwater management action planning. Results documented in this section reflect changes in response to feedback received through the stakeholder outreach.

4 BASIN SELECTION

Based on input received through the stakeholder workshop, the City elected to focus on subbasins in the “Restoration” quadrant of the prioritization matrix: Middle Allen, Lower Quilceda, Hayho Creek, Lower Middle Fork Quilceda, and Munson Creek. City staff reviewed basin characteristics relative to stormwater planning and implementation potential, as summarized below.

Middle Allen:

- Smaller basin that may be easier to capture potential projects and make measurable improvements
- Most of basin has older stormwater treatment
- Major contributor to restored Qwuloolt tidal wetland
- City has projects in the works
- City-owned properties, especially Jennings Park, present opportunities for existing facility retrofits
- Good infiltration potential
- Potential to coordinate on park project – City has already done some critical areas vetting
- No large transportation or utility projects to leverage

Lower Quilceda:

- Roughly half of basin currently untreated
- Much larger area could present a very long list of projects
- State Avenue crossing being replaced by bridge (undersized railroad culvert still remains)
- High infill/redevelopment
- Decent infiltration potential
- Very little City property
- Commercial land use blend provides opportunity to tie in with source control programs

Hayho Creek:

- About a third outside of city (headwaters)
- Stream network is mostly farm ditches
- Lots of development anticipated – will have to construct current code-compliant stormwater facilities
- Already a focus of source-control program
- Transportation projects not anticipated to have much City involvement
- Persistent flooding along 136th that City has not addressed

Lower Middle Fork Quilceda:

- Large basin extending outside city limits
- Quilceda Creek basins have biggest opportunities for significant habitat bump
- Most of basin is untreated but infiltration seems to be controlling stormwater – some nuisance flooding/ponding

- Almost all residential, so programmatic options are more limited
- City has already addressed low-hanging fruit in terms of restoration

Munson Creek:

- Has been a focus for TMDL programs
- Extensive storm system with a lot of potential facility retrofits (most ponds city-owned)
- Not much stream habitat available
- Creek co-mingles with storm system
- Have been a couple fish ladder proposals
- City owns golf course property with existing stormwater ponds, some critical areas limitations
- A couple of small neighborhoods without sewer (some will be redeveloped)
- Lots of retrofit potential

Based on the staff review and project team discussion, the Middle Allen, Lower Quilceda, and Munson Creek subbasins were selected for stormwater retrofit planning. Retrofit opportunity sites will be identified in all three subbasins to support the SMAP and future stormwater planning efforts.

Although not a primary retrofit target, the Downtown subbasin was selected for targeted implementation of stormwater management programs due to disproportionate environmental risks identified through the Environmental Justice review. The City will begin business inspections with a new Source Control Program in 2023, with businesses in the Downtown neighborhood prioritized for inspection. The program will include providing information about operational and/or structural source control BMPs, inspecting businesses, and enforcing local ordinances. Other actions such as a tree planting program or customized implementation of an education and outreach campaign will be explored during the SMAP planning efforts.

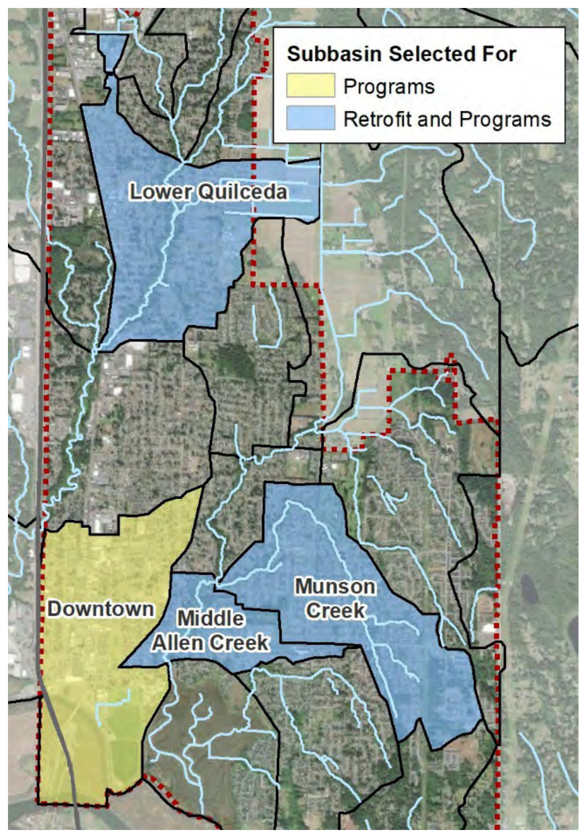


Figure 4.1 Subbasins Selected for Stormwater Management Focus

5 REFERENCES

Booth, D.B., D. Hartley, and R. Jackson, 2002. Forest cover, impervious-surface area, and the mitigation of stormwater impacts. Journal of the American Water Resources Association 38(3): 835-845.

DeGasperi, C. L., H. B. Berge, K. R. Whiting, J. J. Burkey, J. L. Cassin, and R. R. Fuerstenberg, 2009. Linking hydrologic alteration to biological impairment in urbanizing streams of the Puget Lowland, Washington, USA. Journal of the American Water Resources Association 45(2): 512–533.

Washington Department of Commerce, 2016. Building Cities in the Rain: Watershed Prioritization for Stormwater Retrofits. September 2016, 49 pp.

Washington Department of Ecology, 2019. Stormwater Management Action Planning Guidance, Publication 19-10-010. Washington State Department of Ecology, Water Quality Program. Olympia, Washington.

APPENDIX A

SOURCE DATA INVENTORY

Category	Type	Source	URL/Feature Class/Filename	Updated	Spatial Extent	Description
GIS	Land Cover	City of Marysville	reclassified_20210317clip.tif	2020	City of Marysville	Land cover types within City (2017 image analyzed)
GIS	Zoning	City of Marysville	zoning_compplan	2020	City of Marysville	Zoning (Reflecting 2015 City Comprehensive Plan and updates that have been approved since that time.)
GIS	Stormwater System	City of Marysville	MSVLData.gdb	2020	City of Marysville	Stormwater network and facilities in point, line, and polygon formats
GIS	Streams	City of Marysville	StreamClasses	2020	Allen/Quilceda basins	Stream layer with fish information. Streams inside MSVL UGA were created by heads-up digitizing from 1:2400 orthophotography. All others carried over from USGS 1:100,000 hydro layer. Fish use data originated from Streamnet.org (downloaded Dec 2014), Washington Dept. of Fish and Wildlife
GIS	Hazards	City of Marysville			City of Marysville	Top of Slope 25-foot Buffer
GIS	Wetlands	City of Marysville	StreamWetlands; DelineatedWetlands	2020	Allen/Quilceda basins	Location of wetlands delineated for land use actions (PA files). Date of delineation varies.
GIS	Subbasins	Snohomish County	nalcsb	2008	Allen Creek basin	Allen Creek HSPF model subbasins (Updated for this project to reflect storm system and topographic variations from original)
GIS	Subbasins	Snohomish County	nqlcsb	2008	Quilceda Creek basin	Quilceda Creek HSPF model subbasins (Updated for this project to reflect storm system and topographic variations from original)
GIS	Existing Land Use	Snohomish County (updated by NHC)	lunalc	2021	Allen Creek basin	Allen Creek land use, 2008 County layer updated from 2019 USDA NAIP aerial photos
GIS	Existing Land Use	Snohomish County (updated by NHC)	lunqlc_dis	2021	Quilceda Creek basin	Quilceda Creek land use, 2008 County layer updated from 2019 USDA NAIP aerial photos
GIS	Waterbody	WA DNR	https://data-wadnr.opendata.arcgis.com/datasets/dnr-hydrography-water-bodies-forest-practices-regulation		City of Marysville	Waterbodies
GIS	Geology	WA DNR	https://www.dnr.wa.gov/publications/ger_portal_surface_geology_24k.zip	2020	City of Marysville	Surface Geology 1:24,000 scale GIS Dataset
GIS	Topography	Puget Sound Lidar Consortium	https://lidarportal.dnr.wa.gov/	2014	City of Marysville (Partial)	Lidar Bare Earth: Cedar River Watershed
GIS	Topography	Puget Sound Lidar Consortium	https://lidarportal.dnr.wa.gov/	2017	City of Marysville (Partial)	Lidar Bare Earth: North Puget Sound, Washington
GIS	Groundwater	NWIS 2021	https://nwis.waterdata.usgs.gov/usa/nwis/gwlevels	2021	City of Marysville	Groundwater-Levels for the Nation
Ecology	Monitoring	Puget Sound Stream Benthos	https://pugetsoundstreambenthos.org/Biotic-Integrity-Map.aspx	2020		Benthic Index of Biotic Integrity (BIBI) data
WQ	Monitoring	City of Marysville				Water quality data, Allen Creek, 2014 to present
WQ	Monitoring	Snohomish County	http://www.snoco.org/applications/login.html?publicuser=Guest#waterdata/stationoverview	2021	Allen/Quilceda basins	Water quality data, Quilceda and Allen Creeks, 2000-2021
WQ	Monitoring	Tulalip Tribes DNR				Water quality data, Quilceda, 2001-2019
WQ	Regulatory	WA Department of Ecology	https://apps.ecology.wa.gov/waterqualityatlas/wqa/map	2016		Washington State Water Quality Assessment 303(d)/305(b) List

Category	Type	Source	URL/Feature Class/Filename	Updated	Spatial Extent	Description
WQ	Regulatory	WA State Legislature	https://apps.leg.wa.gov/wac/default.aspx?cite=173-201A-200			WAC 173-201A-200
WQ	Regulatory	WA State Legislature	https://apps.leg.wa.gov/Wac/default.aspx?cite=173-201A-240			WAC 173-201A-240
WQ	Regulatory	WA Department of Ecology	https://apps.ecology.wa.gov/publications/documents/1810035.pdf			Water Quality Program, Policy 1-11
Models	HSPF	Snohomish County	Allenc.uci	2007	Allen Creek basin	Allen Creek HSPF model
Models	HSPF	Snohomish County	ALCBASE.wdm	2004		Allen Creek HSPF timeseries input data
Models	HSPF	Snohomish County	Quilcur.uci	2004	Quilceda Creek basin	Quilceda Creek HSPF model
Models	HSPF	Snohomish County	116STNE_Empty.wdm	2017		Quilceda Creek HSPF timeseries input data

APPENDIX B
RECEIVING WATERS ASSESSMENT

Receiving Water Assessment

March 2022

Introduction

The City of Marysville has completed a receiving water inventory following the Stormwater Management Action Planning Guidance (Ecology, 2019; Publication 19-10-010). The subsequent pages summarize the watershed inventory as required by section S5.C.1.d.ii and Ecology Guidance. A full report describing the data sources analyzed, basin delineation and basin characterization has been developed and will be available on the City web site.

Receiving Waters Contributing Areas

The City of Marysville includes portions of the Quilceda and Allen Creek watersheds, as well as areas that drain directly to Ebey Slough in the Snohomish River estuary (Figure 1). Runoff from headwater areas of Quilceda Creek enter the city from the west and northeast; the north fork of Allen Creek also drains areas outside the city. Quilceda Creek outlets to Ebey Slough downstream of the city limits, and inflows from the Coho Creek and Sturgeon Creek tributaries enter the mainstem downstream of the city limits.

The major receiving water basins were broken up into 24 smaller subbasins or planning units, as shown in Figure 1. Previous basin delineations by Snohomish County for watershed modeling were combined and modified based on the mapped stormwater network and updated topography. As mentioned above, several of the subbasins are wholly outside city limits. Table 1 summarizes the total drainage area, in-city area, identifies subbasins with a low Stormwater Management Influence, and which subbasins were prioritized.

Figure 1- City of Marysville Watershed Map

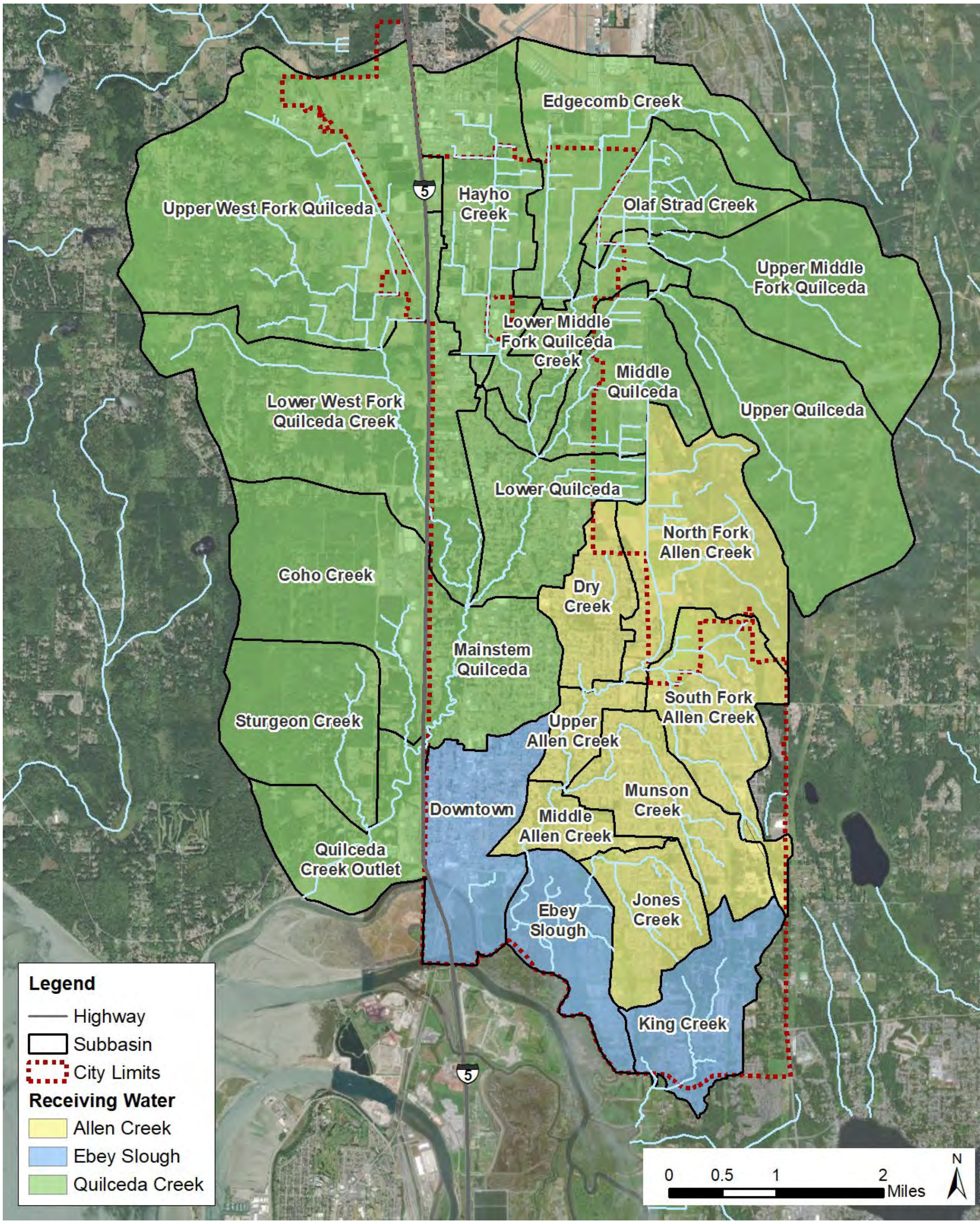


Table 1- Watershed Inventory

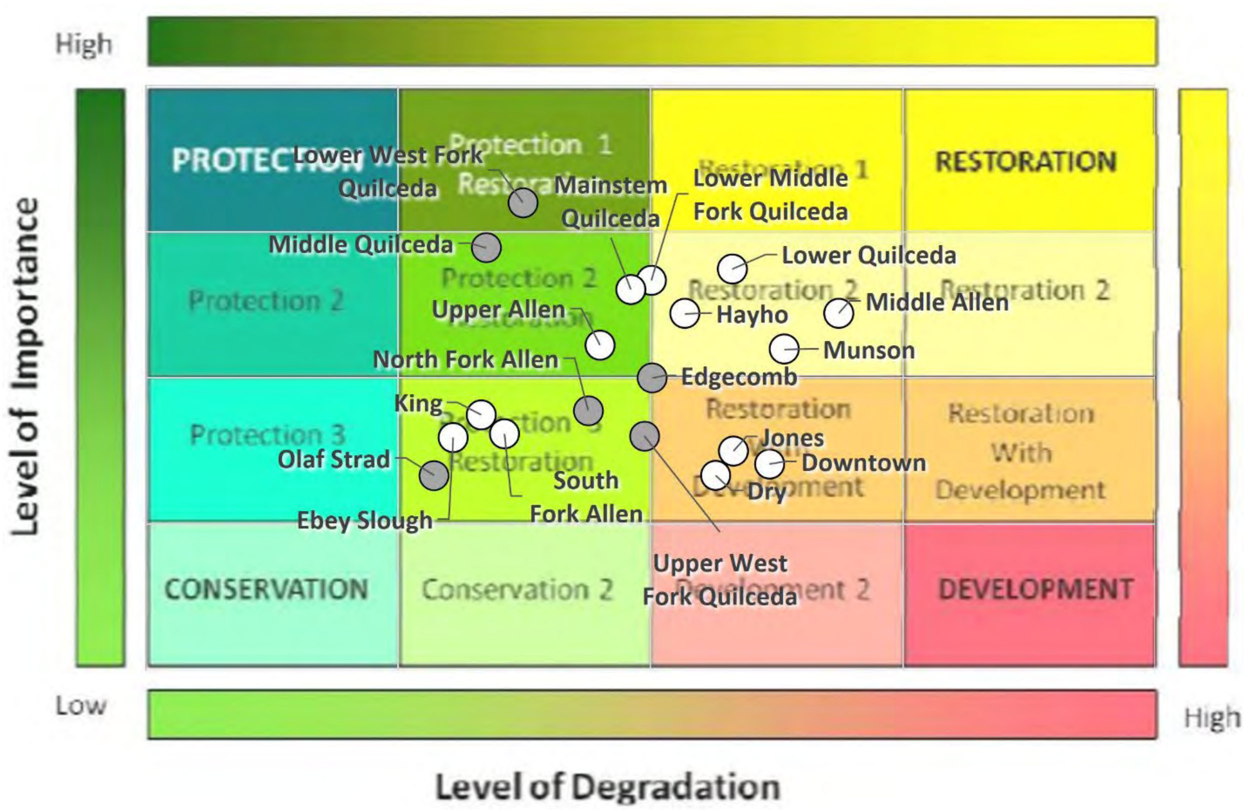
Subbasin	Watershed	Area (ac)	Area in City (ac)	Percent in City	Low SMI*	Included for Prioritization
Dry Creek	Allen Creek	617	543	88%	No	Yes
Jones Creek	Allen Creek	733	733	100%	No	Yes
Middle Allen Creek	Allen Creek	365	365	100%	No	Yes
Munson Creek	Allen Creek	1,015	1,015	100%	No	Yes
North Fork Allen Creek	Allen Creek	1,596	144	9%	No	Yes
South Fork Allen Creek	Allen Creek	1,176	970	82%	No	Yes
Upper Allen Creek	Allen Creek	329	329	100%	No	Yes
Downtown	Ebey Slough	1,186	1,173	99%	No	Yes
Ebey Slough/Lower Allen	Ebey Slough	811	801	99%	No	Yes
King Creek	Ebey Slough	953	897	94%	No	Yes
Coho Creek	Quilceda Creek	1,840	-	0%	Yes	No
Edgecomb Creek	Quilceda Creek	1,792	571	32%	No	Yes
Hayho Creek	Quilceda Creek	1,664	1,047	63%	No	Yes
Lower Middle Fork Quilceda	Quilceda Creek	674	518	77%	No	Yes
Lower Quilceda	Quilceda Creek	1,114	977	88%	No	Yes
Lower West Fork Quilceda	Quilceda Creek	2,863	675	24%	No	Yes
Mainstem Quilceda	Quilceda Creek	1,015	971	96%	No	Yes
Middle Quilceda	Quilceda Creek	964	217	23%	No	Yes
Olaf Strad Creek	Quilceda Creek	770	40	5%	No	Yes
Quilceda Creek Outlet	Quilceda Creek	998	-	0%	Yes	No
Sturgeon Creek	Quilceda Creek	1,298	-	0%	Yes	No
Upper Middle Fork Quilceda	Quilceda Creek	1,854	-	0%	Yes	No
Upper Quilceda	Quilceda Creek	2,199	-	0%	Yes	No
Upper West Fork Quilceda	Quilceda Creek	4,078	912	22%	No	Yes

*SMI= Stormwater Management Influence

Receiving Waters Relative Conditions

A GIS-based screening process was used to characterize each subbasin planning unit in terms of its relative resource value (or importance for natural processes and aquatic species) and level of degradation from existing development and other human impacts. The GIS data and other information collected as part of the Receiving Waters Assessment were used to rank the subbasins in terms of 13 individual metrics related to importance (i.e., resource value) or level of watershed degradation. Values for each metric were assigned a score from zero to three, and scores were summed to provide a relative comparison of each subbasin on the “Importance” and “Degradation” axes.

Figure 2- Subbasin Prioritization Matrix



Subbasin degradation and value scores were plotted on the management matrix as shown below in Figure 2. (Gray dots designate subbasins with less than 50 percent of their area within city limits.) The basins falling into the “Restoration” corner will require a large effort to restore natural processes and achieve significant water quality benefits but also have a high ecosystem value. Basins in the “Protection” corner have a high ecological importance and low degradation. These basins have not been heavily impacted by development and may be target areas for programmatic actions or code revisions to protect existing resources. “Conservation” basins are areas with a low ecological importance but also low degradation. These would require a much lower level of action, mainly to maintain existing conditions. The basins in the “Development” corner have a low ecological importance and significant existing human impact. Significant efforts to achieve water quality benefits may not be warranted by the lower resource value, and development should continue to be directed to these areas.

Stormwater Management Influence and Questions from SMAP Guidance

Dry Creek- Kellogg Marsh Neighborhood

A basin with a low expected Stormwater Management Influence is defined as having both “low expected hydrologic impacts” and “low expected pollutant loadings” from the City’s MS4. Each of the criteria have been assessed for this basin. If the criteria are met it is listed below. If the criteria are not met the basin received a “no” in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The pollutants associated with point sources come from 4 stormwater outfalls and are expected to be typical of a residential area. Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. In this basin a poor relative hydrology rating indicates that the stream has seen significant alteration in flow durations and increased flashiness associated with land use changes.

Modeling has not been completed for future build out conditions. It is unknown if pollutant loading and runoff volumes will increase. The current land use is primarily low density residential. A majority of the development in this basin has moderate or limited stormwater treatment. This area is mostly built out so it is not expected to require a significant increase in the road network to accommodate future growth. Most of the roadway projects listed in the 2015 Comprehensive plan are road widening projects for the main arterials. Under future conditions this area will be high density residential. By 2035 this area is expected to accommodate 910 new housing units to accommodate a 1,941 population growth. Infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

Dry Creek

Watershed	Allen Creek
Waterbodies	Dry Creek, 2 unnamed tributaries 2 Wetlands/ 1.13 acres wetland
Total subbasin area	616.8 acres (0.96 square miles)
Subbasin area within city limits	543.2 acres (0.85 square miles)
Percent of Subbasin within city limits	88%
Impervious land cover (in city limits)	229.8 acres (42%)
Forest land cover (in city limits)	53.4 acres (10%)
Existing Land Use (full subbasin)	Dominant land use: Residential Undeveloped - 14% Agriculture - 8% Residential Low - 43% Residential Med - 9% Residential High - 5% Commercial/Industrial - 4% Multifamily Residential - 4% Roads: 11%
Future Zoning (in city limits)	SF Residential Med - 4% SF Residential High - 86% Multifamily Residential - 4% Commercial/Industrial - <1% Recreation/Open Space - 6%
Water Quality Conditions	No sampling data 303d listings: none TMDL: none
Biological Conditions	Modeled High Pulse Count: 13.5 (existing)/ 5.8 (forested) B-IBI sampling: none Fish species: none
PSWC Restoration Potential/Best Use	Flow: Restoration/Development Sediment: Restoration/Development Nutrients (N/P): N-Restoration, P-Restoration/Development Pathogens: Development/Restoration Metals: Development/Restoration

Jones Creek- Jennings Park and East Sunnyside Neighborhoods

A basin with a low expected Stormwater Management Influence is defined as having both "low expected hydrologic impacts" and "low expected pollutant loadings" from the City's MS4. Each of the criteria have been assessed for this basin. If the criteria are met it is listed below. If the criteria are not met the basin received a "no" in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The pollutants associated with point sources come from 52 stormwater outfalls and are expected to be typical of a residential area. Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. In this basin a poor relative hydrology rating indicates that the stream has seen significant alteration in flow durations and increased flashiness associated with land use changes.

Modeling has not been completed for future build out conditions. It is unknown if pollutant loading and runoff volumes will increase. The current land use is primarily low density residential. A majority of the development in this basin has moderate or limited stormwater treatment. Under future conditions this area is expected to be medium and high density residential. The redevelopment potential varies throughout the basin. The portion in the Jennings Park neighborhood has a relatively low development or redevelopment potential because a majority of the housing has been built in the last twenty five to thirty years. The East Sunnyside Neighborhood is expected to undergo more intensive development. As a whole the East Sunnyside Neighborhood is anticipated to grow by 4,660 housing units to accommodate an 8,826 population increase by 2035. The road network will need to be expanded in some areas to accommodate the growth. Infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

Jones Creek

Watershed	Allen Creek
Waterbodies	Jones Creek, 2 unnamed tributaries 38 Wetlands/ 28.9 acres wetland
Total subbasin area	732.6 acres (1.1 square miles)
Subbasin area within city limits	732.6 acres (1.1 square miles)
Percent of Subbasin within city limits	100%
Impervious land cover (in city limits)	266.7 acres (36.4%)
Forest land cover (in city limits)	132.0 acres (18%)
Existing Land Use (full subbasin)	Dominant land use: Residential Undeveloped - 23% Agriculture - 0% Residential Low - 64% Residential Med - 1% Residential High - 0% Commercial/Industrial - 0.3% Multifamily Residential - 0.7% Roads: 10%
Future Zoning (in city limits)	SF Residential Med - 80% SF Residential High - 16% Multifamily Residential - 2% Commercial/Industrial - 0% Recreation/Open Space - 1.5%
Water Quality Conditions	No sampling data 303d listings: bacteria TMDL: none
Biological Conditions	Modeled High Pulse Count: 18.3 (existing)/ 9.0 (forested) B-IBI sampling: none Fish species: Coho, Cutthroat
PSWC Restoration Potential/Best Use	Flow: Restoration/Development Sediment: Conservation Nutrients (N/P): N - Restoration/Development, P - Development/Restoration Pathogens: Development/Restoration Metals: Development/Restoration

Middle Allen Creek- Jennings Park Neighborhood

A basin with a low expected Stormwater Management Influence is defined as having both “low expected hydrologic impacts” and “low expected pollutant loadings” from the City’s MS4. Each of the criteria have been assessed for this basin. If the criteria are met it is listed below. If the criteria are not met the basin received a “no” in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The pollutants associated with point sources come from 10 stormwater outfalls and are expected to be typical of a residential area. Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. In this basin a fair relative hydrology rating indicating that stormwater from development in the subbasin has caused notable increases in streamflow peaks and high flow durations.

Modeling has not been completed for future build out conditions. It is unknown if pollutant loading and runoff volumes will increase. The current land use is primarily low density residential. A majority of the development in this basin has moderate or limited stormwater treatment. The Jennings Park neighborhood has a relatively low development or redevelopment potential because a majority of the housing has been built in the last twenty five to thirty years. Under future conditions the majority of this basin is expected to be medium and high density residential. But the area is only expected to grow by 283 housing units to accommodate a 580 population increase by 2035. Infill development will require the implementation of modern stormwater systems but may not be enough to improve the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

Middle Allen Creek

Watershed	Allen Creek
Waterbodies	Allen Creek, no tributaries 4 Wetlands/ 47.4 acres wetland
Total subbasin area	365.4 acres (0.57 square miles)
Subbasin area within city limits	365.4 acres (0.57 square miles)
Percent of Subbasin within city limits	100%
Impervious land cover (in city limits)	165.4 acres (45%)
Forest land cover (in city limits)	58.5 acres (16%)
Existing Land Use (full subbasin)	Dominant land use: Residential Undeveloped - 24% Agriculture - 0% Residential Low - 35% Residential Med - 10% Residential High - 1.5% Commercial/Industrial - 6% Multifamily Residential - 11% Roads: 9%
Future Zoning (in city limits)	SF Residential Med - 14% SF Residential High - 54% Multifamily Residential - 17% Commercial/Industrial - 2% Recreation/Open Space - 13%
Water Quality Conditions	No sampling data 303d listings: bacteria TMDL: dissolved oxygen, pH
Biological Conditions	Modeled High Pulse Count: 13.3 (existing)/ 7.4 (forested) B-IBI sampling: none Fish species: Chinook, Coho, Cutthroat
PSWC Restoration Potential/Best Use	Flow: Restoration/Development Sediment: Conservation Nutrients (N/P): N - Restoration/Development, P - Development, Restoration Pathogens: Development/Restoration Metals: Development/Restoration

Munson Creek- Jennings Park, Getchell Hill and East Sunnyside Neighborhoods

A basin with a low expected Stormwater Management Influence is defined as having both "low expected hydrologic impacts" and "low expected pollutant loadings" from the City's MS4. Each of the criteria has been assessed for this basin. If the criteria is met it is listed below. If the criteria was not met the basin received a "no" in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The pollutants associated with point sources come from 44 stormwater outfalls and are expected to be typical of a residential area. Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. In this basin a poor relative hydrology rating indicates that the stream has seen significant alteration in flow durations and increased flashiness associated with land use changes.

Modeling has not been completed for future build out conditions. It is unknown if pollutant loading and runoff volumes will increase. The current land use is primarily low density residential. Currently a majority of the development in this basin has moderate or limited stormwater treatment. The basin is split between several neighborhoods and only the upper most reaches are expected to see significant redevelopment. Under future conditions this area is expected to be medium and high density residential. Infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

Munson Creek

Watershed	Allen Creek
Waterbodies	Munson Creek, 3 unnamed tributaries 48 Wetlands/ 43 acres wetland
Total subbasin area	1015.2 acres (1.6 square miles)
Subbasin area within city limits	1015.2 acres (1.6 square miles)
Percent of Subbasin within city limits	100%
Impervious land cover (in city limits)	376.6 acres (37%)
Forest land cover (in city limits)	185.4 acres (18%)
Existing Land Use (full subbasin)	Dominant land use: Residential Undeveloped - 18% Agriculture - 0% Residential Low - 58% Residential Med - 2% Residential High - 0% Commercial/Industrial - 7% Multifamily Residential - 1% Roads: 14%
Future Zoning (in city limits)	SF Residential Med - 43% SF Residential High - 44% Multifamily Residential - 8% Commercial/Industrial - <0% Recreation/Open Space - 5%
Water Quality Conditions	WQ sampling: Meets temperature, DO standards; fails pH and fecal 303d listings: bacteria TMDL: none
Biological Conditions	Modeled High Pulse Count: 19.4 (existing)/ 7.2 (forested) B-IBI sampling: 22.9 (1 sample) Fish species: Chinook, Coho, Cutthroat
PSWC Restoration Potential/Best Use	Flow: Restoration/Development Sediment: Conservation Nutrients (N/P): N - Restoration/Development, P - Development/Restoration Pathogens: Development/Restoration Metals: Development/Restoration

North Fork Allen Creek- Kellogg Marsh and County

A basin with a low expected Stormwater Management Influence is defined as having both "low expected hydrologic impacts" and "low expected pollutant loadings" from the City's MS4. Each of the criteria have been assessed for this basin. If the criteria are met it is listed below. If the criteria are not met the basin received a "no" in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

Only 9% of this basin is within the city limits. The pollutants associated with point sources come from 3 stormwater outfalls in city limits and are expected to be typical of a residential area. It is unknown how many point sources are located in the basin outside of the city limits. Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. In this basin a good relative hydrology rating suggests that development effects on flow peaks and durations have been limited or are otherwise mitigated by natural or constructed features.

Modeling has not been completed for future build out conditions. It is unknown if pollutant loading and runoff volumes will increase. Currently a majority of the development within the city limits has moderate or limited stormwater treatment. Road network improvements identified in the 2015 Comprehensive plan are focused on improvements and widening existing roads. Under future conditions the City area is expected to be high density residential. Infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

North Fork Allen Creek

Watershed	Allen Creek
Waterbodies	Allen Creek, Little Coho Creek, South Fork Allen Creek, 3 unnamed tributaries 4 Wetlands/ 1.4 acres wetland
Total subbasin area	1596.0 acres (2.5 square miles)
Subbasin area within city limits	144.5 acres (0.2 square miles)
Percent of Subbasin within city limits	9%
Impervious land cover (in city limits)	50.3 acres (35%)
Forest land cover (in city limits)	11.7 acres (8.0%)
Existing Land Use (full subbasin)	Dominant land use: Residential/Undeveloped Undeveloped - 38% Agriculture - 12% Residential Low - 42% Residential Med - 0% Residential High - 0% Commercial/Industrial - 1% Multifamily Residential - 0.1% Roads: 7%
Future Zoning (in city limits)	SF Residential Med - 0% SF Residential High - 88% Multifamily Residential - 0% Commercial/Industrial - 11% Recreation/Open Space - 1%
Water Quality Conditions	WQ Sampling: Meets temperature, metals standards; fails pH, DO, fecal, E. coli 303d listings: bacteria TMDL: dissolved oxygen
Biological Conditions	Modeled High Pulse Count: 9.9 (existing)/ 8.9 (forested) B-IBI sampling: none Fish species: Chinook, Coho, Cutthroat
PSWC Restoration Potential/Best Use	Flow: Restoration/Development Sediment: Restoration/Development Nutrients (N/P): N - Restoration, P - Restoration/Development Pathogens: Development/Restoration Metals: Development/Restoration

South Fork Allen Creek- Getchell Hill

A basin with a low expected Stormwater Management Influence is defined as having both "low expected hydrologic impacts" and "low expected pollutant loadings" from the City's MS4. Each of the criteria have been assessed for this basin. If the criteria are met it is listed below. If the criteria are not met the basin received a "no" in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The pollutants associated with point sources come from 38 stormwater outfalls and are expected to be typical of a residential area. Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. This basin received a fair-good relative hydrology rating indicating that stormwater from development in the subbasin has caused notable increases in streamflow peaks and high flow durations.

Modeling has not been completed for future build out conditions. It is unknown if pollutant loading and runoff volumes will increase. The current land use is primarily low density residential. A majority of the development in this basin has moderate or limited stormwater treatment. This area is expected to have additional growth and the road network will need to be increased. Most projects identified in the 2015 Comprehensive plan relate to widening and intersection improvements. Under future conditions this area is expected to be medium density residential. The neighborhood is expected to add 985 housing units to accommodate and increase population of 2,291 by 2035. Infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

South Fork Allen Creek

Watershed	Allen Creek
Waterbodies	South Fork Allen Creek, 2 unnamed tributaries 64 Wetlands/ 53 acres wetland
Total subbasin area	1176.5 acres (1.8 square miles)
Subbasin area within city limits	970.1 acres (1.5 square miles)
Percent of Subbasin within city limits	82%
Impervious land cover (in city limits)	301.5 acres (32%)
Forest land cover (in city limits)	199.5 acres (21%)
Existing Land Use (full subbasin)	Dominant land use: Residential Undeveloped - 35% Agriculture - 0% Residential Low - 42% Residential Med - 4% Residential High - 4% Commercial/Industrial - 6% Multifamily Residential - 0.4% Roads: 9%
Future Zoning (in city limits)	SF Residential Med - 70% SF Residential High - 17% Multifamily Residential - 1% Commercial/Industrial - 6% Recreation/Open Space - 5%
Water Quality Conditions	No sampling data 303d listings: bacteria TMDL: none
Biological Conditions	Modeled High Pulse Count: 10.1 (existing)/ 7.8 (forested) B-IBI sampling: none Fish species: Coho, Cutthroat
PSWC Restoration Potential/Best Use	Flow: Restoration/Development Sediment: Restoration/Development Nutrients (N/P): N - Restoration , P - Restoration/Development Pathogens: Development/Restoration Metals: Development/Restoration

Upper Allen Creek- Getchell Hill and Pinewood Neighborhoods

A basin with a low expected Stormwater Management Influence is defined as having both “low expected hydrologic impacts” and “low expected pollutant loadings” from the City’s MS4. Each of the criteria have been assessed for this basin. If the criteria are met it is listed below. If the criteria are not met the basin received a “no” in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The pollutants associated with point sources come from 11 stormwater outfalls and are expected to be typical of a residential area. Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. This basin received a fair-good relative hydrology rating indicating that stormwater from development in the subbasin has caused notable increases in streamflow peaks and high flow durations.

Modeling has not been completed for future build out conditions. It is unknown if pollutant loading and runoff volumes will increase. The current land use is primarily low density residential. A majority of the development in this basin has limited stormwater treatment. Transportation projects planned for these neighborhoods in the 2015 Comprehensive plan include arterial widening and intersection improvements. Under future conditions this area is expected to be high density residential. Infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

Upper Allen Creek

Watershed	Allen Creek
Waterbodies	Allen Creek, no tributaries 2 Wetlands/ 0.8 acres wetland
Total subbasin area	329.3 acres (0.5 square miles)
Subbasin area within city limits	329.3 acres (0.5 square miles)
Percent of Subbasin within city limits	100%
Impervious land cover (in city limits)	136 acres (41%)
Forest land cover (in city limits)	40 acres (12%)
Existing Land Use (full subbasin)	Dominant land use: Residential Undeveloped - 3% Agriculture - 0% Residential Low - 46% Residential Med - 19% Residential High - 2% Commercial/Industrial - 11% Multifamily Residential - 3% Roads: 16%
Future Zoning (in city limits)	SF Residential Med - <1% SF Residential High - 86% Multifamily Residential - 12% Commercial/Industrial - <1% Recreation/Open Space - <1%
Water Quality Conditions	No sampling data 303d listings: bacteria TMDL: none
Biological Conditions	Modeled High Pulse Count: 10.5 (existing)/ 7.7 (forested) B-IBI sampling: none Fish species: Chinook, Coho, Cutthroat
PSWC Restoration Potential/Best Use	Flow: Restoration/Development Sediment: Restoration/Development Nutrients (N/P): N - Restoration, P - Restoration/Development Pathogens: Development/Restoration Metals: Development/Restoration

Downtown

A basin with a low expected Stormwater Management Influence is defined as having both “low expected hydrologic impacts” and “low expected pollutant loadings” from the City’s MS4. Each of the criteria have been assessed for this basin. If the criteria are met it is listed below. If the criteria are not met the basin received a “no” in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- Yes, flow control exempt
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

No major streams run through this basin. Stormwater is either infiltrated or the outfalls flow to Ebey Slough. The pollutants associated with point sources come from 9 stormwater outfalls and are expected to be typical of a commercial area. The land uses include residential, retail, warehousing, fabrication shops, and auto repair. These uses can produce a variety of potential pollutants to stormwater.

Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. Applicability of the HPC metric is questionable in this subbasin, as stormwater is routed through pipes and there are no significant receiving streams. Ebey Slough is classified by Ecology as an exempt receiving water, indicating that flow control from direct stormwater sources is not a priority for system health. This basin received a poor relative hydrology rating indicating that the system has seen significant alteration in flow durations and increased flashiness associated with land use changes.

Modeling has not been completed for future build out conditions. The current land use is already a mix of residential and commercial. This basin has a range of stormwater treatment levels but overall it is expected to be quite low. Most of this area was developed before stormwater controls were required. Under future conditions this area is expected to have an increased residential density and transition additional areas to commercial. The 2015 Comprehensive Plan anticipates an additional 1,992 housing units to accommodate a population increase of 2,896 by 2035. Infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements. The City will also begin to implement a source control program for existing development. The Downtown neighborhood will be prioritized for source control inspections. This tailored implementation of a SWMP action is being taken to address the findings in the City’s environmental justice review.

The Stormwater Comprehensive Plan has prioritized actions in Downtown for many years now. As a result several retrofit projects have been completed or are underway currently. The retrofits will treat a majority of the stormwater from the Downtown basin so further retrofit opportunities are limited.

Land use management strategies for Downtown have also been a focus for our Community Development and Executive departments. Studies, planning documents and projects have been completed to address issues related to environmental justice, through traffic revisions, increased walkability corridors, stormwater treatment projects and contaminated site cleanup. An update to the Downtown master plan was completed in September 2021.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

Downtown

Watershed	Ebey Slough
Waterbodies	No Creeks, no tributaries 10 Wetlands/ 64.4 acres wetland
Total subbasin area	1185.8acres (1.8 square miles)
Subbasin area within city limits	1172.6 acres (1.8 square miles)
Percent of Subbasin within city limits	99%
Impervious land cover (in city limits)	585.3 acres (50%)
Forest land cover (in city limits)	98.6 acres (8.4%)
Existing Land Use (full subbasin)	Dominant land use: Commercial Undeveloped - 9% Agriculture - 0% Residential Low - 2% Residential Med - 12% Residential High - 4% Commercial/Industrial - 42% Multifamily Residential - 5% Roads: 25%
Future Zoning (in city limits)	SF Residential Med - 0% SF Residential High - 24% Multifamily Residential - 12% Commercial/Industrial - 55% Recreation/Open Space - 9%
Water Quality Conditions	Meets temperature, pH, DO, and fecal standards 303d listings: none TMDL: none
Biological Conditions	Modeled High Pulse Count: n/a B-IBI sampling: none Fish species: none
PSWC Restoration Potential/Best Use	Flow: Restoration/Development Sediment: Conservation Nutrients (N/P): N - Development/Restoration, P - Development/Restoration Pathogens: Restoration Metals: Restoration/Development

Ebey Slough/Lower Allen- Sunnyside Neighborhood

A basin with a low expected Stormwater Management Influence is defined as having both “low expected hydrologic impacts” and “low expected pollutant loadings” from the City’s MS4. Each of the criteria have been assessed for this basin. If the criteria are met it is listed below. If the criteria are not met the basin received a “no” in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no with some areas that could be flow control exempt
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The outlet of Allen Creek, Jones Creek and un-named tributary converge in this basin. Tidal influence has been restored to a majority of the area in this basin. The pollutants associated with point sources comes from 18 stormwater outfalls and are expected to be typical of a residential area. Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. Applicability of the HPC metric is questionable in this subbasin, as some of the stormwater is routed through pipes to tidally influenced areas. Ebey Slough is classified by Ecology as an exempt receiving water, indicating that flow control from direct stormwater sources is not a priority for system health. This basin received a fair relative hydrology rating indicating that stormwater from development in the subbasin has caused notable increases in streamflow peaks and high flow durations.

Modeling has not been completed for future build out conditions. It is unknown if pollutant loading and runoff volumes will increase. The current land use is primarily low density residential and open space. The development in this basin has significant or moderate levels of stormwater treatment. The 2015 Comprehensive Plan anticipates an additional 655 housing units to accommodate a population increase of 1,434 by 2035. The buildable area is rapidly redeveloping. Under future conditions this area is expected to be medium density residential and open space. Infill development will require the implementation of modern stormwater systems improving the overall treatment levels in the basin. Much of the developable portion of the basin directly discharges into Ebey Slough, so new or redevelopment may qualify for flow control exemption.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements. This neighborhood has a subarea master plan to help guide new development.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements

Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

Ebey Slough/Lower Allen

Watershed	Ebey Slough
Waterbodies	Allen Creek, Jones Creek, two unnamed tributaries 25 Wetlands/ 65.8 acres wetland
Total subbasin area	810.9 acres (1.3 square miles)
Subbasin area within city limits	801.4 acres (1.2 square miles)
Percent of Subbasin within city limits	99%
Impervious land cover (in city limits)	124.4 acres (15.5%)
Forest land cover (in city limits)	56.2 acres (7%)
Existing Land Use (full subbasin)	Dominant land use: Undeveloped Undeveloped - 58% Agriculture - 0% Residential Low - 32% Residential Med - 4% Residential High - 0% Commercial/Industrial - 1% Multifamily Residential - 0.1% Roads: 5%
Future Zoning (in city limits)	SF Residential Med - 34% SF Residential High - 9% Multifamily Residential - 0% Commercial/Industrial - <1% Recreation/Open Space - 57%
Water Quality Conditions	Meets temperature, pH standards; fails DO, fecal 303d listings: bacteria TMDL: bacteria, dissolved oxygen, pH
Biological Conditions	Modeled High Pulse Count: n/a B-IBI sampling: none Fish species: Chinook, Coho, Cutthroat
PSWC Restoration Potential/Best Use	Flow: Restoration/Development Sediment: Conservation Nutrients (N/P): N - Restoration/Development, P - Development/Restoration Pathogens: Development/Restoration Metals: Development/Restoration

King Creek- East Sunnyside

A basin with a low expected Stormwater Management Influence is defined as having both "low expected hydrologic impacts" and "low expected pollutant loadings" from the City's MS4. Each of the criteria have been assessed for this basin. If the criteria are met it is listed below. If the criteria are not met the basin received a "no" in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The pollutants associated with point sources come from 40 stormwater outfalls and are expected to be typical of a residential area. The major flow impacts associated with point sources and non-point sources were not modeled in the data provided by Snohomish County.

Modeling has not been completed for future build out conditions. It is unknown if pollutant loading and runoff volumes will increase. The current land use is primarily low density residential. The development in this basin has significant or moderate levels of stormwater treatment. This area is developing rapidly and the 2015 Comprehensive Plan expects 4,660 additional housing units to accommodate a population increase of 8,826 by 2035. Under future conditions this area is expected to be high density residential. New road connections will be required for this growth. New development will require the implementation of modern stormwater systems but this area may be impacted based on the relative future development intensity.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements. This neighborhood has a subarea master plan to help guide new development.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

King Creek

Watershed	Ebey Slough
Waterbodies	King Creek, 3 unnamed tributaries 58 Wetlands/ 41.9 acres wetland
Total subbasin area	952.7 acres (1.5 square miles)
Subbasin area within city limits	897.2 acres (1.4 square miles)
Percent of Subbasin within city limits	94%
Impervious land cover (in city limits)	217.5 acres (24%)
Forest land cover (in city limits)	256.7 acres (28.6%)
Existing Land Use (full subbasin)	Dominant land use: Residential Undeveloped - 25% Agriculture - 32% Residential Low - 40% Residential Med - 9% Residential High - 0% Commercial/Industrial - 1% Multifamily Residential - 0% Roads: 4%
Future Zoning (in city limits)	SF Residential Med - 4% SF Residential High - 90% Multifamily Residential - 4% Commercial/Industrial - 0% Recreation/Open Space - 2%
Water Quality Conditions	No sampling data 303d listings: none TMDL: none
Biological Conditions	Modeled High Pulse Count: n/a B-IBI sampling: none Fish species: Coho, Cutthroat
PSWC Restoration Potential/Best Use	Flow: Restoration/Development Sediment: Conservation Nutrients (N/P): N - Restoration/Development, P - Development/Restoration Pathogens: Restoration/Development Metals: Restoration/Development

Edgecomb Creek- Smokey Point Neighborhood

A basin with a low expected Stormwater Management Influence is defined as having both “low expected hydrologic impacts” and “low expected pollutant loadings” from the City’s MS4. Each of the criteria have been assessed for this basin. If the criteria are met it is listed below. If the criteria are not met the basin received a “no” in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

Only 32% of this basin is within the city limits. The pollutants associated with point sources within the City come from 10 stormwater outfalls and are expected to be typical of agricultural and residential land uses. Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. This basin received a fair relative hydrology rating indicating that stormwater from development in the subbasin has caused notable increases in streamflow peaks and high flow durations.

Modeling has not been completed for future build out conditions. The current land use is primarily agricultural. A majority of the development in this basin is untreated because treatment isn’t required for the existing agricultural land use. This area is not developed so it is expected to require an increase in the road network to accommodate future growth. Under future conditions this area is expected to be commercial and industrial. Based on the land use intensity changes planned for this basin the potential pollutant loading and runoff volumes could increase. New development will require the implementation of modern stormwater systems providing treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements. This neighborhood has a subarea master plan to help guide new development.

The City will also begin to implement a source control program for existing development. As this area develops the new commercial and industrial sites will be inspected to ensure that source control BMP’s are in place.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

Edgecomb Creek

Watershed	Quilceda Creek
Waterbodies	Edgecomb Creek, 3 unnamed tributaries 18 Wetlands/ 4.3 acres wetland
Total subbasin area	1791.9 acres (2.8 square miles)
Subbasin area within city limits	570.7 acres (0.9 square miles)
Percent of Subbasin within city limits	32%
Impervious land cover (in city limits)	69.7 acres (12.2%)
Forest land cover (in city limits)	11.3 acres (2.0%)
Existing Land Use (full subbasin)	Dominant land use: Agriculture Undeveloped - 19% Agriculture - 47% Residential Low - 15% Residential Med - 4% Residential High - 1% Commercial/Industrial - 7% Multifamily Residential - 2% Roads: 4%
Future Zoning (in city limits)	SF Residential Med - 12% SF Residential High - 0% Multifamily Residential - 10% Commercial/Industrial - 78% Recreation/Open Space - 0%
Water Quality Conditions	No sampling data 303d listings: bacteria TMDL: none
Biological Conditions	Modeled High Pulse Count: 12.7 (existing)/ 6.9 (forested) B-IBI sampling: none Fish species: Chinook, Coho, Chum, Cutthroat
PSWC Restoration Potential/Best Use	Flow: Restoration/Development Sediment: Development/Restoration Nutrients (N/P): N - Restoration/Development, P - Development/Restoration Pathogens: Development/Restoration Metals: Restoration

Hayho Creek- Smokey Point Neighborhood

A basin with a low expected Stormwater Management Influence is defined as having both “low expected hydrologic impacts” and “low expected pollutant loadings” from the City’s MS4. Each of the criteria have been assessed for this basin. If the criteria are met it is listed below. If the criteria are not met the basin received a “no” in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The pollutants associated with point sources comes from 7 stormwater outfalls and are expected to be typical of agricultural and commercial uses. The commercial land uses include retail, warehousing, fabrication shops, and auto repair. These uses can produce a variety of potentially pollutants to stormwater. Of these commercial uses there are 3 Industrial Permittees in this basin, Whitley Evergreen, Rubber Granulators and Equipment and Hyponex Corp. They are each required to sample their stormwater discharge for a variety of toxins.

Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. This basin received a poor relative hydrology rating indicating that the stream has seen significant alteration in flow durations and increased flashiness associated with land use changes.

Modeling has not been completed for future build out conditions. It is unknown if pollutant loading and runoff volumes will increase. The current land use is primarily agricultural. A majority of the development in this basin is untreated because treatment isn’t required for the existing agricultural land use. The developed areas of this basin have moderate stormwater treatment. This area is not developed so it is expected to require an increase in the road network to accommodate future growth. Under future conditions this area is expected to be commercial and industrial. Based on the land use intensity changes planned for this basin the potential pollutant loading and runoff volumes could increase. New development will require the implementation of modern stormwater systems providing treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements. This neighborhood has a subarea master plan to help guide new development.

The City will also begin to implement a source control program for existing development. As this area develops the new commercial and industrial sites will be inspected to ensure that source control BMP’s are in place.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

Hayho Creek

Watershed	Quilceda Creek
Waterbodies	Hayho Creek, 11 unnamed tributaries 20 Wetlands/ 28.6 acres wetland
Total subbasin area	1663.5 acres (2.6 square miles)
Subbasin area within city limits	1047.4 acres (1.6 square miles)
Percent of Subbasin within city limits	63%
Impervious land cover (in city limits)	276.7 acres (26.4%)
Forest land cover (in city limits)	74.0 acres (7.0%)
Existing Land Use (full subbasin)	Dominant land use: Agriculture/Commercial Undeveloped - 15% Agriculture - 32% Residential Low - 6% Residential Med - 9% Residential High - 2% Commercial/Industrial - 23% Multifamily Residential - 4% Roads: 8%
Future Zoning (in city limits)	SF Residential Med - 12% SF Residential High - 0% Multifamily Residential - 10% Commercial/Industrial - 75% Recreation/Open Space - 3%
Water Quality Conditions	No sampling data 303d listings: none TMDL: none
Biological Conditions	Modeled High Pulse Count: 15.4 (existing)/ 6.7 (forested) B-IBI sampling: 15.3 (1 sample) Fish species: Chinook, Coho, Chum, Steelhead, Cutthroat
PSWC Restoration Potential/Best Use	Flow: Restoration/Development Sediment: Conservation Nutrients (N/P): N - Development/Restoration, P - Development/Restoration Pathogens: Development/Restoration Metals: Highest Restoration

Lower Middle Fork Quilceda- Shoultes Neighborhood

A basin with a low expected Stormwater Management Influence is defined as having both “low expected hydrologic impacts” and “low expected pollutant loadings” from the City’s MS4. Each of the criteria have been assessed for this basin. If the criteria are met it is listed below. If the criteria are not met the basin received a “no” in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The pollutants associated with point sources come from 25 stormwater outfalls and are expected to be typical of a residential area. Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. This basin received a fair relative hydrology rating indicating that stormwater from development in the subbasin has caused notable increases in streamflow peaks and high flow durations.

Modeling has not been completed for future build out conditions. It is unknown if pollutant loading and runoff volumes will increase. The current land use is primarily low and medium density residential. A majority of the development in this basin does not have stormwater treatment. This area is mostly built out with limited development and redevelopment identified in the 2015 Comprehensive Plan. Infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin. With a low expected redevelopment potential some retrofits may be required to bring the basin into compliance with modern stormwater standards.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

Lower Middle Fork Quilceda

Watershed	Quilceda Creek
Waterbodies	Middle Fork Quilceda Creek, Olaf Creek, Edgecomb Creek, Hayho Creek 16 Wetlands/6 acres wetland
Total subbasin area	674.1 acres (1.0 square miles)
Subbasin area within city limits	518.1 acres (0.8 square miles)
Percent of Subbasin within city limits	77%
Impervious land cover (in city limits)	188.3 acres (36.3%)
Forest land cover (in city limits)	65.6 acres (12.7%)
Existing Land Use (full subbasin)	Dominant land use: Residential Undeveloped - 8% Agriculture - 21% Residential Low - 20% Residential Med - 36% Residential High - 0% Commercial/Industrial - 2% Multifamily Residential - 0.1% Roads: 10%
Future Zoning (in city limits)	SF Residential Med - 87% SF Residential High - 0% Multifamily Residential - 0% Commercial/Industrial - 1% Recreation/Open Space - 12%
Water Quality Conditions	No sampling data 303d listings: bacteria TMDL: none
Biological Conditions	Modeled High Pulse Count: 10.2 (existing)/ 6.9 (forested) B-IBI sampling: none Fish species: Chinook, Coho, Chum, Steelhead, Cutthroat, Bull Trout
PSWC Restoration Potential/Best Use	Flow: Restoration/Development Sediment: Conservation Nutrients (N/P): N - Development/Restoration, P - Development/Restoration Pathogens: Development/Restoration Metals: Restoration/Development

Lower Quilceda- Marshall and Kellogg Marsh Neighborhoods

A basin with a low expected Stormwater Management Influence is defined as having both “low expected hydrologic impacts” and “low expected pollutant loadings” from the City’s MS4. Each of the criteria have been assessed for this basin. If the criteria are met it is listed below. If the criteria are not met the basin received a “no” in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The pollutants associated with point sources come from 15 stormwater outfalls and are expected to be typical of a residential area. Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. This basin received a good relative hydrology rating suggesting that development effects on flow peaks and durations have been limited or are otherwise mitigated by natural or constructed features.

Modeling has not been completed for future build out conditions. It is unknown if pollutant loading and runoff volumes will increase. The current land use is primarily low and medium density residential. Currently the development in this basin is split between the moderate/ limited stormwater treatment levels or does not have any stormwater treatment. Most of the roadway projects listed in the 2015 Comprehensive plan are road widening projects for the main arterials. Under future conditions this area is expected to be medium density residential. Infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin. Due to the low existing treatment levels some retrofits may be required to bring the basin into compliance with modern stormwater standards.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

Lower Quilceda

Watershed	Quilceda Creek
Waterbodies	Quilceda Creek, 1 unnamed tributary 9 Wetlands/ 54.3 acres wetland
Total subbasin area	1114.4 acres (1.7 square miles)
Subbasin area within city limits	976.8 acres (1.5 square miles)
Percent of Subbasin within city limits	88%
Impervious land cover (in city limits)	408.8 acres (42%)
Forest land cover (in city limits)	86.1 acres (8.8%)
Existing Land Use (full subbasin)	Dominant land use: Residential Undeveloped - 9% Agriculture - 11% Residential Low - 21% Residential Med - 26% Residential High - 6% Commercial/Industrial - 6% Multifamily Residential - 7% Roads: 13%
Future Zoning (in city limits)	SF Residential Med - 70% SF Residential High - 12% Multifamily Residential - 4% Commercial/Industrial - 12% Recreation/Open Space - 1.5%
Water Quality Conditions	No sampling data 303d listings: bacteria TMDL: dissolved oxygen
Biological Conditions	Modeled High Pulse Count: 9.2 (existing)/ 7.0 (forested) B-IBI sampling: none Fish species: Chinook, Coho, Chum, Steelhead, Cutthroat, Bull Trout
PSWC Restoration Potential/Best Use	Flow: Restoration/Development Sediment: Conservation Nutrients (N/P): N - Development/Restoration, P - Development/Restoration Pathogens: Development/Restoration Metals: Restoration/Development

Lower West Fork Quilceda- Marshall Neighborhood

A basin with a low expected Stormwater Management Influence is defined as having both “low expected hydrologic impacts” and “low expected pollutant loadings” from the City’s MS4. Each of the criteria have been assessed for this basin. If the criteria are met it is listed below. If the criteria are not met the basin received a “no” in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

This basin is only 24% within the city limits. There are no outfalls from the City MS4 in this basin. Non-point sources of pollution are expected to be typical of a residential area. There is one Industrial Permittee, Zodiac Aerospace in this basin. They are required to sample their stormwater discharge for a variety of toxins.

Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. This basin received a good relative hydrology rating suggesting that development effects on flow peaks and durations have been limited or are otherwise mitigated by natural or constructed features.

Modeling has not been completed for future build out conditions. The current land use is primarily low density residential but there are still quite a few undeveloped parcels. A majority of the development in this basin has moderate stormwater treatment. Under future conditions this area is expected to be commercial. Based on the land use intensity changes planned for this basin the potential pollutant loading and runoff volumes could increase. Infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements. The City will also begin to implement a source control program for existing development. As this area develops the new commercial and industrial sites will be inspected to ensure that source control BMP’s are in place.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

Lower West Fork Quilceda

Watershed	Quilceda Creek
Waterbodies	West Fork Quilceda Creek, 2 unnamed tributaries 2 Wetlands/ 35.2 acres wetland
Total subbasin area	2862.8 acres (4.5 square miles)
Subbasin area within city limits	675.3 acres (1.0 square miles)
Percent of Subbasin within city limits	24%
Impervious land cover (in city limits)	270.1 acres (40%)
Forest land cover (in city limits)	115.3 acres (17%)
Existing Land Use (full subbasin)	Dominant land use: Residential Undeveloped - 37% Agriculture - 1% Residential Low - 42% Residential Med - 3% Residential High - 0% Commercial/Industrial - 6% Multifamily Residential - 0% Roads: 11%
Future Zoning (in city limits)	SF Residential Med - 27% SF Residential High - 0% Multifamily Residential - 6% Commercial/Industrial - 53% Recreation/Open Space - 13%
Water Quality Conditions	WQ Sampling: Meets temperature, pH, E. coli standards; fails DO, fecal 303d listings: bacteria TMDLs: dissolved oxygen, pH
Biological Conditions	Modeled High Pulse Count: 8.7 (existing)/ 7.1 (forested) B-IBI sampling: 32.9 (1 sample) Fish species: Chinook,Coho, Chum, Steelhead, Cutthroat, Bull Trout
PSWC Restoration Potential/Best Use	Flow: Restoration/Development Sediment: Conservation Nutrients (N/P): N - Development/Restoration, P - Development/Restoration Pathogens: Development/Restoration Metals: Restoration/Development

Mainstem Quilceda- Pinewood Neighborhood

A basin with a low expected Stormwater Management Influence is defined as having both "low expected hydrologic impacts" and "low expected pollutant loadings" from the City's MS4. Each of the criteria have been assessed for this basin. If the criteria are met it is listed below. If the criteria are not met the basin received a "no" in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

The pollutants associated with point sources come from 8 stormwater outfalls and are expected to be typical of a residential area. Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. This basin received a good relative hydrology rating suggesting that development effects on flow peaks and durations have been limited or are otherwise mitigated by natural or constructed features.

Modeling has not been completed for future build out conditions. It is unknown if pollutant loading and runoff volumes will increase. The current land use is already a mix of residential and commercial. A majority of the development in this basin has moderate or limited stormwater treatment. This area is expected to add 688 housing units to accommodate a 1,257 population increase. The road improvement projects in the 2015 Comprehensive plan are primarily arterial widening and intersection improvements. Under future conditions this area is expected to have an increased residential density. Infill development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements. The City will also begin to implement a source control program for existing development. As this area develops the new commercial and industrial sites will be inspected to ensure that source control BMP's are in place.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

Mainstem Quilceda

Watershed	Quilceda Creek
Waterbodies	Quilceda Creek, no tributaries 1 Wetlands/ 61.8 acres wetland
Total subbasin area	1014.9 acres (1.6 square miles)
Subbasin area within city limits	970.6acres (1.5 square miles)
Percent of Subbasin within city limits	96%
Impervious land cover (in city limits)	474.9 acres (49%)
Forest land cover (in city limits)	100.4 acres (10.3%)
Existing Land Use (full subbasin)	Dominant land use: Residential Undeveloped - 10% Agriculture - 0% Residential Low - 19% Residential Med - 30% Residential High - 2% Commercial/Industrial - 16% Multifamily Residential - 6% Roads: 17%
Future Zoning (in city limits)	SF Residential Med - 18% SF Residential High - 47% Multifamily Residential - 10% Commercial/Industrial - 23% Recreation/Open Space - 2%
Water Quality Conditions	WQ Sampling: Meets temperature, pH, DO, fecal standards 303d listings: bacteria TMDL: dissolved oxygen
Biological Conditions	Modeled High Pulse Count: 9.0 (existing)/ 6.9 (forested) B-IBI sampling: none Fish species: Chinook, Coho, Chum, Steelhead, Cutthroat, Bull Trout
PSWC Restoration Potential/Best Use	Flow: Development/Restoration Sediment: Protection/Restoration Nutrients (N/P): N -Restoration/Development, P - Development/Restoration Pathogens: Restoration Metals: Restoration

Middle Quilceda- Shoultes Neighborhood and County

A basin with a low expected Stormwater Management Influence is defined as having both “low expected hydrologic impacts” and “low expected pollutant loadings” from the City’s MS4. Each of the criteria have been assessed for this basin. If the criteria are met it is listed below. If the criteria are not met the basin received a “no” in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

This basin is only 23% within the city limits. The pollutants associated with point sources come from 14 stormwater outfalls within city limits and are expected to be typical of a residential area. Outside city limits pollutants are expected to be associated with an agricultural use.

Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. This basin received a good relative hydrology rating suggesting that development effects on flow peaks and durations have been limited or are otherwise mitigated by natural or constructed features.

Modeling has not been completed for future build out conditions. It is unknown if pollutant loading and runoff volumes will increase. The current land use within city limits is primarily low density residential. A majority of the development in this basin has moderate or limited stormwater treatment. Within city limits is mostly built out with limited development and redevelopment identified in the 2015 Comprehensive Plan. Under future conditions this area is expected to be medium density residential. With a low expected redevelopment potential some retrofits may be required to bring the basin into compliance with modern stormwater standards.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

Middle Quilceda

Watershed	Quilceda Creek
Waterbodies	Quilceda Creek, 5 unnamed tributaries 2 Wetlands/ 7.8 acres wetland
Total subbasin area	964.1 acres (1.5 square miles)
Subbasin area within city limits	217.4 acres (0.3 square miles)
Percent of Subbasin within city limits	23%
Impervious land cover (in city limits)	76.0 acres (35%)
Forest land cover (in city limits)	50.1 acres (23%)
Existing Land Use (full subbasin)	Dominant land use: Agriculture Undeveloped - 24% Agriculture - 39% Residential Low - 23% Residential Med - 6% Residential High - 3% Commercial/Industrial - 1% Multifamily Residential - 0.3% Roads: 4%
Future Zoning (in city limits)	SF Residential Med - 80% SF Residential High - 20% Multifamily Residential - 0% Commercial/Industrial - 0% Recreation/Open Space - <1%
Water Quality Conditions	No sampling data 303d listings: bacteria TMDL: none
Biological Conditions	Modeled High Pulse Count: 8.5 (existing)/ 7.6 (forested) B-IBI sampling: none Fish species: Chinook, Coho, Chum, Steelhead, Cutthroat
PSWC Restoration Potential/Best Use	Flow: Development/Restoration Sediment: Protection Nutrients (N/P): N - Restoration, P - Restoration/Development Pathogens: Restoration/Development Metals: Restoration

Olaf Strad Creek- Smokey Point Neighborhood and County

A basin with a low expected Stormwater Management Influence is defined as having both "low expected hydrologic impacts" and "low expected pollutant loadings" from the City's MS4. Each of the criteria has been assessed for this basin. If the criteria is met it is listed below. If the criteria was not met the basin received a "no" in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

This basin is only 5% within the city limits. It is unknown what pollutants may be associated with point sources in this area. There are no City MS4 outfalls in this basin. The pollutants associated with non-point sources are typical of agricultural land use areas.

Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. This basin received a good relative hydrology rating suggesting that development effects on flow peaks and durations have been limited or are otherwise mitigated by natural or constructed features.

Modeling has not been completed for future build out conditions. The current land use within city limits is primarily agricultural. Currently a majority of the basin is untreated because it isn't required. This area is not developed so it is expected to require an increase in the road network to accommodate future growth. Under future conditions this area is expected to be commercial and industrial. Based on the land use intensity changes planned for this basin the potential pollutant loading and runoff volumes could increase. New development will require the implementation of modern stormwater systems providing treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements. This neighborhood has a subarea master plan to help guide new development.

The City will also begin to implement a source control program for existing development. As this area develops the new commercial and industrial sites will be inspected to ensure that source control BMP's are in place.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements

Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

Olaf Strad Creek

Watershed	Quilceda Creek
Waterbodies	Olaf Strad Creek, 7 unnamed tributaries 2 Wetlands/ 0.4 acres wetland
Total subbasin area	770.1 acres (1.2 square miles)
Subbasin area within city limits	40.2 acres (0.06 square miles)
Percent of Subbasin within city limits	5%
Impervious land cover (in city limits)	3.7 acres (9.2%)
Forest land cover (in city limits)	0.4 acres (1.1%)
Existing Land Use (full subbasin)	Dominant land use: Residential Undeveloped - 15% Agriculture - 24% Residential Low - 54% Residential Med - 0% Residential High - 0% Commercial/Industrial - 0% Multifamily Residential - 0% Roads: 7%
Future Zoning (in city limits)	SF Residential Med - 0% SF Residential High - 0% Multifamily Residential - 0% Commercial/Industrial - 79% Recreation/Open Space - 21%
Water Quality Conditions	No sampling data 303d listings: none TMDL: none
Biological Conditions	Modeled High Pulse Count: 8.9 (existing)/ 8.0 (forested) B-IBI sampling: none Fish species: Coho, Cutthroat
PSWC Restoration Potential/Best Use	Flow: Restoration/Development Sediment: Restoration/Development Nutrients (N/P): N - Restoration, P - Development/Restoration Pathogens: Restoration/Development Metals: Development/Restoration

Upper West Fork Quilceda- Lakewood Neighborhood

A basin with a low expected Stormwater Management Influence is defined as having both “low expected hydrologic impacts” and “low expected pollutant loadings” from the City’s MS4. Each of the criteria has been assessed for this basin. If the criteria is met it is listed below. If the criteria was not met the basin received a “no” in Table 1 above and does not have a low expected stormwater management influence.

- Low expected hydrologic impacts- no
- Low expected pollutant loadings- no

1. What are the major pollutants and/or flow impacts associated with individual point sources versus non-point sources? Will the loadings and/or runoff volumes increase under expected future land use conditions?

This basin is only 22% within the city limits. The pollutants associated with point sources come from 4 stormwater outfalls within city limits and are expected to be typical of a residential area. Existing hydrologic models of the Quilceda and Allen Creek basins (Snohomish County, 2002 and as revised) were used to characterize flow impacts associated with existing point and non-point sources compared to predevelopment conditions. The high pulse count (HPC) metric, which indicates relative flashiness of runoff response, was compared for existing and forested land cover conditions as an indicator of the magnitude of development impact on streamflows. Because the models are fairly coarse and have limited representation of existing stormwater facilities, a qualitative assessment (based on ratio of existing to forested HPC) was judged to be more appropriate for this study than the computed values. This basin received a good relative hydrology rating suggesting that development effects on flow peaks and durations have been limited or are otherwise mitigated by natural or constructed features.

Modeling has not been completed for future build out conditions. The current land use within city limits is a mix of agricultural, undeveloped and low density residential. The development portions of this basin have significant or moderate stormwater treatment. The agricultural areas do not have any treatment because it is not required. Within the city limits this area is not fully developed so it is expected to require an increase in the road network to accommodate future growth. Under future conditions this area is expected to be commercial and multifamily. Based on the land use intensity changes planned for this basin the potential pollutant loading and runoff volumes could increase. New development will require the implementation of modern stormwater systems improving the overall treatment and flow control for the basin.

2. Can these sources be addressed through other land management strategies, including policies, code, or development standards?

Yes, pollution and runoff volumes from future growth are expected to be mitigated by implementing current and future development requirements. This neighborhood has a subarea master plan to help guide new development.

The City will also begin to implement a source control program for existing development. As this area develops the new commercial and industrial sites will be inspected to ensure that source control BMP’s are in place.

3. Can future growth be managed to minimize adverse stormwater impacts?

Yes, the City is in compliance with the state Growth Management Act. The City implements a Stormwater Comprehensive Plan, has adopted development standards in Municipal Code, implements Engineering Design and Development standards along with the requirements of the 2014 Stormwater Management Manual for Western Washington.

Upper West Fork Quilceda

Watershed	Quilceda Creek
Waterbodies	West Fork Quilceda, 3 unnamed tributaries 18 Wetlands/ 38.8 acres wetland
Total subbasin area	4077.5 acres (6.4 square miles)
Subbasin area within city limits	911.6 acres (1.4 square miles)
Percent of Subbasin within city limits	22%
Impervious land cover (in city limits)	291.0 acres (32%)
Forest land cover (in city limits)	56.5 acres (6.2%)
Existing Land Use (full subbasin)	Dominant land use: Residential Undeveloped - 32% Agriculture - 10% Residential Low - 44% Residential Med - 2% Residential High - 1% Commercial/Industrial - 4% Multifamily Residential - 1% Roads: 6%
Future Zoning (in city limits)	SF Residential Med - 0% SF Residential High - 6% Multifamily Residential - 19% Commercial/Industrial - 61% Recreation/Open Space - 14%
Water Quality Conditions	Meets E. coli standard; fails temperature, pH, DO, fecal 303d listings: bacteria TMDL: dissolved oxygen, pH
Biological Conditions	Modeled High Pulse Count: 9.0 (existing)/ 6.8 (forested) B-IBI sampling: none Fish species: Coho, Cutthroat
PSWC Restoration Potential/Best Use	Flow: Development/Restoration Sediment: Development/Restoration Nutrients (N/P): N - Development/Restoration, P - Development/Restoration Pathogens: Development/Restoration Metals: Restoration/Development

Coho Creek, Quilceda Creek Outlet, Sturgeon Creek, Upper Middle Fork Quilceda & Upper Quilceda

A basin with a low expected Stormwater Management Influence is defined as having both “low expected hydrologic impacts” and “low expected pollutant loadings” from the City’s MS4. These basins are entirely outside the city limits and beyond the City’s MS4 and therefore they have a low Stormwater Management Influence.

Coho Creek

Watershed	Quilceda Creek
Waterbodies	Coho Creek, 2 unnamed tributaries 0 Wetlands/ wetland area
Total subbasin area	1840.5 acres (2.9 square miles)
Subbasin area within city limits	0 acres (0 square miles)
Percent of Subbasin within city limits	0%
Impervious land cover (in city limits)	n/a
Forest land cover (in city limits)	n/a
Existing Land Use (full subbasin)	Dominant land use: Undeveloped Undeveloped - 59% Agriculture - 0% Residential Low - 26% Residential Med - 0% Residential High - 0% Commercial/Industrial - 11% Multifamily Residential - 0% Roads: 4%
Future Zoning (in city limits)	n/a
Water Quality Conditions	No sampling data 303d listings: none TMDL: none
Biological Conditions	Modeled High Pulse Count: 8.0 (existing)/ 7.5 (forested) B-IBI sampling: yes Fish species: Coho
PSWC Restoration Potential/Best Use	Flow: Development/Restoration Sediment: Conservation Nutrients (N/P): N - Restoration/Development, P - Development/Restoration Pathogens: Development/Restoration Metals: Development/Restoration

Quilceda Creek Outlet

Watershed	Quilceda Creek
Waterbodies	Quilceda Creek, Sturgeon Creek, Boeing Test Creek 0 Wetlands/ wetland area
Total subbasin area	997.8 acres (1.6 square miles)
Subbasin area within city limits	0 acres (0 square miles)
Percent of Subbasin within city limits	0%
Impervious land cover (in city limits)	n/a
Forest land cover (in city limits)	n/a
Existing Land Use (full subbasin)	Dominant land use: Undeveloped Undeveloped - 54% Agriculture - 0% Residential Low - 22% Residential Med - 3% Residential High - 0% Commercial/Industrial - 12% Multifamily Residential - 0% Roads: 9%
Future Zoning (in city limits)	n/a
Water Quality Conditions	WQ Sampling: Meets pH standard; fails temperature, DO, fecal 303d listings: none TMDL: none
Biological Conditions	Modeled High Pulse Count: n/a B-IBI sampling: none Fish species: Chinook, Coho, Chum, Steelhead, Cutthroat, Bull Trout
PSWC Restoration Potential/Best Use	Flow: Highest Restoration Sediment: Conservation Nutrients (N/P): N - Development/Restoration, P - Development/Restoration Pathogens: Development/Restoration Metals: Development/Restoration

Sturgeon Creek

Watershed	Quilceda Creek
Waterbodies	Sturgeon Creek, 1 unnamed tributary 0 Wetlands/ wetland area
Total subbasin area	1297.6 acres (2.0 square miles)
Subbasin area within city limits	0 acres (0 square miles)
Percent of Subbasin within city limits	0%
Impervious land cover (in city limits)	n/a
Forest land cover (in city limits)	n/a
Existing Land Use (full subbasin)	Dominant land use: Undeveloped Undeveloped - 59% Agriculture - 0% Residential Low - 34% Residential Med - 2% Residential High - 0% Commercial/Industrial - 1% Multifamily Residential - 0% Roads: 4%
Future Zoning (in city limits)	n/a
Water Quality Conditions	No sampling data 303d listings: none TMDL: none
Biological Conditions	Modeled High Pulse Count: 9.5 (existing)/ 8.0 (forested) B-IBI sampling: none Fish species: Coho
PSWC Restoration Potential/Best Use	Flow: Development/Restoration Sediment: Conservation Nutrients (N/P): N -Protection, P - Conservation Pathogens: Protection/Restoration Metals: Protection/Restoration

Upper Middle Fork Quilceda

Watershed	Quilceda Creek
Waterbodies	Middle Fork Quilceda, 1 unnamed tributary 0 Wetlands/ wetland area
Total subbasin area	1854.2 acres (2.9 square miles)
Subbasin area within city limits	0 acres (0 square miles)
Percent of Subbasin within city limits	0%
Impervious land cover (in city limits)	n/a
Forest land cover (in city limits)	n/a
Existing Land Use (full subbasin)	Dominant land use: Residential/Undeveloped Undeveloped - 48% Agriculture - 0% Residential Low - 49% Residential Med - 0% Residential High - 0% Commercial/Industrial - 0% Multifamily Residential - 0% Roads: 3%
Future Zoning (in city limits)	n/a
Water Quality Conditions	Meets temperature, pH, DO, and fecal standards 303d listings: bacteria TMDL listings: none
Biological Conditions	Modeled High Pulse Count: 8.2 (existing)/ 7.2 (forested) B-IBI sampling: none Fish species: Coho, Steelhead, Cutthroat
PSWC Restoration Potential/Best Use	Flow: Restoration/Development Sediment: Restoration/Development Nutrients (N/P): N - Restoration, P - Development/Restoration Pathogens: Restoration/Development Metals: Development/Restoration

Upper Quilceda

Watershed	Quilceda Creek
Waterbodies	Quilceda Creek, 2 unnamed tributaries 0 Wetlands/ wetland area
Total subbasin area	2198.8 acres (3.4 square miles)
Subbasin area within city limits	0 acres (0 square miles)
Percent of Subbasin within city limits	0%
Impervious land cover (in city limits)	n/a
Forest land cover (in city limits)	n/a
Existing Land Use (full subbasin)	Dominant land use: Residential Undeveloped - 39% Agriculture - 0% Residential Low - 56% Residential Med - 0% Residential High - 0% Commercial/Industrial - 0% Multifamily Residential - 0% Roads: 5%
Future Zoning (in city limits)	n/a
Water Quality Conditions	Meets temperature, pH, DO, and fecal standards 303d listings: none TMDL: none
Biological Conditions	Modeled High Pulse Count: 8.4 (existing)/ 7.4 (forested) B-IBI sampling: 46.9-72.5 (3 samples) Fish species: Coho, Chum, Steelhead, Cutthroat
PSWC Restoration Potential/Best Use	Flow: Development/Restoration Sediment: Protection Nutrients (N/P): N - Restoration, P - Restoration/Development Pathogens: Restoration/Development Metals: Restoration

APPENDIX C

INFILTRATION ASSESSMENT

MEMORANDUM

Project No. 200222

April 26, 2022

To: Brooke Ensor, NPDES Coordinator, City of Marysville

cc: Patty Dillon, PE, Principal, Northwest Hydraulic Consultants

From:

4/26/2022

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Re: **City of Marysville Infiltration Feasibility Assessment**

Introduction

The City of Marysville (City) is conducting watershed-scale stormwater planning as required under its National Pollutant Discharge Elimination System (NPDES) Phase II municipal stormwater permit (Permit). In accordance with the Permit, work done to characterize water quality, flow, and ecological conditions will be used to prioritize stormwater management planning. Specific project and policy actions to meet stormwater management goals within a selected subbasin will be identified and included in a Stormwater Management Action Plan (SMAP). The SMAP's objective is to identify approaches that accommodate population growth and development while preventing water quality degradation—ideally, improving conditions in receiving waters harmed by past development.

The City has retained a team of consultants led by Northwest Hydraulic Consultants to conduct the planning effort and develop the SMAP. A strategic and preliminary step in the planning is to perform a Geographic Information System (GIS)-based infiltration feasibility assessment to assist with evaluating potential stormwater retrofit projects. This desktop assessment provides a general (or baseline) review of the feasibility of shallow and deep infiltration across the City. The findings of this study are based on regional information and are appropriate for planning purposes.

Site-specific characterization should be performed for design of any infiltration facility. In this study, **shallow infiltration** refers to infiltration within the upper 10 feet of the soil horizon, and **deep infiltration** refers to infiltration at depths greater than 10 feet.

Study Area

The Study Area (Study Area), shown on **Figure 1,** covers the 21.4 square mile area encompassed by the City boundary and associated urban growth area (UGA). The Study Area mostly drains to fish-bearing Quilceda and Allen creeks, and ultimately to the Snohomish River estuary. Both topography and geology play a significant role for feasibility of areas within the City to be candidates for projects that manage runoff by infiltration. The following sections describe the topography and geology within the Study Area.

Topography

Figure 2 shows the ground surface elevation of the City and was produced by combining two available LiDAR datasets to cover the Study Area (PSLC, 2014 and 2017). As visible on Figure 2, most of the City falls within the Marysville Trough, a low-lying plain oriented north to south that ranges in elevation from approximately Elevation 130[1] at the north to Elevation 5 along the shoreline at the south end of the City. To the east, the Trough rises into the eastern highlands, reaching elevations of over 450 feet in the north Getchel Hill Plateau; the southern section of the eastern highlands is located in the southeast portion of the City. To the west, the trough rises to the Tulalip Plateau, which is outside of the City boundary.

Quilceda Creek and Allen Creek both originate in the eastern highlands and are fed by multiple smaller tributaries as they flow south towards the Snohomish River estuary. Various sections of these creeks have been channelized and piped through the City and surrounding lowlands.

Geology

The surficial geology of the Puget Sound basin results from long periods of erosion and nonglacial sedimentation in depositional environments similar to those present today, punctuated by multiple glacial advances into the Puget Sound lowland. The most recent glaciation, the Vashon Stade of the Fraser glaciation, ended 13,000 years ago, and the resulting landform consists of glacially sculpted uplands composed of north-to-south elongated glacial drumlins and flutes, and the waterways of Puget Sound.

Since the end of the Vashon glaciation, post-glacial erosion has locally incised the uplands and created steep-sided ravines and steep bluffs near coastal areas and river valleys and recent alluvial soils have been deposited by rivers and streams in valleys. **Figure 3** illustrates the surficial geology of the Study Area as presented by the Washington Department of Natural Resources (WADNR, 2020a) based on original geologic mapping by Minard (1985a; 1985b; and 1985c). The geologic units that are present at the surface and in the shallow surface are divided into the following general categories:

- **Transitional Beds:** Included in the City area are the Transitional beds (Qtb), the geologic unit that marks the transition from Olympia non-glacial deposition to Vashon Stade glacial deposition. The unit is found where the eastern highlands meet the low-lying areas. Lower

[1] Elevations in this report reference North American Vertical Datum of 1998 (NAVD88), in feet.

parts of the unit consist of clay, silt, and fine sand, whereas upper parts consist of medium to coarse sand and silty sand with sparse pebble. Due to the fine-grained makeup of the unit transitional beds are generally considered poor for infiltration.

- **Vashon Deposits:** Deposited during the Vashon Stade glaciation, these deposits include the following units (from oldest to youngest): advance outwash (Qva), Vashon till (Qvt), recessional outwash (Qvr), clay member (Qvrc), and Marysville sand member (Qvrm). The advance outwash is a predominately glacially consolidated sandy unit found along the eastern edge of the valley and is considered relatively permeable. The Vashon till covers much of the eastern highlands and generally consists of a glacially consolidated compact mixture of clay, silt, sand, pebbles, cobbles, and boulders that is considered low permeability. Vashon-age recessional outwash is often found overlying the Vashon till and typically consists of relatively permeable sand and gravel typically with few fines. Clay member includes deposits of silt and clay associated with recessional outwash that are relatively impermeable. Marysville sand deposits fill the Marysville valley and consist of mostly well-drained, stratified to massive outwash sand, a little fine gravel, and some beds of silt and clay and is considered moderately permeable.
- **Post-glacial (Recent) Deposits:** Deposited following the Vashon glaciation, these deposits include young alluvium (Qyal) and older alluvium (Qoal). The young alluvial deposits occur in and along streams and near the water table, and consist of relatively permeable sand, silt, clay, and organic matter laid by streams. Old alluvium deposits were deposited by streams and are found at the bases of the slopes along the east and west sides of the Marysville valley. The unit consists of small alluvial fans of stratified sand and gravel which are typically well draining.

GIS Data and Mapping

For this assessment, infiltration feasibility was evaluated by overlaying GIS data layers known to influence the infiltration potential. A variety of GIS datasets were reviewed for use in the assessment, including data provided by the City, available from public sources, and created by the project team. The following sections describe the data sources, preparation steps, and how data was evaluated for use in the shallow and deep infiltration assessments.

Shallow Infiltration Datasets

A total of four factors and associated GIS data were used, as follows:

- Surficial geology/assumed soil permeability
- Surface slope gradient
- Proximity to landslide hazard areas
- Presumed depth to groundwater

Permeability

Soil permeability of the surficial geologic unit is a principal factor in the feasibility and cost effectiveness of shallow infiltration. If stormwater runoff cannot effectively infiltrate soil, it can create flooding or other drainage and water quality concerns. In general, relatively higher permeability soils are more feasible for stormwater infiltration systems than are lower permeability soils. Mapped surficial geologic units can correlate to high-level estimates of surface soil permeability.

Surficial geology for the Study Area is discussed above and presented on **Figure 3**. Each of the geologic units included within the Study Area were categorized into broad permeability categories, as follows, based on generalizations of grain size particle consolidation. **Figure 4** shows surface permeability based on geologic mapping and these subjective permeability categories:

- **High Permeability** (>10 inches/hour):
  - Old Alluvium (Qoal)
  - Vashon Recessional Outwash (Qvr)
- **Moderate Permeability** (2-10 inches/hour):Vashon Advance Outwash (Qva)
  - Marysville Sand Member (Qvrm)
  - Young Alluvium (Qyal)
- **Low Permeability** (0-2 inches/hour):
  - Transitional Beds (Qtb)
  - Vashon Clay Member (Qvrc)
  - Vashon Till (Qvt)

The majority of the Study Area falls within areas of moderate permeability due to the presence of Marysville sand unit across most of the Marysville Trough (**Figure 4**). Large areas of poor soil permeability are found in the glacial till of the eastern highlands and other localized areas within the city. A small area of high permeability outwash is found at the base of the eastern plateau in the southeast portion of the City, near Ingram Boulevard.

Surface Slope

Shallow infiltration is generally considered more feasible in flat areas and less feasible on steep slopes, where runoff and shallow infiltration can migrate along a perching layer (such as Vashon till) and daylight at the ground surface or in a crawl space/basement downslope of an infiltration facility. In addition, surface slope can affect the cost of construction of shallow infiltration facilities, where the addition of check dams, berms, or other retaining structures are required to create storage on steep slopes.

Surface slope was calculated based on Light Detection and Ranging (LiDAR) elevation data from two different flights (PSLC, 2014 and 2017) that were stitched together using GIS processing tools. The Study Area was divided into the following surface slope categories:

1. **Low Gradient** (good for infiltration): Less than 8 percent
2. **Moderate Gradient:** Between 8 percent and 20 percent
3. **High Gradient** (poor for infiltration): Greater than 20 percent

The definition of these categories is based on the Washington State Department of Ecology's (Ecology) 2019 stormwater infiltration feasibility criteria and supported by Aspect's observations of slopes that typically have water-seepage issues. As shown on **Figure 5**, the majority of the Study Area has either low or moderate surface slope gradient.

Landslide Hazard Areas

Much of the Study Area is mapped as low landslide hazard (**Figure 6**), but there are some areas with known high landslide hazards. In high landslide hazard areas, increased groundwater recharge from infiltration can increase the potential for landslides in some situations. Infiltration facilities generally should not be located close to slopes that may be susceptible to landslides.

The City uses a Geologic Hazards map as part of their critical area management (City of Marysville, 2014). The City's Geologic Hazards map identifies four classifications that include 15- to 25-percent, 25- to 33-percent, 33- to 40-percent, and greater than 40-percent slopes. For the purposes of this study, all slopes greater than 25 percent were considered high landslide hazard areas. In addition to slopes greater than 25 percent, the areas considered as "Top of Bank - 25 Percent Slope" and their associated 25-foot buffers signify a landslide hazard and were used in the analysis. This dataset was provided by the City to the project team; the top-of-slope line is shown on the City's Geologic Hazards map.

The Study Area was divided into the following two landslide hazard categories:

- **High Landslide Hazard Area:** areas with slopes greater than 25 percent (PSLC, 2014 and 2017), areas with a 25-foot buffer from the top of slopes (City of Marysville, 2021a)
- **Low Landslide Hazard Area:** all other areas

The slide hazard areas were used in both the deep and shallow infiltration feasibility assessment; however, the accuracy of their mapped extents cannot be relied upon without a site-specific evaluation. Site-specific explorations and slope stability modeling may be necessary to evaluate potential landslide hazards when designing retrofit projects.

Depth to Groundwater

If groundwater is present at a shallow depth, it can reduce the effectiveness of infiltration when aquifer transmissivity is sufficiently low to cause groundwater mounding. If the groundwater mound rises to the bottom of the infiltration facility, a reduction in hydraulic gradient can reduce infiltration rates and cause ponding. Reliable state or regional GIS coverages of depth to groundwater do not exist; however, depth to groundwater can be approximated using available water level data, spatial analysis, and professional judgement.

The following procedure was used to generalize the depth to groundwater within the Site Area for this assessment (**Figure 7**):

Step 1 – Extract Groundwater Elevation Points from Historical Records

Groundwater level measurements across the nation are stored in the USGS National Water Information System and can be queried via their web interface (NWIS, 2021). Groundwater levels within and around the Study Area were extracted as point locations from the web interface. The database query identified 2,027 groundwater elevation records (NAVD88 vertical datum) spanning from the 1920s to 2021. These records are for a wide range of well completion depths and were not individually reviewed. Where multiple measurements were recorded at a single point location, the data were averaged during the Step 3 interpolation.

Step 2 – Create Groundwater Elevation Points along Stream Courses, Shoreline and Around Wetlands

Surface water was presumed to reflect groundwater elevation where water and land meet. Therefore, ground elevation values were extracted from the Digital Elevation Model (DEM) (PSLC, 2014 and 2017), at points every 1,000 feet along stream courses (City of Marysville, 2021b), shorelines (WADNR, 2020b), and every 100 feet on wetland perimeters (City of Marysville, 2021c).

Step 3 – Create Interpolated Groundwater Elevation Surface

Using Esri's Topo to Raster tool,[2] the point cloud from Steps 1 and 2 was interpolated to depict a groundwater elevation surface. The Topo to Raster tool is an interpolation method designed for the creation of hydrologically correct DEMs. It is the only ArcGIS interpolator designed to work with contour inputs, which was required in the smoothing process.

Step 4 – Smooth the Surface

Contours of the interpolated surface were manually adjusted to remove perceived outliers and smooth the interpolated results. The contours were then re-interpolated with Topo to Raster to approximate the groundwater level surface across the Study Area. This process was repeated seven times to further generalize the results. This overgeneralization was completed to offset the varying well completions and periods of record in the historical groundwater level records queried in Step 1. This allows for a generalized approximation of groundwater elevations across the Study Area without implying overly precise values in specific locations. This technique is appropriate for creating a dataset to be used at a regional scale for planning purposes; however, it should not be relied upon to represent actual site conditions without further analysis.

Step 5 – Estimate the Depth to Groundwater

The interpolated and smoothed groundwater elevation surface was subtracted from the LiDAR elevation and used as the depth to groundwater data in this analysis.

- **Shallow Groundwater:** depth to groundwater is 10 feet or less
- **Moderate Groundwater:** depth to groundwater is 10 to 20 feet
- **Deep Groundwater:** depth to groundwater is greater than 20 feet

Deep Infiltration Datasets

A total of two factors and associated GIS data were used, as follows:

- Proximity to landslide hazard areas (see *Landslide Hazard Areas* section above)
- Presumed thickness of permeable unsaturated zone

[2] https://pro.arcgis.com/en/pro-app/latest/tool-reference/3d-analyst/how-topo-to-raster-works.htm

Thickness of Permeable Unsaturated Zone

The thickness of the permeable unsaturated zone (**Figure 8**) is an important factor for evaluating deep infiltration feasibility. For this study, an unsaturated thickness of 10 feet or more is assumed adequate to accommodate groundwater mounding that could occur during deep infiltration. Infiltration feasibility increases as the zone's thickness increases, allowing for more capacity and less potential for mounding-related issues. There is no publicly available dataset for thickness of the permeable unsaturated zone. However, it could be estimated from the groundwater elevation data (above) and mapped geologic units.

The thickness of the permeable unsaturated zone was assumed to be the distance (or numerical difference) between the generalized elevation of groundwater and the ground surface, except in cases where till (Qvt) or clay (Qvrc) are mapped at the surface. In areas mapped as till or clay (which have low permeability), an additional step was taken to estimate the permeable unsaturated thickness. Average thickness of these units ranged from 9.8 to 49.2 feet in the Arlington and Lake Stevens and 9.8 to 39.4 feet in Marysville for till and 6.6 to 26.2 feet for clay (Minard 1985a; 1985b; 1985c). The project team assumed that where till or clay are mapped at surface, these units were 10 feet thick. In those areas, 20 feet was subtracted from the estimated depth to groundwater (*Step 5* above). The resulting data, shown on **Figure 8**, was classified into the following categories:

- **Poor Thickness of Permeable Unsaturated Unit:** areas where approximated thickness of the unsaturated zone is less than 10 feet.
- **Moderate Thickness of Permeable Unsaturated Unit:** areas where the approximated thickness of the permeable unsaturated zone is between 10 and 40 feet.
- **Good Thickness of Permeable Unsaturated Unit:** areas where the approximated thickness of the permeable unsaturated zone is more than 40 feet.

The resulting GIS layer illustrates the estimated thickness of the permeable unsaturated unit at a scale appropriate for regional screening; however, a detailed assessment should be conducted when reviewing site-specific feasibility for deep infiltration by conducting groundwater monitoring, modelling, borehole infiltration testing, and analysis.

Infiltration Assessment

The GIS data layers were classified as described in the previous sections and overlaid using spatial analysis techniques. For this study, infiltration feasibility was determined by evaluating and overlaying existing or created GIS data layers known to affect infiltration potential. Hydrogeomorphic units represent the unique combinations of the input factors as shown in **Table 1** and **Table 2**. For both shallow and deep infiltration, these hydrogeomorphic units are categorized as "good," "moderate," or "poor" based on professional judgment of the generalized effectiveness of each unit to infiltrate stormwater runoff without causing or exacerbating hazards.

Hydrogeomorphic Units and Potential for Shallow Infiltration

A total of 23 shallow infiltration hydrogeomorphic units (**Table 1**) represent the distinct combinations of the following data inputs:

- Soil permeability
- Surface slope

- Landslide hazards
- Depth to groundwater

Each of these shallow infiltration hydrogeomorphic units was rated as “good,” “moderate,” or “poor” based on the following criteria:

- **Good**: high permeability soils, low gradient slope, low slide hazard, and depth to groundwater greater than 20 feet.
- **Moderate**: high or moderate permeability soils, low or moderate gradient slope, low slide hazard, depth to groundwater greater than 10 feet.
- **Poor**: poor permeability soils, or high gradient slope, or high slide hazard, or depth to groundwater less than 10 feet, or combinations of more than one of these criteria.

Hydrogeomorphic Units and Potential for Deep infiltration

A total of six deep infiltration hydrogeomorphic units (**Table 2**) represent the distinct combinations of the follow data inputs:

- Landslide hazards
- Thickness of unsaturated permeable zone

Each of these deep infiltration hydrogeomorphic units was rated as “good,” “moderate,” or “poor” based on the following criteria:

- **Good**: low landslide hazard area and greater than 40 feet of unsaturated permeable zone.
- **Moderate**: low landslide hazard area and thickness of unsaturated permeable zone between 10 and 40 feet.
- **Poor**: high landslide hazard area and/or unsaturated zone less than 10 feet thick.

Summary of Results

The shallow infiltration assessment results are shown on **Figure 9** and the deep infiltration assessment results are shown on **Figure 10**. The results indicate that:

- In the northern portion of the City, along stream courses, and surrounding the southern shoreline, the moderately permeable soils have a limited capacity to infiltrate due to the shallow depth to groundwater.
- In the central portion of the City, soils have moderate feasibility for shallow infiltration.
- Certain areas within the City may accommodate deep infiltration projects.

The feasibility assessments provided in this report are suitable for screening the locations of potential infiltration retrofit projects. Specific projects could perform either better or worse than is shown in this broad categorization for both deep and shallow infiltration. The accuracy of the input data and methods used will determine the accuracy of the resulting rank at any specific location within the Study Area; additional subsurface explorations, infiltration testing, and analysis are needed to verify actual conditions.

References

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Limitations

Work for this project was performed for NHC (Client) and City of Marysville (Owner), and this report was prepared consistent with recognized standards of professionals in the same locality and involving similar conditions, at the time the work was performed. No other warranty, expressed or implied, is made by Aspect Consulting, LLC (Aspect).

Recommendations presented herein are based on our interpretation of site conditions, geotechnical engineering calculations, and judgment in accordance with our mutually agreed-upon scope of work. Our recommendations are unique and specific to the project, site, and Client. Application of this report for any purpose other than the project should be done only after consultation with Aspect.

Variations may exist between the soil and groundwater conditions reported and those actually underlying the site. The nature and extent of such soil variations may change over time and may not be evident before construction begins. If any soil conditions are encountered at the site that are different from those described in this report, Aspect should be notified immediately to review the applicability of our recommendations.

It is the Client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, and agents, are made aware of this report in its entirety. At the time of this report, design plans and construction methods have not been finalized, and the recommendations presented herein are based on preliminary project information. If project developments result in changes from the preliminary project information, Aspect should be contacted to determine if our recommendations contained in this report should be revised and/or expanded upon.

The scope of work does not include services related to construction safety precautions. Site safety is typically the responsibility of the contractor, and our recommendations are not intended to direct the contractor's site safety methods, techniques, sequences, or procedures. The scope of our work also does not include the assessment of environmental characteristics, particularly those involving potentially hazardous substances in soil or groundwater.

All reports prepared by Aspect for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect. Aspect's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

We appreciate the opportunity to perform these services. If you have any questions, please call Emelie Crumbaker, Senior GIS Analyst, at 907-947-9598.

Attachments: Table 1 – Shallow Infiltration Hydrogeomorphic Units
Table 2 – Deep Infiltration Hydrogeomorphic Units
Figure 1 – Site Location Map
Figure 2 – Ground Surface Elevation
Figure 3 – Surficial Geology Map
Figure 4 – Surficial Permeability Map
Figure 5 – Surface Slope
Figure 6 – Landslide Hazard Map
Figure 7 – Depth to Groundwater Map
Figure 8 – Thickness of Permeable Unsaturated Unit
Figure 9 – Shallow Infiltration Feasibility
Figure 10 – Deep Infiltration Feasibility

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TABLES

Table 1. Shallow Infiltration Hydrogeomorphic Units

Project 200222, Marysville, Washington

Geology/Permeability
G1 = Good permeability
G2 = Moderate Permeability
G3 = Poor permeability

Surface Slope
S1 = <8%
S2 = 8-20%
S3 = >20%

Proximity to Landslide Hazard Area
SH1 = Low Hazard
SH3 = High Hazard

Depth to GW
GW1 = >20 ft
GW2 = 10-20
GW3 = <10 ft

Hydrogeomorphic Unit	Permeability	Slope	Landslide Hazard	Depth to Groundwater	Shallow Infiltration Feasibility
G1-S1-SH1-GW1	G1	S1	SH1	GW1	Good
G1-S1-SH1-GW2	G1	S1	SH1	GW2	Moderate
G1-S1-SH1-GW3	G1	S1	SH1	GW3	Poor
G2-S1-SH1-GW1	G2	S1	SH1	GW1	Moderate
G3-S1-SH1-GW1	G3	S1	SH1	GW1	Poor
G3-S1-SH1-GW2	G3	S1	SH1	GW2	Poor
G1-S1-SH3-GW1	G1	S1	SH3	GW1	Poor
G1-S1-SH3-GW2	G1	S1	SH3	GW2	Poor
G1-S1-SH3-GW3	G1	S1	SH3	GW3	Poor
G1-S2-SH1-GW1	G1	S2	SH1	GW1	Moderate
G1-S2-SH1-GW2	G1	S2	SH1	GW2	Moderate
G1-S2-SH1-GW3	G1	S2	SH1	GW3	Poor
G3-S2-SH1-GW1	G3	S2	SH1	GW1	Poor
G3-S2-SH1-GW2	G3	S2	SH1	GW2	Poor
G1-S2-SH3-GW1	G1	S2	SH3	GW1	Poor
G1-S2-SH3-GW2	G1	S2	SH3	GW2	Poor
G1-S2-SH3-GW3	G1	S2	SH3	GW3	Poor
G1-S3-SH1-GW1	G1	S3	SH1	GW1	Poor
G1-S3-SH1-GW2	G1	S3	SH1	GW2	Poor
G1-S3-SH1-GW3	G1	S3	SH1	GW3	Poor
G1-S3-SH3-GW1	G1	S3	SH3	GW1	Poor
G1-S3-SH3-GW2	G1	S3	SH3	GW2	Poor
G1-S3-SH3-GW3	G1	S3	SH3	GW3	Poor

Table 2. Deep Infiltration Hydrogeomorphic Units

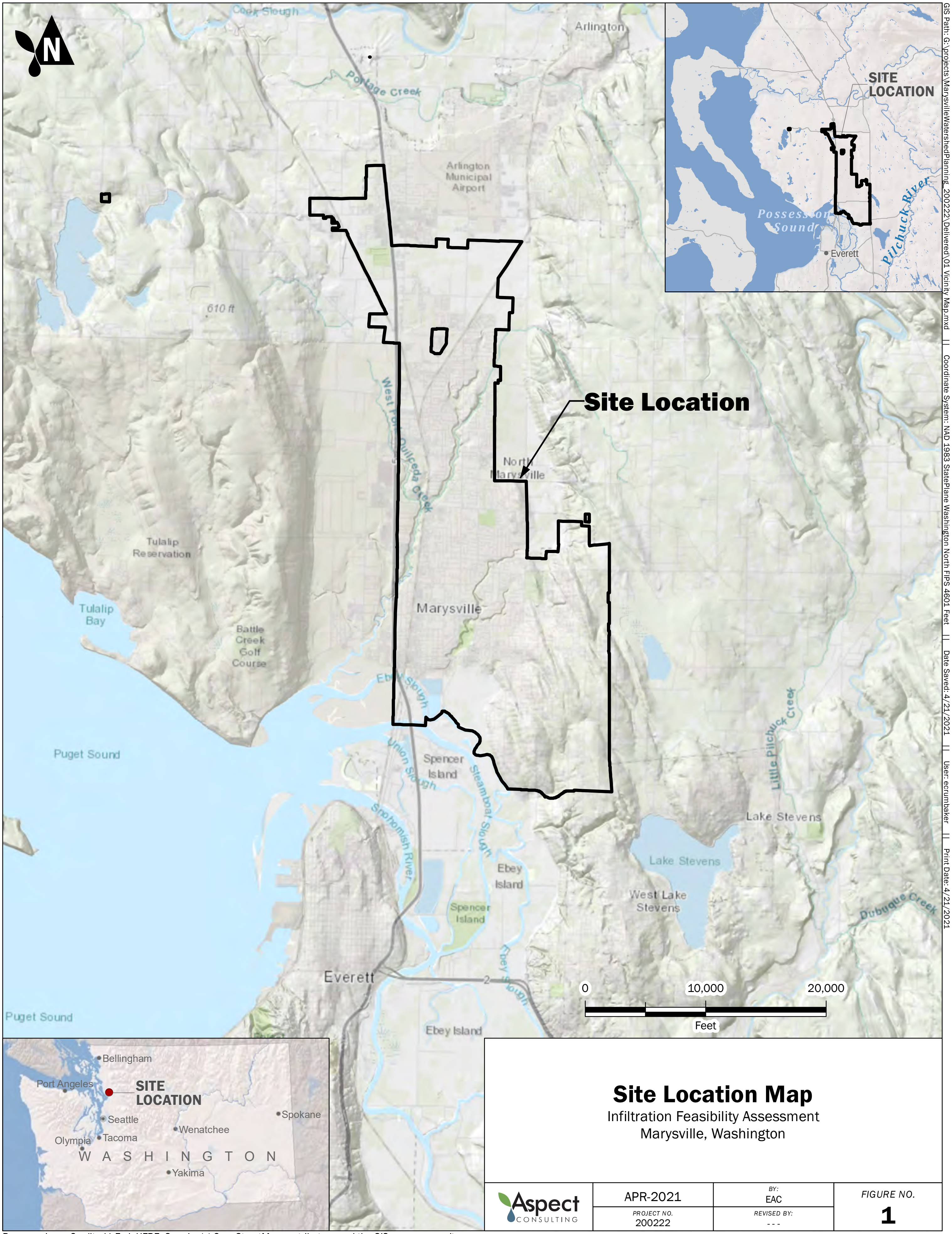
Project 200222, Marysville, Washington

Proximity to Landslide Hazard Area
SH1 = Low Hazard
SH3 = High Hazard

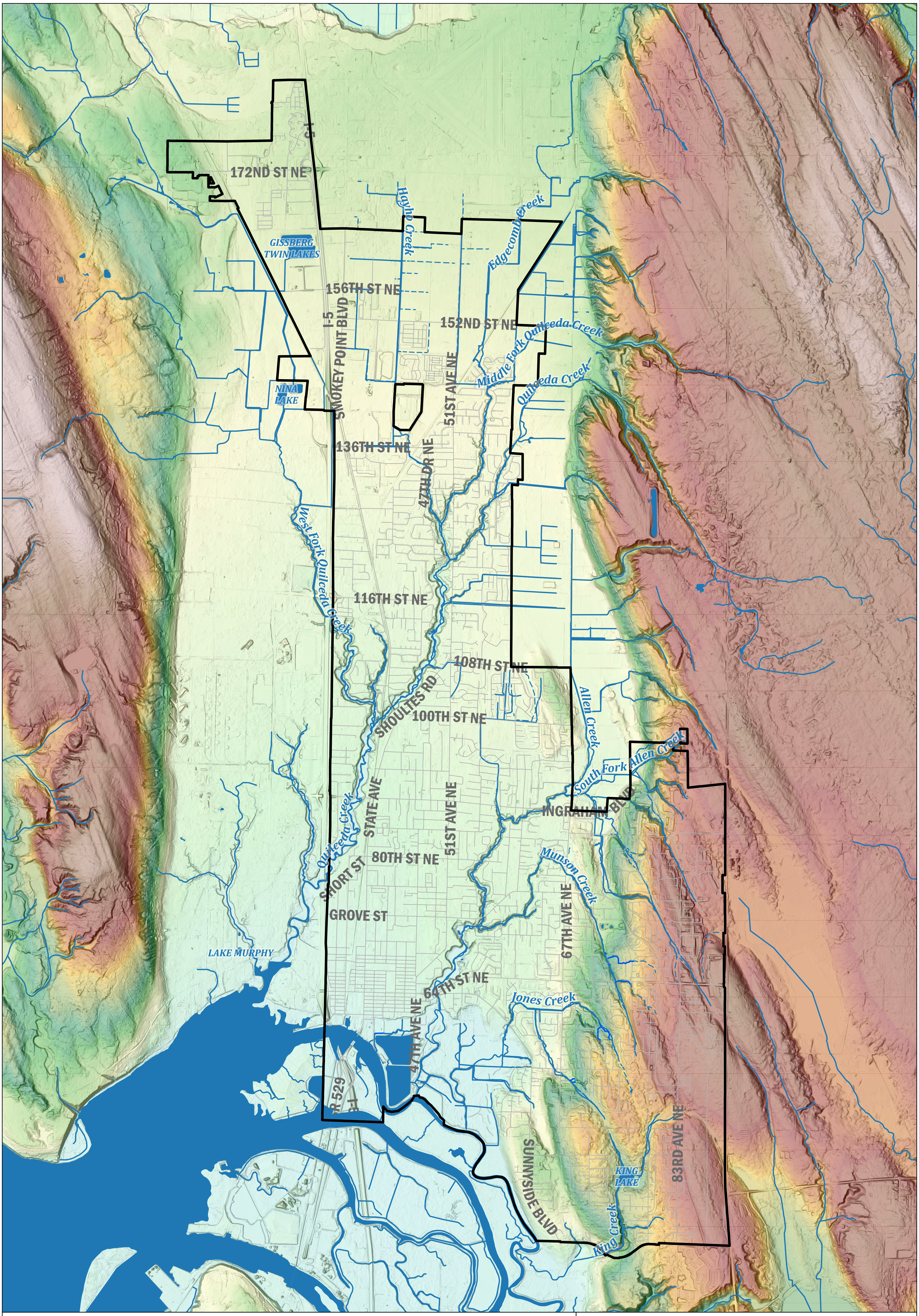
Thickness of Permeable Unsaturated Zone
U1 = <10 feet
U2 = 10-40 feet
U3 = >40 feet

Hydrogeomorphic Unit	Landslide Hazard	Thickness of Permeable Unsaturated Zone	Deep Infiltration Feasibility
SH1-U1	SH1	U1	Poor
SH1-U2	SH1	U2	Moderate
SH1-U3	SH1	U3	Good
SH3-U1	SH3	U1	Poor
SH3-U2	SH3	U2	Poor
SH3-U3	SH3	U3	Poor

FIGURES



Basemap Layer Credits || Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community



City of Marysville

Ground Surface Elevation

Feet (NAVD88)

622.88

0

N

0 4,000 8,000 Feet

Ground Surface Elevation

Infiltration Feasibility Assessment
Marysville, Washington

Aspect CONSULTING

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PROJECT NO. 200222	REVISED BY: ---/---	2

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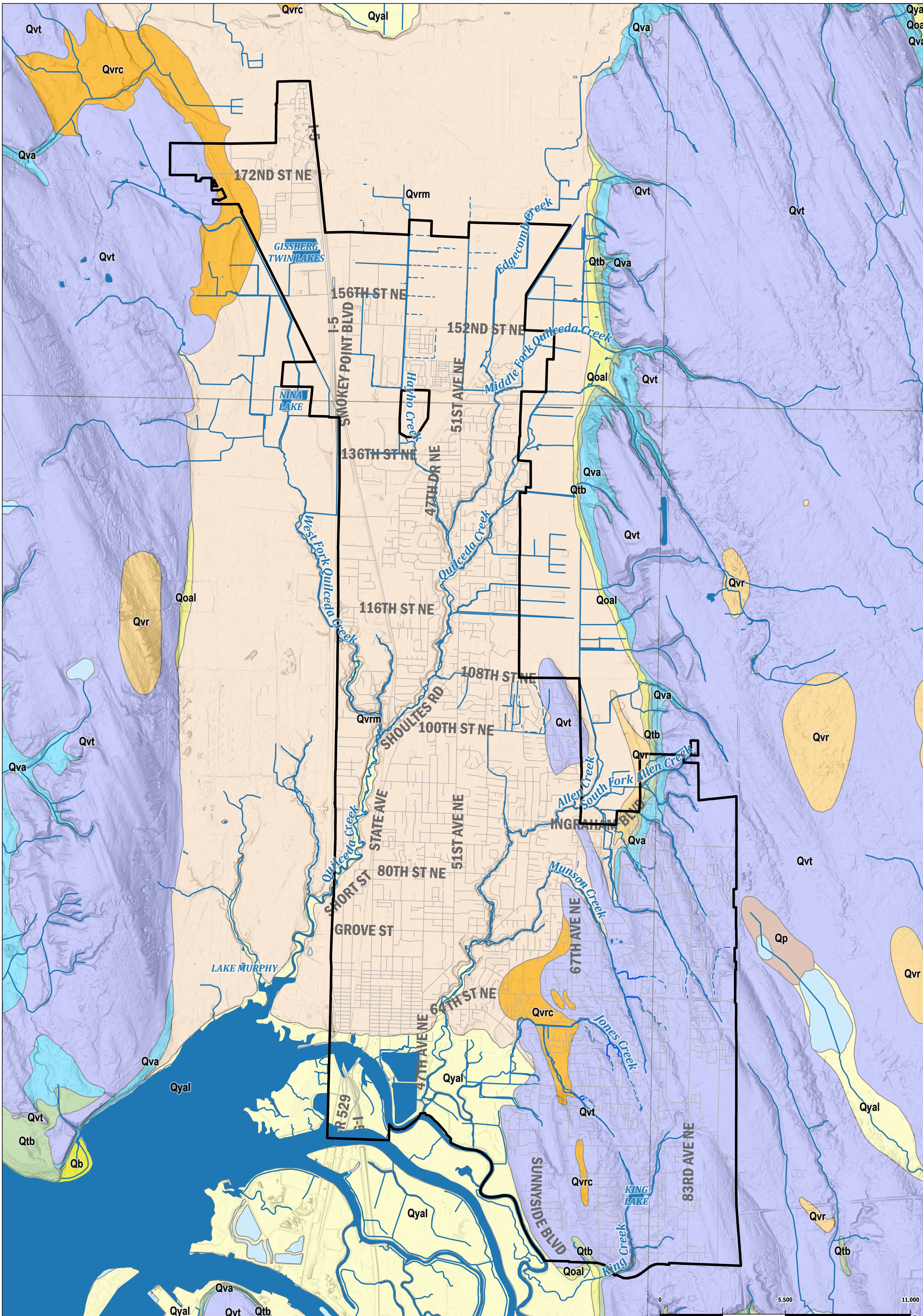

City of Marysville

Surficial Geologic Unit (WA DNR 1:24,000)

- Qvrc - Vashon Clay Member
- Qoal - Quaternary alluvium
- Qp - Quaternary bog, marsh, swamp, or lake deposits
- Qtb - Transitional beds
- Qva - Vashon Advance Outwash
- Qvr - Vashon Recessional Outwash
- Qb - Quaternary alluvium
- Qvrm - Marysville Sand Member
- Qvt - Pleistocene continental glacial till
- Qyal - Quaternary alluvium
- wtr - Water

N

Surficial Geology Map

Infiltration Feasibility Assessment
Marysville, Washington

Aspect CONSULTING	JUN-2021	BY: EAC	FIGURE NO.
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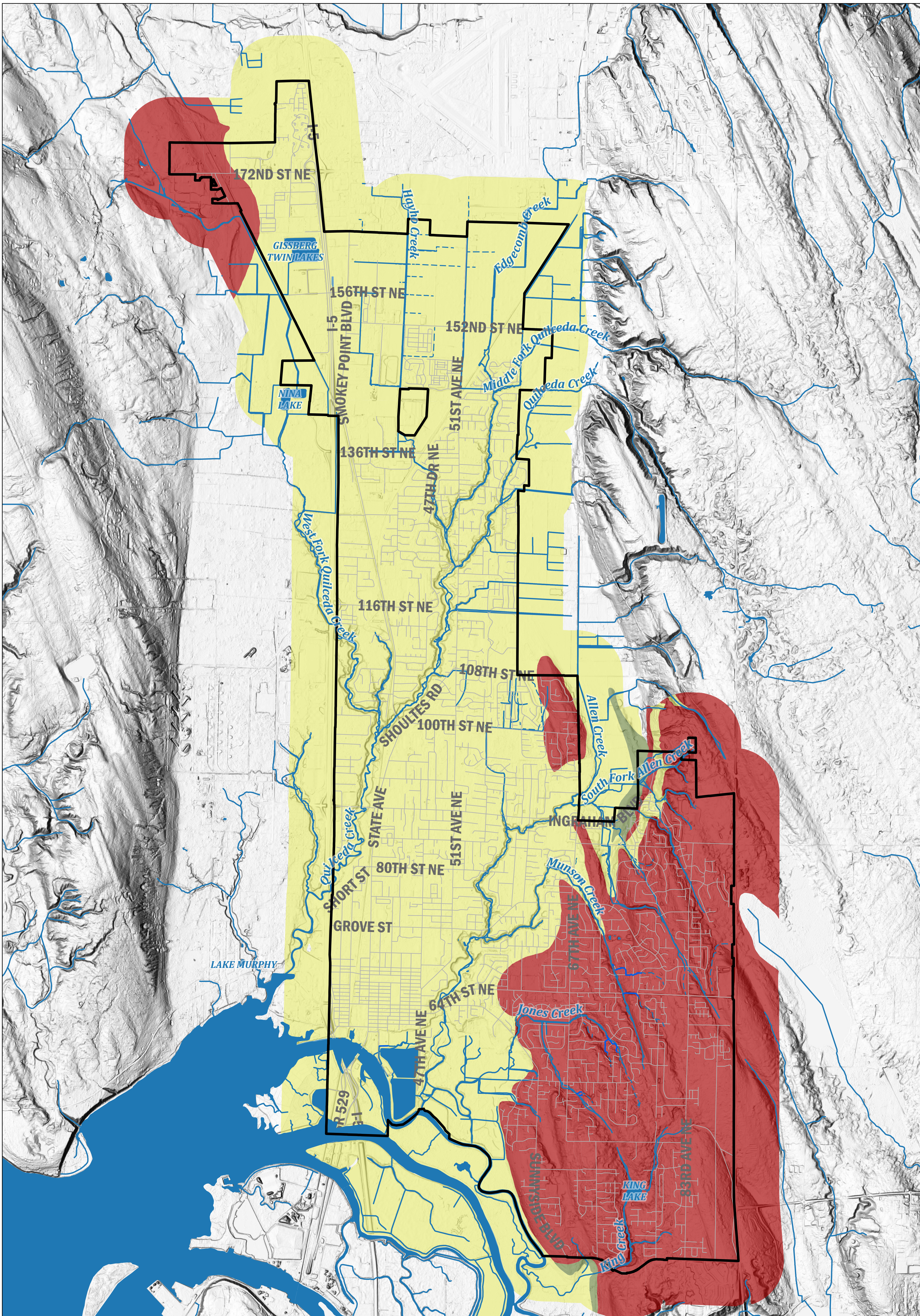

City of Marysville

Permeability

- High Permeability
- Moderate Permeability
- Low Permeability
- Water

N

0 4,000 8,000 Feet

Surficial Permeability Map

Infiltration Feasibility Assessment
Marysville, Washington

Aspect CONSULTING	JUN-2021	BY: EAC	FIGURE NO.
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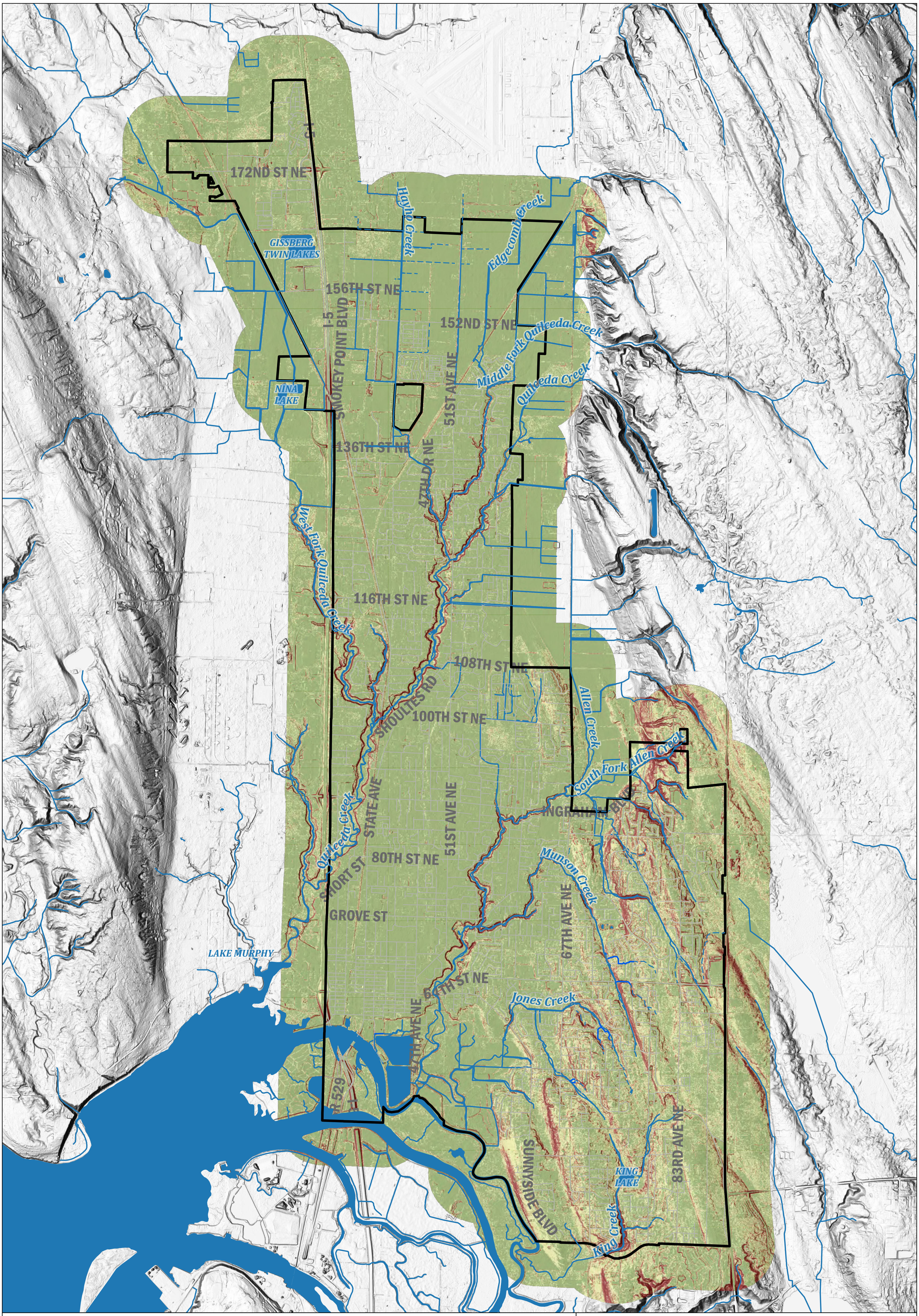

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City of Marysville

Slope Gradient (PSLC 2014, 2017)

- 0 to 8%
- 8 to 20%
- Greater than 20%

N

0 4,000 8,000 Feet

Surface Slope

Infiltration Feasibility Assessment
Marysville, Washington

Aspect CONSULTING

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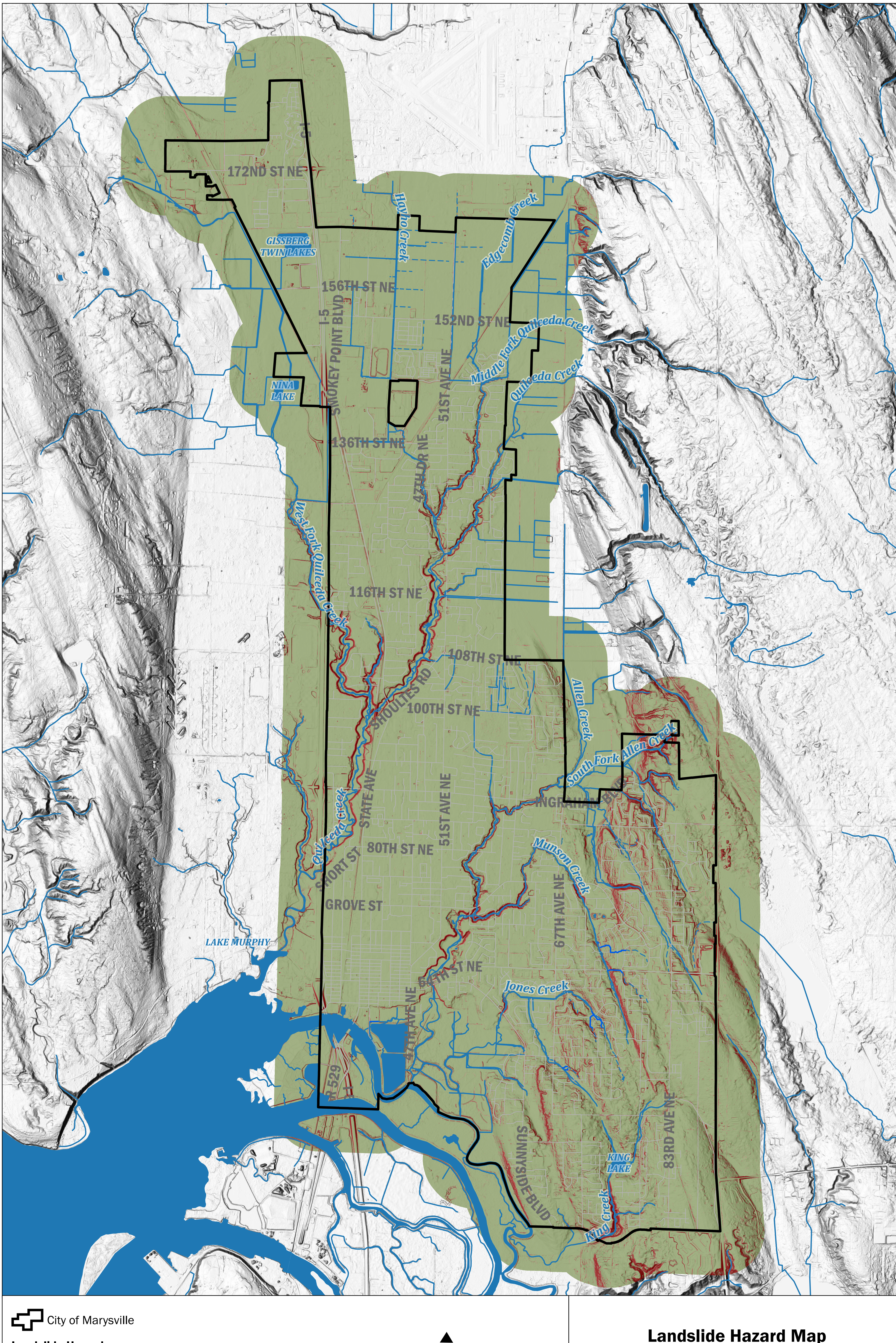

City of Marysville

Landslide Hazards

Low Slide Hazard Area

High Slide Hazard Area

N

0 4,000 8,000 Feet

Landslide Hazard Map

Infiltration Feasibility Assessment
Marysville, Washington

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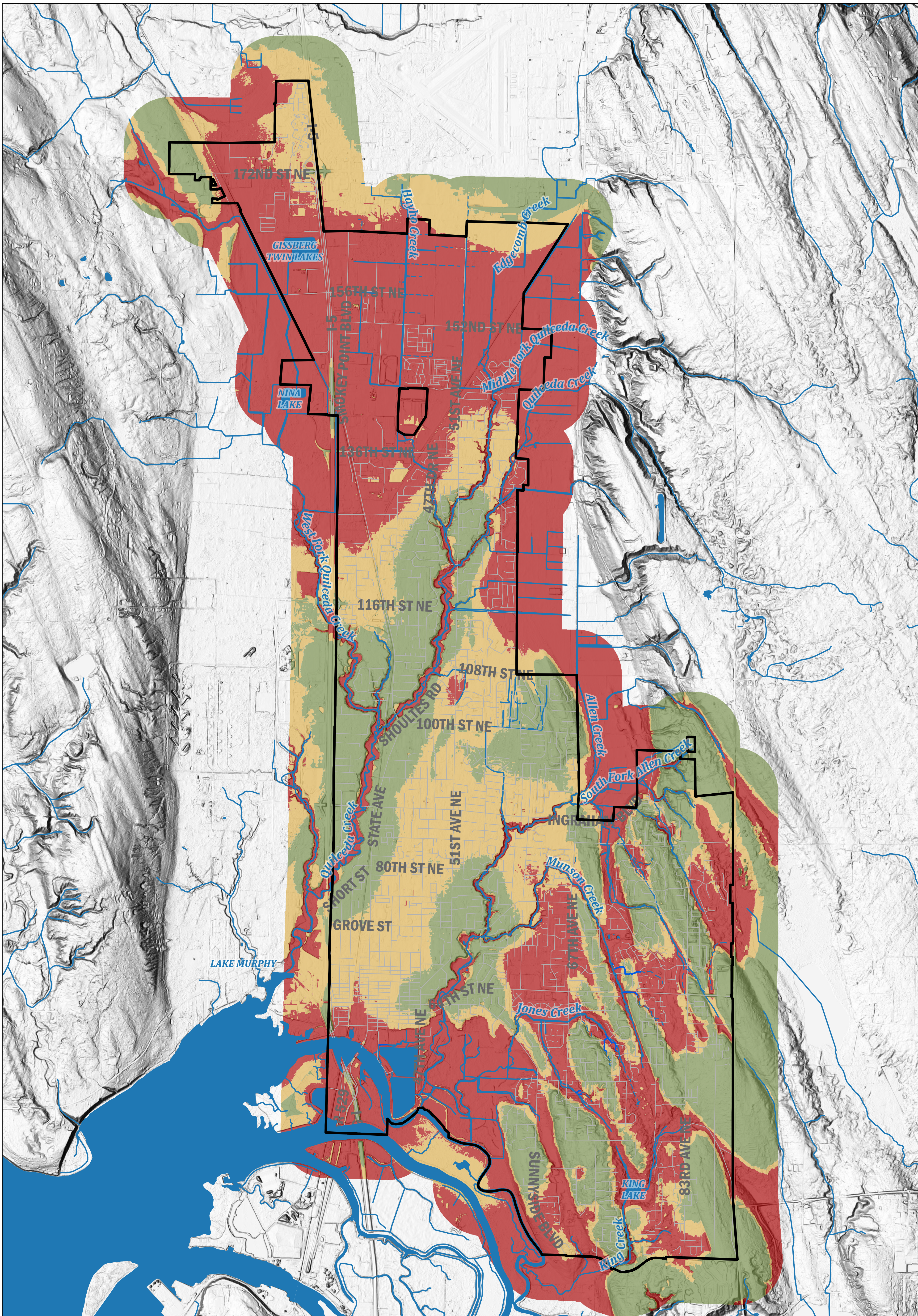

City of Marysville

Depth To Groundwater

<10 feet

10-20 feeet

>20 feet

N

0 4,000 8,000 Feet

Depth to Groundwater Map

Infiltration Feasibility Assessment
Marysville, Washington

Aspect CONSULTING	MAY-2021	BY: EAC	FIGURE NO.
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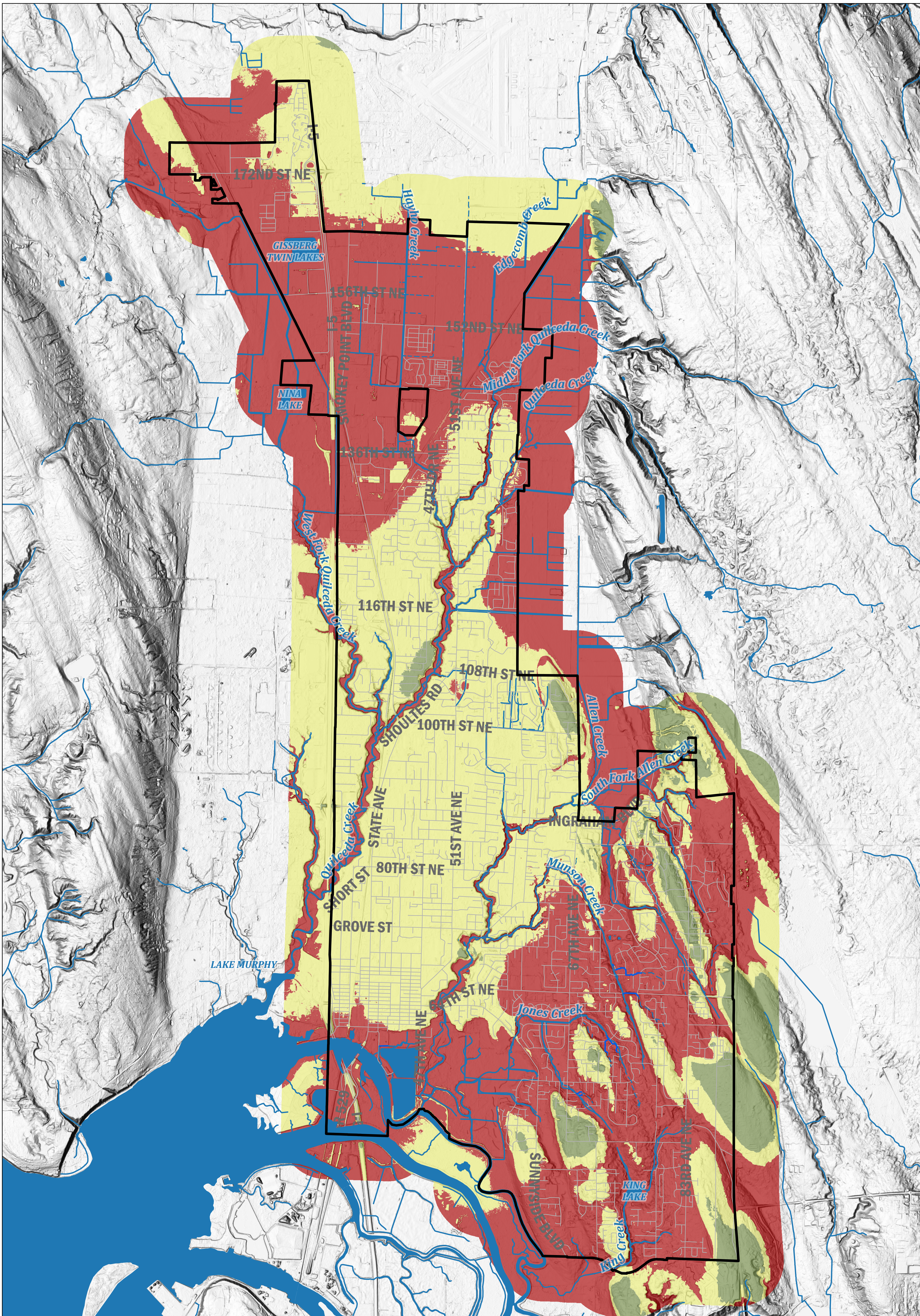

City of Marysville

Thickness of Permeable Unsaturated Unit

- Poor (<10 feet)
- Moderate (10 - 40 feet)
- Good (>40 feet)

N

0 4,000 8,000 Feet

Thickness of Permeable Unsaturated Unit

Infiltration Feasibility Assessment
Marysville, Washington

Aspect CONSULTING

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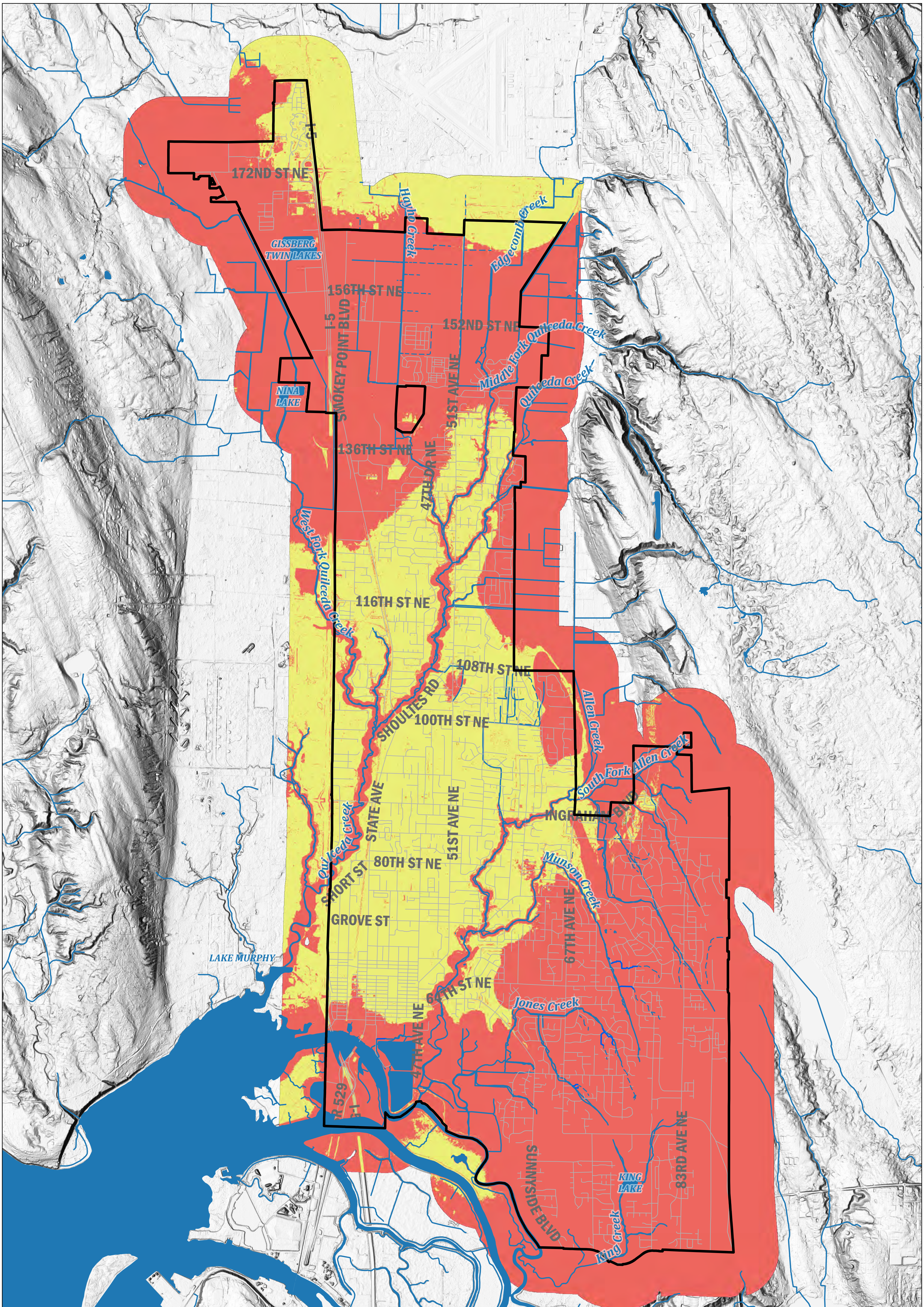

Shallow Infiltration Feasibility

- Good
- Moderate
- Poor
- City of Marysville

N

0 4,000 8,000 Feet

Shallow Infiltration Feasibility

Infiltration Feasibility Assessment
Marysville, Washington

Aspect CONSULTING	JUN-2021	BY: EAC	FIGURE NO.
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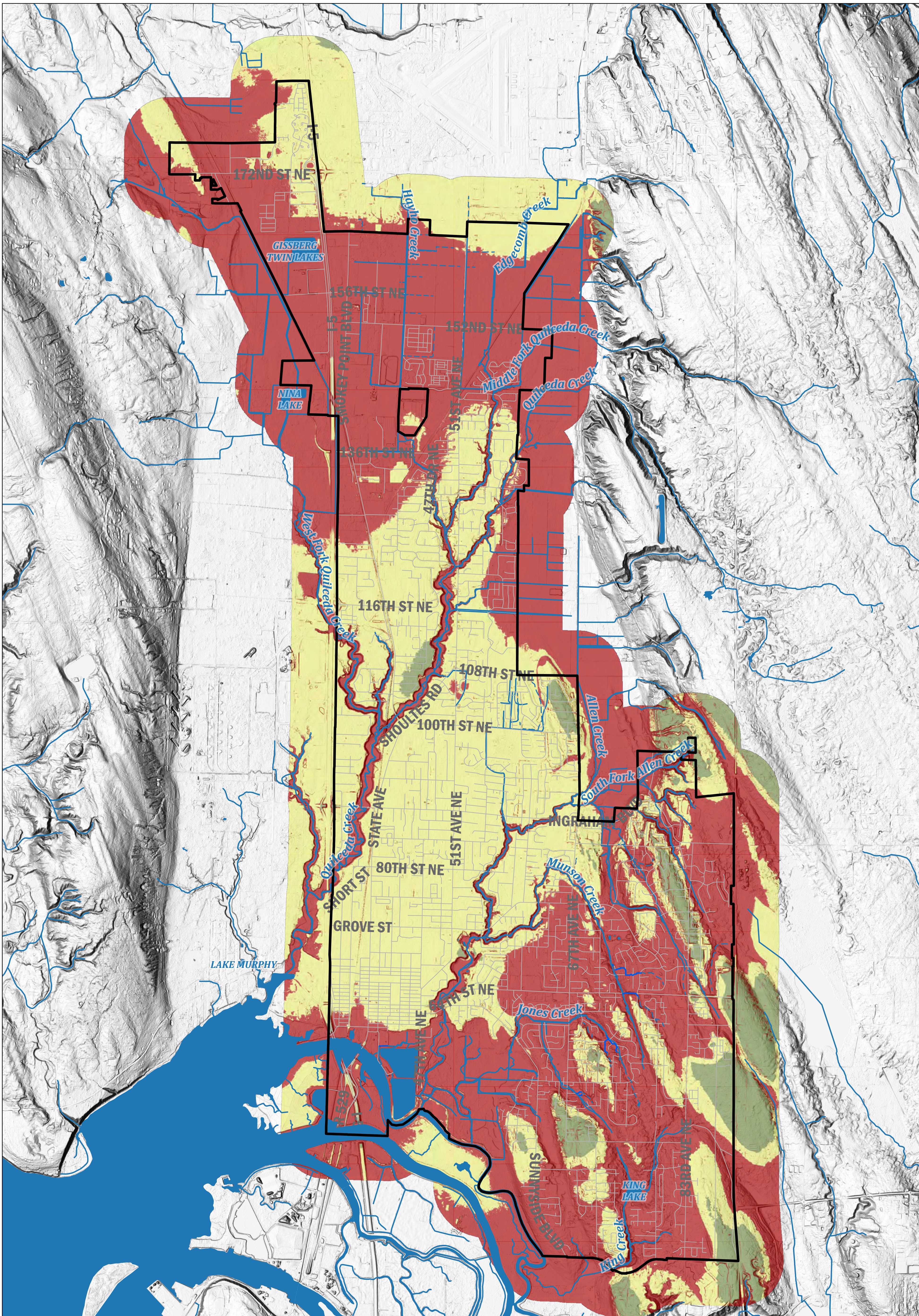

City of Marysville

Deep Infiltration Feasibility

- Good
- Moderate
- Poor

N

0 | 4,000 | 8,000 Feet

Deep Infiltration Feasibility

Infiltration Feasibility Assessment
Marysville, Washington

Aspect CONSULTING	MAY-2021	BY: EAC	FIGURE NO. 10
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APPENDIX D

ENVIRONMENTAL JUSTICE REVIEW

Introduction

Permit condition S5.C.3.a requires the City to create opportunities for the public, including populations that may experience disproportionate environmental harms or risks, to participate in the SMAP process. The first step to expanding participation opportunities is identifying the populations that may be at an increased risk and/or geographic areas of the City that may pose an environmental hazard. Several sources of data were utilized and evaluated for this task, including US Census Bureau data, Marysville School District data, Washington State Department of Ecology- What's In My Neighborhood Toxic Cleanup Site map, the EPA EJSCREEN-Environmental Justice Screening and Mapping Tool, and Washington State Department of Health Environmental Health Disparities Map.

Data Review

The population census data from April 2010 was downloaded from the US Census Bureau QuickFacts web site. This data was compared with the 2020-21 enrollment demographic data from the Marysville School District. Student's gender and race/ethnicity are determined by their most recent enrollment record available.

Overall the 2020-21 Marysville School District demographic data doesn't match up well with the 2010 Census data for the City. The City reported 80.50% "white alone" in the 2010 Census. The School District reported only 48.2% "white alone" in the 2020-21 school year. While all of the non "white alone" demographics in the school district are higher percentages than reported by the City census data, most are fairly similar. The only demographic that has a noticeably different reported number is the "Hispanic or Latino" demographic. The City reported only 12.10% but the School District reported 25.50%.

Table 1: City of Marysville Demographic Information (2010 US Census Bureau and Marysville School District

Race and Hispanic Origin	**2010 Census Marysville**	**MSVL School District 20-21**
White alone, percent	80.50%	48.2%
Black or African American alone, percent	1.50%	2.1%
American Indian and Alaska Native alone, percent	1.10%	5.6%
Asian alone, percent	6.30%	6.5%
Native Hawaiian and Other Pacific Islander alone, percent	0.80%	1.1%
Two or More Races, percent	6.80%	11.0%
Hispanic or Latino, percent	12.10%	25.5%
Language other than English spoken at home, percent of persons age 5 years+, 2015-2019	16.7%	No comparable data available

This could suggest that older individuals and families without children are more likely to report "white alone" while families with school age children represent more diversity. Alternatively this could also suggest that the census data is simply out of date and doesn't accurately represent the demographics of the City.

Looking at the demographics reported at the MSVL schools individually, and comparing them to the MSVL school district as a whole, the demographic mix is virtually the same for each school. This shows that the demographic mix for the whole school district is the same as each neighborhood. Indicating there isn't a single neighborhood that has one demographic represented at a higher rate. The demographic mix is similar throughout the City for families with school age children.

The next piece of information reviewed is the list of the toxic cleanup sites in Marysville. The list was downloaded from the Washington State Department of Ecology- What's In My Neighborhood Toxic Cleanup Site map web site. The list was reviewed and all sites with a no further action (NFA) designation were removed from the list because it indicates the site has been cleaned up. The remaining sites were mapped using the City GIS and compared with other existing City data sources.

Ecology has 24 documented cleanup sites within the City. The majority of these sites (14) are located in the Downtown neighborhood. By adding a buffer around the sites it was determined that there are approximately 300 residential parcels within 500 feet of these toxic sites. Most of these parcels are multifamily land uses. In addition there are also about 300 nonresidential parcels within the 500 foot buffer area. These parcels have a variety of uses but most are related to commercial business.

Most of these sites have not been assigned a risk level by Ecology. Without any risk assessment information it is hard to know which, if any, of these sites might pose a risk to the health of the people living around them. In the absence of risk quantification for this data two other map based systems were utilized.

The EPA EJSCREEN-Environmental Justice Screening and Mapping Tool, and Washington State Department of Health Environmental Health Disparities Map function similarly. Each tool evaluates sources of pollutants or the potential for pollutants to be present. Then compares these pollutant risks with demographic and other population statistics that could indicate a susceptibility for harm to the people who live in the area. Here is a comparison of the environmental indicators used in each tool. For the most part the pollutant indicators are very similar.

Table 2: Environmental Screening Indicators

EPA EJSCREEN	Washington Environmental Health Disparities Map
Air pollution- PM2.5 level in air	Particulate Matter 2.5 (PM2.5)
Air pollution- Ozone level in air	Ozone
Air pollution- NATA air toxics	Diesel emissions
Traffic proximity and volume	Traffic density
Lead paint indicator	Lead risk and exposure
Proximity to waste and hazardous chemical facilities or sites - National Priorities List (NPL) sites	Proximity to Superfund sites (similar but not the same indicator)
Proximity to waste and hazardous chemical facilities or sites - Risk Management Plan (RMP) Facilities	Proximity to hazardous waste generators and facilities (similar but not the same indicator)
Proximity to waste and hazardous chemical facilities or sites - Hazardous waste Treatment, Storage and Disposal Facilities (TSDFs)	Proximity to facilities with highly toxic substances (similar but not the same indicator)
Wastewater discharge indicator	Wastewater discharge
	Toxic releases from facilities

Here is a comparison of the population data used by each tool. Several of the categories are very similar but the Washington Environmental Health Disparities Map includes additional data.

Table 3: Population Information used for Risk Factor Assessment

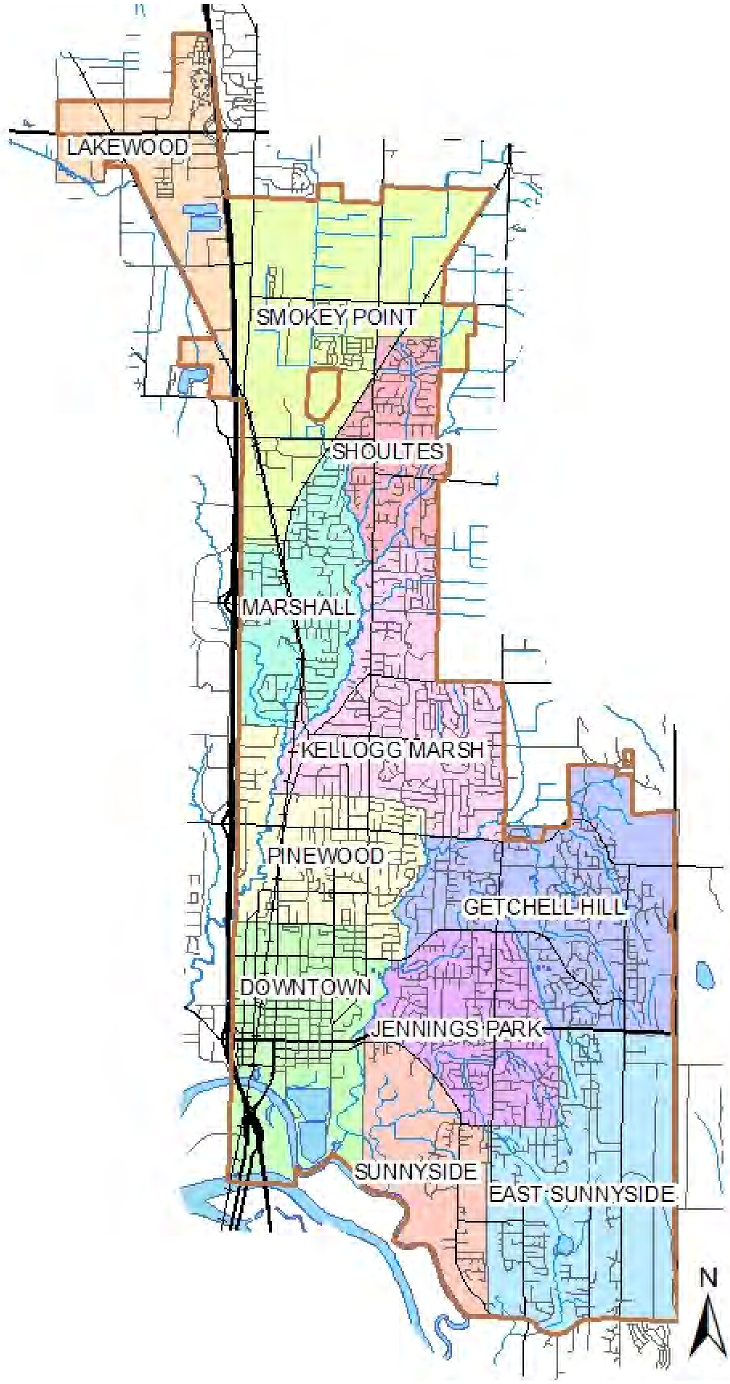
EPA EJSCREEN	Washington Environmental Health Disparities Map*
Minority	Race (People of color)
Less than high school education	Poor educational attainment
Linguistic isolation	Linguistic isolation
Individuals under age 5	NA
Individuals over age 64	(not listed in guide book but appears in tool)
Low-Income	Poverty
	Housing burden
	Transportation expense
	Unemployment
	Cardiovascular disease
	Low birth weight infants

* These are the indicators listed in the guide book, however many additional variables are present in the currently available map.

The impacts of pollutants vary depending on the exposure and susceptibility of the population to the exposure. The tools combine the population data and environmental risks to the form of an index or composite score to rank geographic areas. The tools represent the data in map format, giving darker colors to indicate a higher risk.

The EPA EJSCREEN tool can be customized to display index values for different areas then print out a standard report for that area. The City neighborhoods were used for the analysis. Overall the index values, displayed as percentiles, were low throughout most of the City when compared to the state, EPA region and USA. Low Index percentiles are a good sign. This means that most of the City is exposed to, or has a lower susceptibility to pollutants than most people in the state, EPA region or USA. The Downtown neighborhood is the one exception. Overall it had the highest index values of any neighborhood in the City and most values were higher than the USA percentiles.

The Washington Environmental Health Disparities Map displays a wide variety of data in differing combinations. The data does not export into a report, but individual map displays can be exported. By reviewing all the mapped data it is hard to make generalizations because of the number of data combinations available. When viewing only the primarily categories, Diesel Pollution and Disproportionate Impact, Environmental Health Disparities, Health Disparities, Lead Exposure Risk, and Social Vulnerability to Hazards, a slight pattern does emerge. Downtown and the areas directly adjacent seem to have a higher exposure or higher susceptibility, than the rest of the state.



Conclusions

The tabular race and ethnicity data available indicate that the City is generally becoming more diverse than it was previously. This shows that City services will also need to be adapted and expanded to ensure that everyone is being served equitably.

The map based data indicates that the Downtown neighborhood is likely experiencing a higher risk for environmental harms than other areas of the City. Many of these risks factors are already being addressed by the City. The 2016 Stormwater Comprehensive Plan included several stormwater retrofit projects in this neighborhood. Several projects have been completed or are under construction currently, including a facility that will treat stormwater from 463 acres of Downtown. The neighborhood has also been a focus for our Executive and Community Development Departments. Studies, planning documents and projects have been completed to address environmental justice, through traffic revisions, increased walkability corridors, stormwater projects, park improvements and contaminated site cleanup. With the extensive work that has already been done in the Downtown neighborhood the stormwater retrofit opportunities have been exhausted. Prioritizing Downtown for further stormwater retrofits based on the risk of environment harms is not necessary.

Programmatic opportunities to reduce environmental risks in the Downtown neighborhood are still available. The City will begin business inspections under a new Source Control Program for existing development in 2023. Businesses in the Downtown neighborhood will be prioritized for inspections. The program will include providing information about operational and/or structural source control BMPs, inspecting businesses and enforcing local ordinances. Other actions such as a tree planting program or customized implementation of an education and outreach campaign will be explored during the SMAP planning efforts.

Sources

“EJSCREEN: Environmental Justice Screening and Mapping Tool.” EPA, Environmental Protection Agency, 15 April 2021, https://www.epa.gov/ejscreen.

“Information by Location, Washington Tracking Network.” Washington State Department of Health. 26 April 2021, https://fortress.wa.gov/doh/wtn/WTNIBL/

“Report Card- Washington State Report Card.” Washington Office of Superintendent of Public Instruction. 16 April 2021, https://washingtonstatereportcard.ospi.k12.wa.us/ReportCard/ViewSchoolOrDistrict/100142 Marysville School District

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“U.S Census Bureau QuickFacts: Marysville city, Washington; United States.” Bureau, US Census. 16 April 2021, https://www.census.gov/quickfacts/fact/table/marysvillecitywashington,US/PST045219.

U.S. Environmental Protection Agency (EPA), 2019. EJSCREEN Technical Documentation.

“What's In My Neighborhood, Toxics Program Cleanup Sites Map.” Washington State Department of Ecology. 13 April 2021, https://apps.ecology.wa.gov/neighborhood/.

EJSCREEN Report (Version 2020)

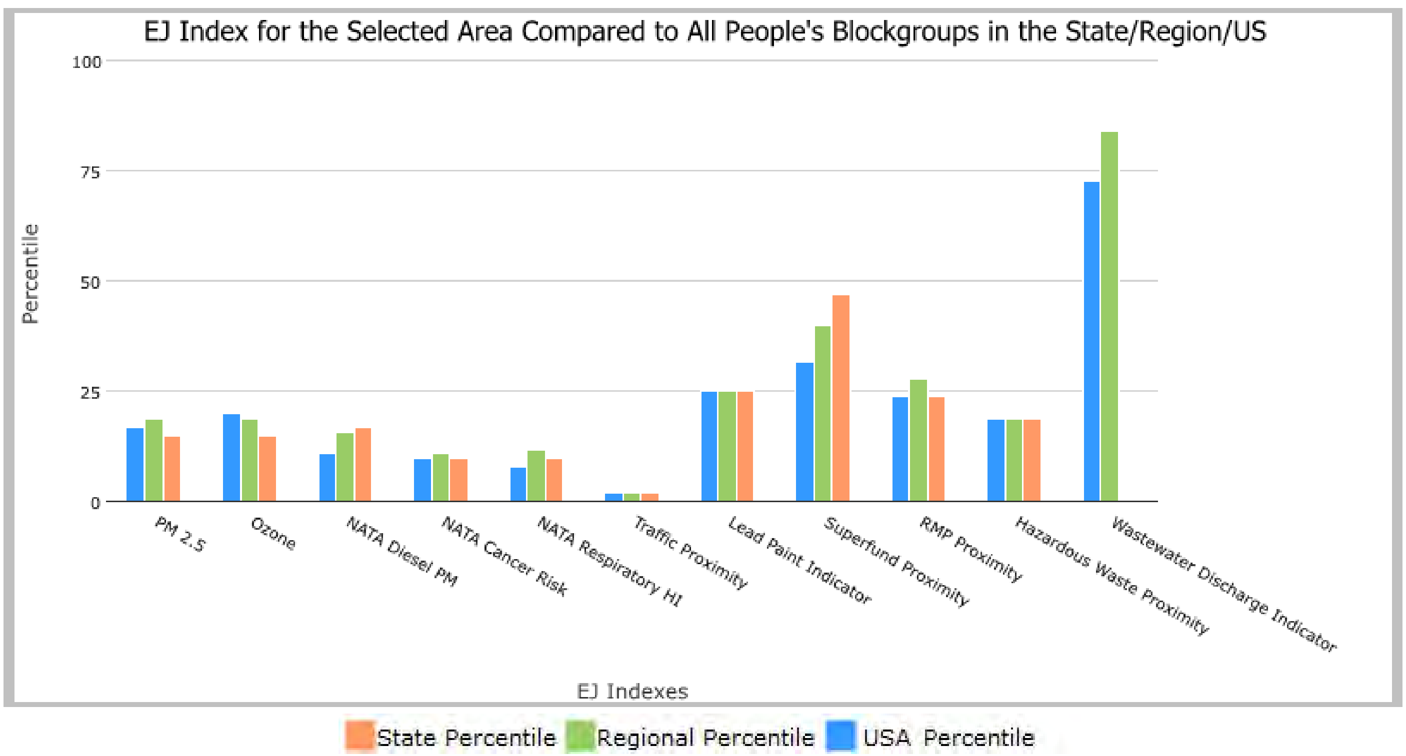
the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 2,468

Input Area (sq. miles): 1.49

Lakewood

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	15	19	17
EJ Index for Ozone	15	19	20
EJ Index for NATA* Diesel PM	17	16	11
EJ Index for NATA* Air Toxics Cancer Risk	10	11	10
EJ Index for NATA* Respiratory Hazard Index	10	12	8
EJ Index for Traffic Proximity and Volume	2	2	2
EJ Index for Lead Paint Indicator	25	25	25
EJ Index for Superfund Proximity	47	40	32
EJ Index for RMP Proximity	24	28	24
EJ Index for Hazardous Waste Proximity	19	19	19
EJ Index for Wastewater Discharge Indicator	N/A	84	73



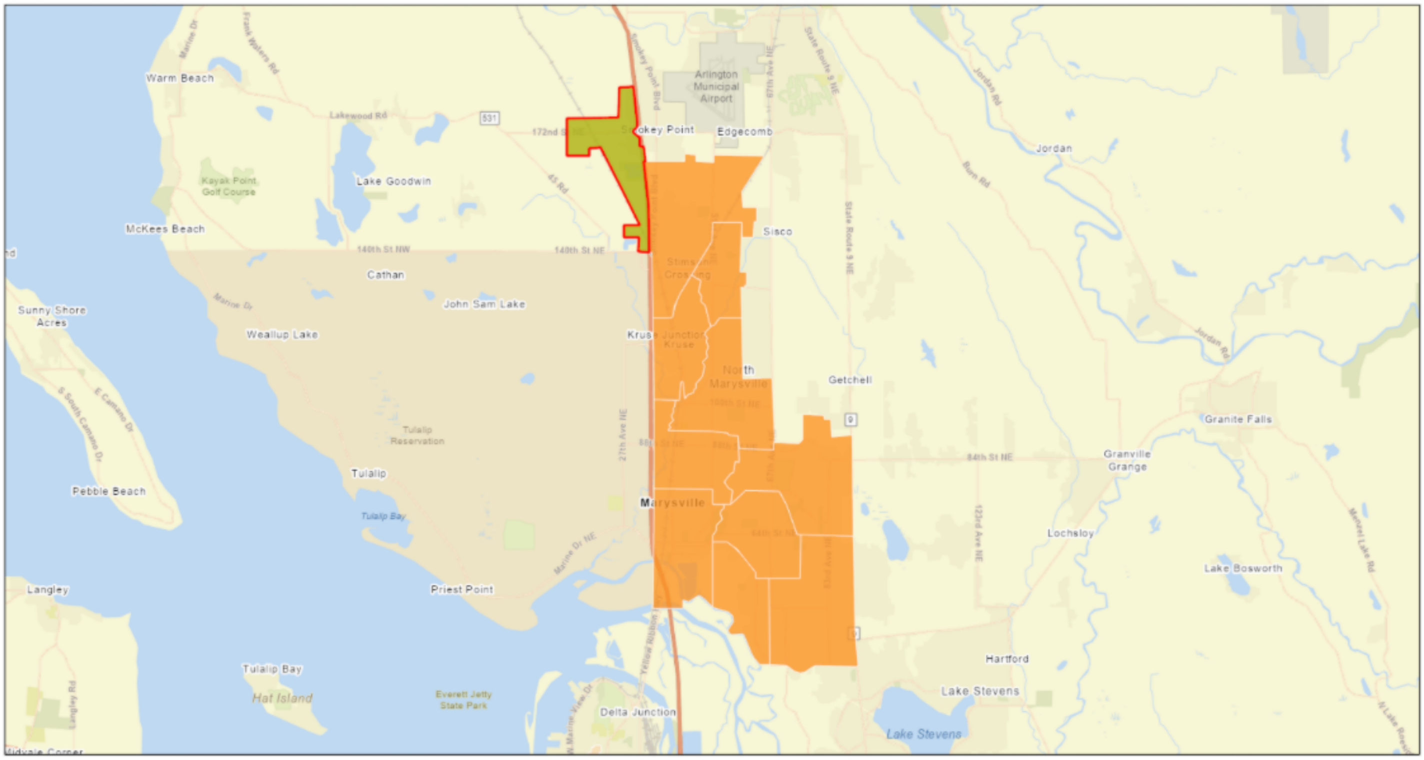
This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 2,468

Input Area (sq. miles): 1.49



April 16, 2021

Project 1

neighborhoods

1:144,448

0 1.25 2.5 5 mi

0 1.75 3.5 7 km

Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

Ecology listed Toxics Program Cleanup Sites 1

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 2,468

Input Area (sq. miles): 1.49

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m^3)	7.16	8.21	20	8.52	15	8.55	15
Ozone (ppb)	32.9	37.3	16	39.1	10	42.9	5
NATA* Diesel PM (µg/m^3)	0.433	0.585	43	0.481	50-60th	0.478	50-60th
NATA* Cancer Risk (lifetime risk per million)	34	34	49	31	60-70th	32	60-70th
NATA* Respiratory Hazard Index	0.5	0.5	46	0.46	50-60th	0.44	60-70th
Traffic Proximity and Volume (daily traffic count/distance to road)	1100	610	85	510	88	750	82
Lead Paint Indicator (% Pre-1960 Housing)	0.094	0.23	41	0.22	42	0.28	37
Superfund Proximity (site count/km distance)	0.025	0.19	13	0.13	27	0.13	22
RMP Proximity (facility count/km distance)	0.18	0.63	40	0.65	41	0.74	33
Hazardous Waste Proximity (facility count/km distance)	0.73	1.9	52	1.5	57	5	44
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	0	0.0091	N/A	3.1	49	9.4	33
Demographic Indicators							
Demographic Index	18%	29%	29	29%	28	36%	27
People of Color Population	17%	31%	28	28%	34	39%	32
Low Income Population	20%	27%	43	30%	35	33%	34
Linguistically Isolated Population	6%	4%	78	3%	82	4%	76
Population With Less Than High School Education	6%	9%	48	9%	44	13%	35
Population Under 5 years of age	10%	6%	85	6%	85	6%	85
Population over 64 years of age	13%	15%	49	15%	47	15%	47

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

For additional information, see: www.epa.gov/environmentaljustice

EJSCREEN Report (Version 2020)

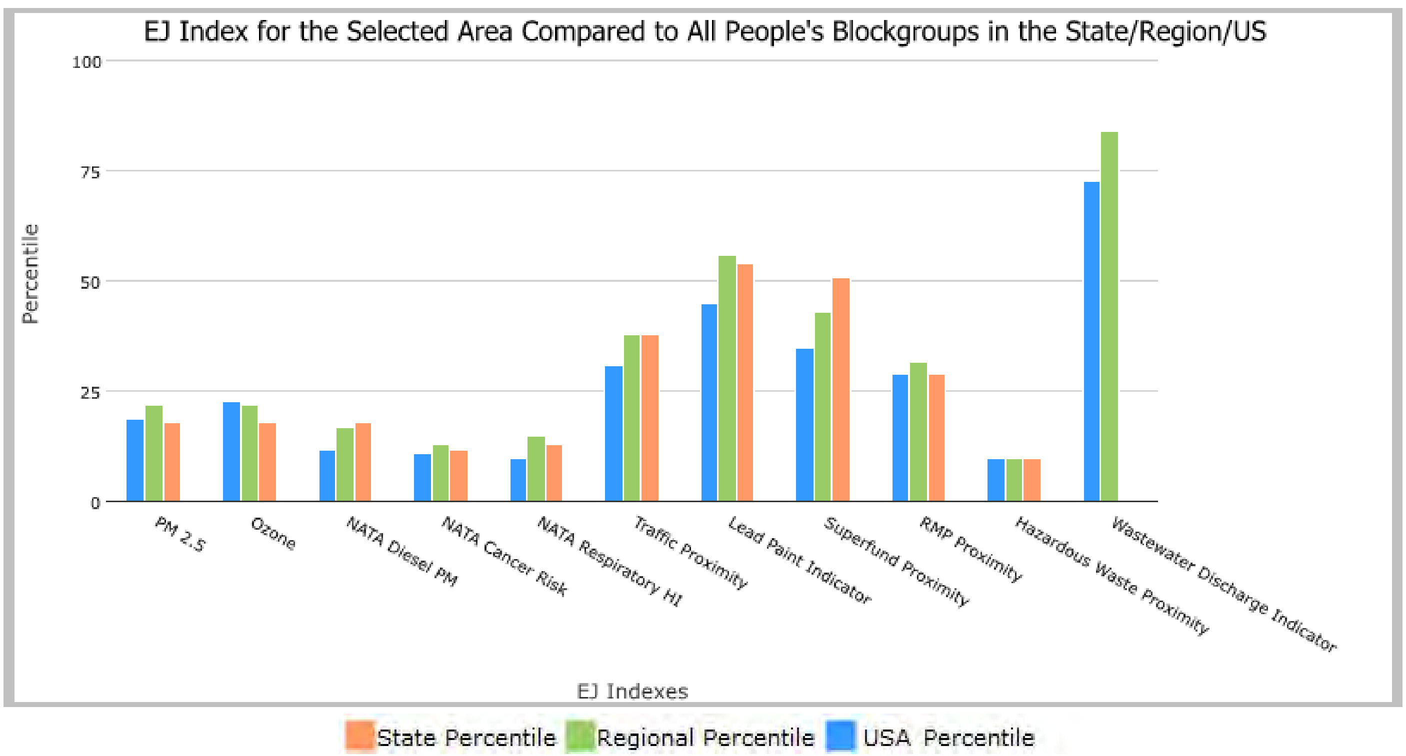
the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 2,922

Input Area (sq. miles): 3.13

Smokey Point

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	18	22	19
EJ Index for Ozone	18	22	23
EJ Index for NATA* Diesel PM	18	17	12
EJ Index for NATA* Air Toxics Cancer Risk	12	13	11
EJ Index for NATA* Respiratory Hazard Index	13	15	10
EJ Index for Traffic Proximity and Volume	38	38	31
EJ Index for Lead Paint Indicator	54	56	45
EJ Index for Superfund Proximity	51	43	35
EJ Index for RMP Proximity	29	32	29
EJ Index for Hazardous Waste Proximity	10	10	10
EJ Index for Wastewater Discharge Indicator	N/A	84	73



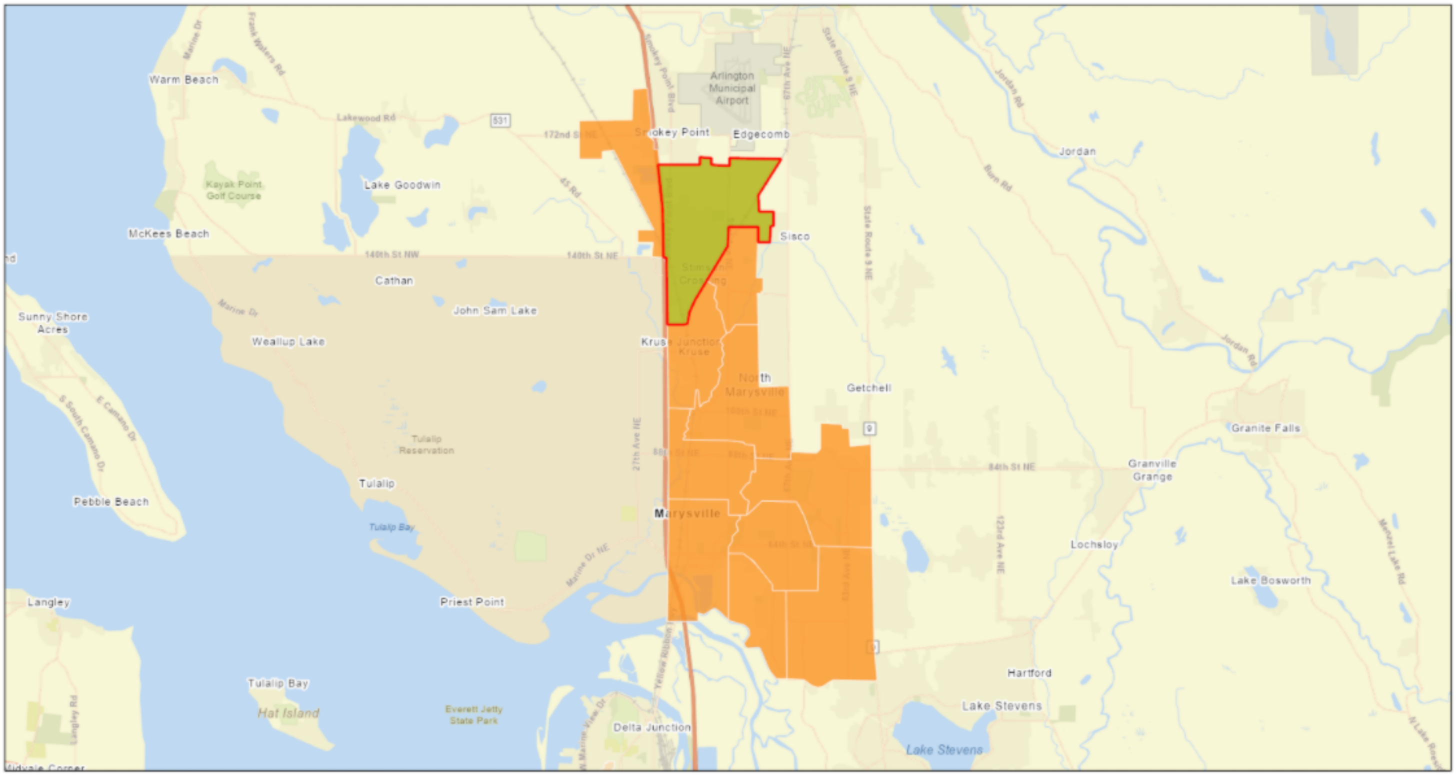
This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 2,922

Input Area (sq. miles): 3.13



April 16, 2021

Project 1

neighborhoods

1:144,448

0 1.25 2.5 5 mi

0 1.75 3.5 7 km

Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	2

Ecology listed Toxics Program Cleanup Sites 5

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 2,922

Input Area (sq. miles): 3.13

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m^3)	7.28	8.21	23	8.52	17	8.55	16
Ozone (ppb)	33.5	37.3	25	39.1	15	42.9	6
NATA* Diesel PM (µg/m^3)	0.455	0.585	44	0.481	50-60th	0.478	50-60th
NATA* Cancer Risk (lifetime risk per million)	36	34	56	31	60-70th	32	60-70th
NATA* Respiratory Hazard Index	0.51	0.5	50	0.46	50-60th	0.44	70-80th
Traffic Proximity and Volume (daily traffic count/distance to road)	68	610	29	510	31	750	29
Lead Paint Indicator (% Pre-1960 Housing)	0.021	0.23	16	0.22	17	0.28	18
Superfund Proximity (site count/km distance)	0.023	0.19	11	0.13	25	0.13	20
RMP Proximity (facility count/km distance)	0.15	0.63	35	0.65	35	0.74	28
Hazardous Waste Proximity (facility count/km distance)	1.6	1.9	68	1.5	73	5	61
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	0	0.0091	N/A	3.1	49	9.4	33
Demographic Indicators							
Demographic Index	20%	29%	33	29%	33	36%	30
People of Color Population	27%	31%	52	28%	59	39%	46
Low Income Population	13%	27%	22	30%	17	33%	19
Linguistically Isolated Population	0%	4%	43	3%	47	4%	45
Population With Less Than High School Education	12%	9%	75	9%	74	13%	61
Population Under 5 years of age	8%	6%	69	6%	69	6%	69
Population over 64 years of age	13%	15%	48	15%	46	15%	45

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

For additional information, see: www.epa.gov/environmentaljustice

EJSCREEN is a screening tool for pre-decisional use only. It can help identify areas that may warrant additional consideration, analysis, or outreach. It does not provide a basis for decision-making, but it may help identify potential areas of EJ concern. Users should keep in mind that screening tools are subject to substantial uncertainty in their demographic and environmental data, particularly when looking at small geographic areas. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports. This screening tool does not provide data on every environmental impact and demographic factor that may be relevant to a particular location. EJSCREEN outputs should be supplemented with additional information and local knowledge before taking any action to address potential EJ concerns.

EJSCREEN Report (Version 2020)

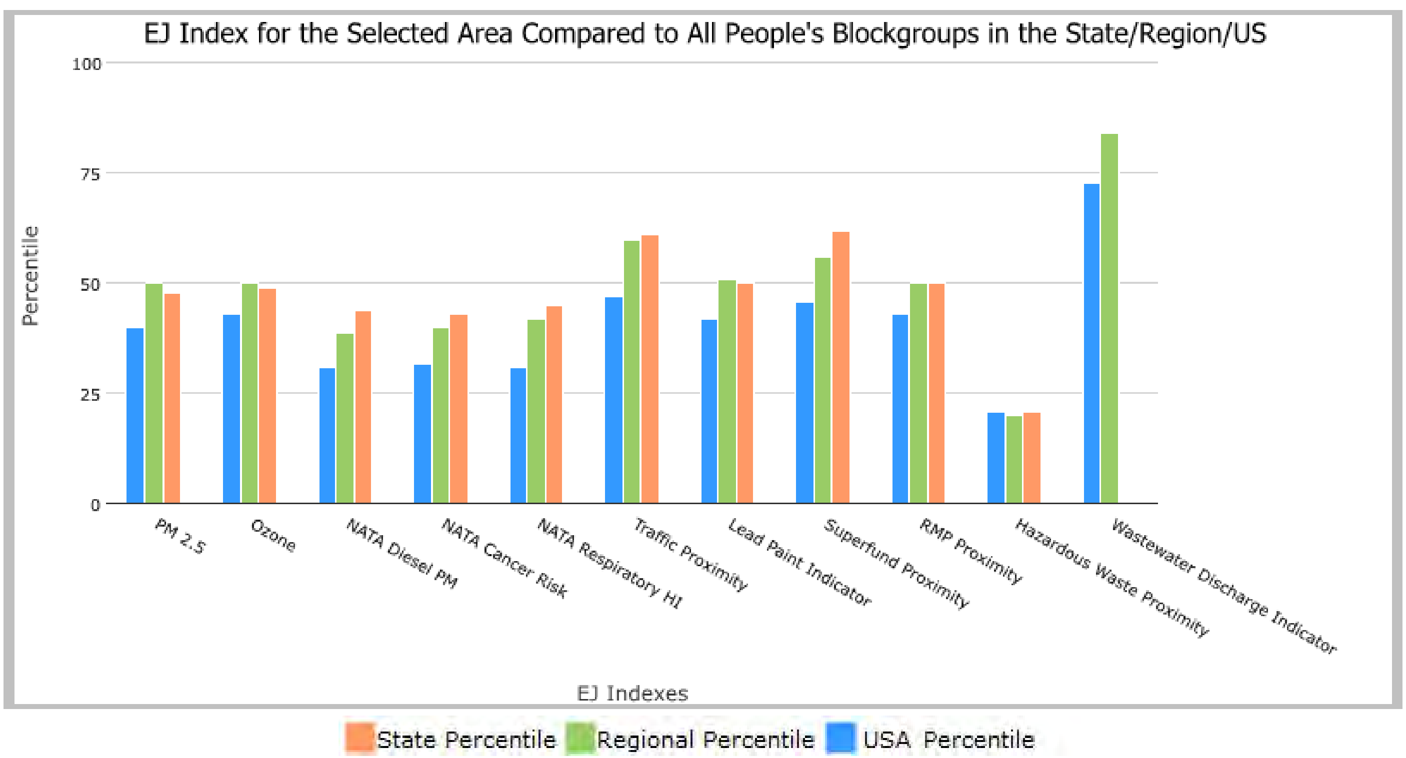
the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 4,467

Input Area (sq. miles): 1.07

Shoultes

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	48	50	40
EJ Index for Ozone	49	50	43
EJ Index for NATA* Diesel PM	44	39	31
EJ Index for NATA* Air Toxics Cancer Risk	43	40	32
EJ Index for NATA* Respiratory Hazard Index	45	42	31
EJ Index for Traffic Proximity and Volume	61	60	47
EJ Index for Lead Paint Indicator	50	51	42
EJ Index for Superfund Proximity	62	56	46
EJ Index for RMP Proximity	50	50	43
EJ Index for Hazardous Waste Proximity	21	20	21
EJ Index for Wastewater Discharge Indicator	N/A	84	73



This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

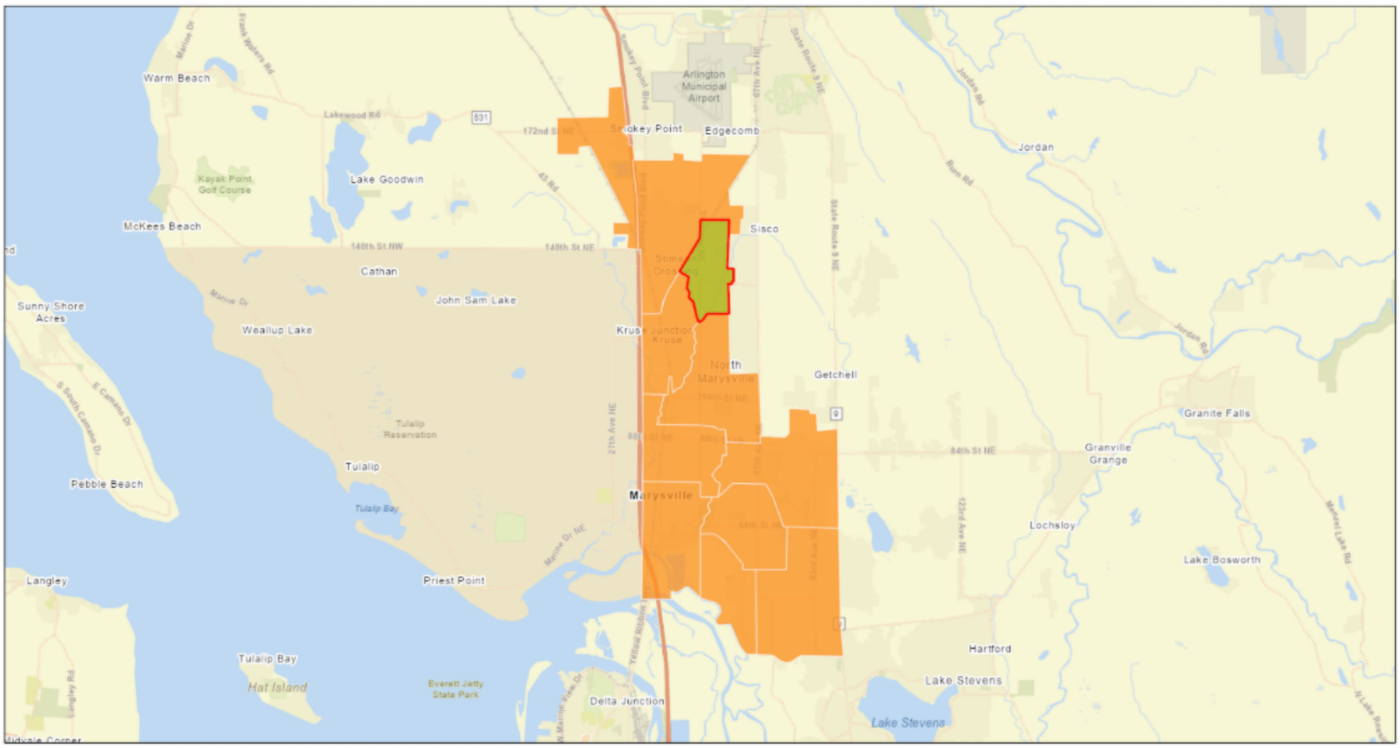
EPA United States Environmental Protection Agency

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 4,467

Input Area (sq. miles): 1.07



April 16, 2021

Project 1

neighborhoods

1:144,448

0 1.25 2.5 5 mi

0 1.75 3.5 7 km

Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

Ecology listed Toxics Program Cleanup Sites 0

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 4,467

Input Area (sq. miles): 1.07

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m^3)	7.34	8.21	26	8.52	19	8.55	17
Ozone (ppb)	33.5	37.3	26	39.1	16	42.9	6
NATA* Diesel PM (µg/m^3)	0.424	0.585	42	0.481	50-60th	0.478	50-60th
NATA* Cancer Risk (lifetime risk per million)	36	34	55	31	60-70th	32	60-70th
NATA* Respiratory Hazard Index	0.5	0.5	48	0.46	50-60th	0.44	60-70th
Traffic Proximity and Volume (daily traffic count/distance to road)	12	610	12	510	13	750	12
Lead Paint Indicator (% Pre-1960 Housing)	0.065	0.23	34	0.22	34	0.28	31
Superfund Proximity (site count/km distance)	0.022	0.19	10	0.13	24	0.13	20
RMP Proximity (facility count/km distance)	0.14	0.63	32	0.65	32	0.74	25
Hazardous Waste Proximity (facility count/km distance)	1.5	1.9	66	1.5	71	5	58
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	0	0.0091	N/A	3.1	49	9.4	33
Demographic Indicators							
Demographic Index	24%	29%	46	29%	46	36%	40
People of Color Population	28%	31%	53	28%	60	39%	47
Low Income Population	21%	27%	44	30%	37	33%	35
Linguistically Isolated Population	7%	4%	80	3%	84	4%	78
Population With Less Than High School Education	9%	9%	65	9%	62	13%	51
Population Under 5 years of age	6%	6%	52	6%	52	6%	53
Population over 64 years of age	15%	15%	60	15%	58	15%	57

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

For additional information, see: www.epa.gov/environmentaljustice

EJSCREEN Report (Version 2020)

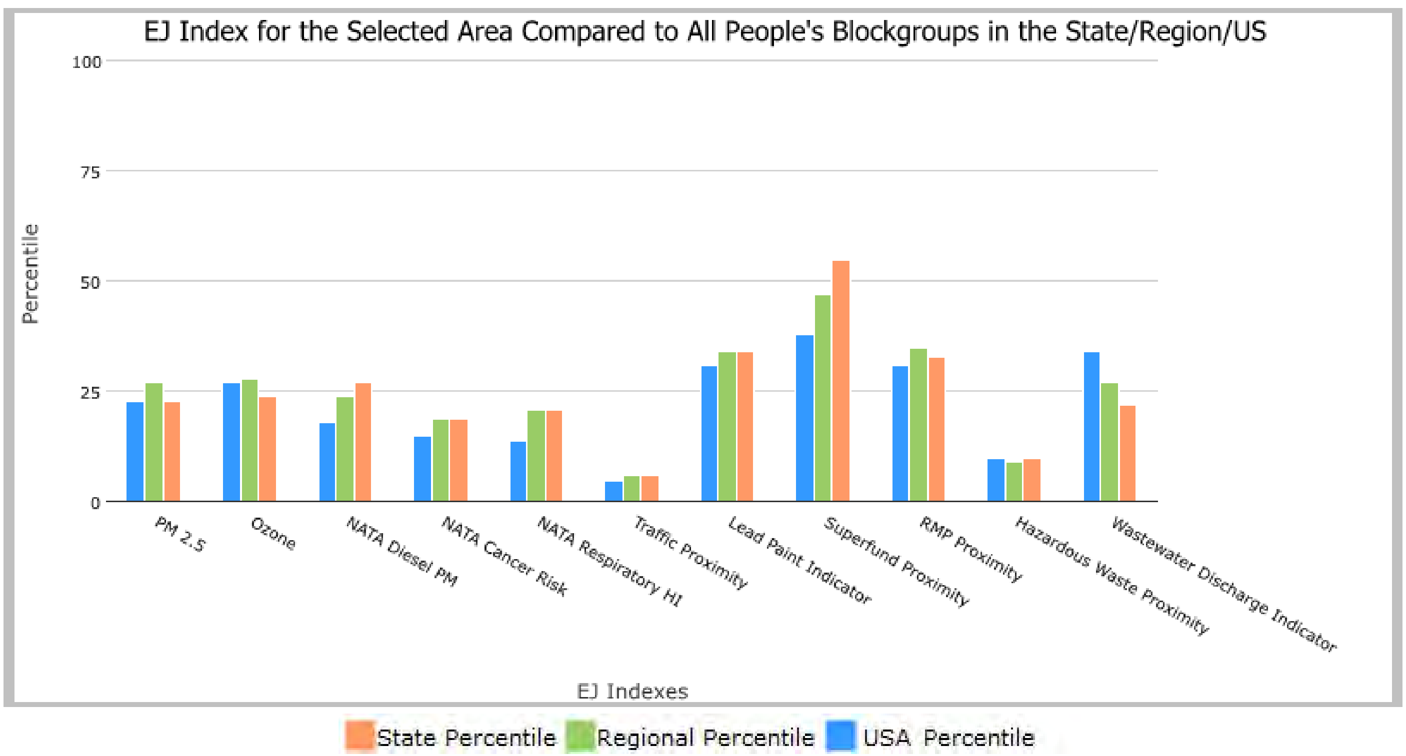
the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 4,532

Input Area (sq. miles): 1.42

Marshall

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	23	27	23
EJ Index for Ozone	24	28	27
EJ Index for NATA* Diesel PM	27	24	18
EJ Index for NATA* Air Toxics Cancer Risk	19	19	15
EJ Index for NATA* Respiratory Hazard Index	21	21	14
EJ Index for Traffic Proximity and Volume	6	6	5
EJ Index for Lead Paint Indicator	34	34	31
EJ Index for Superfund Proximity	55	47	38
EJ Index for RMP Proximity	33	35	31
EJ Index for Hazardous Waste Proximity	10	9	10
EJ Index for Wastewater Discharge Indicator	22	27	34



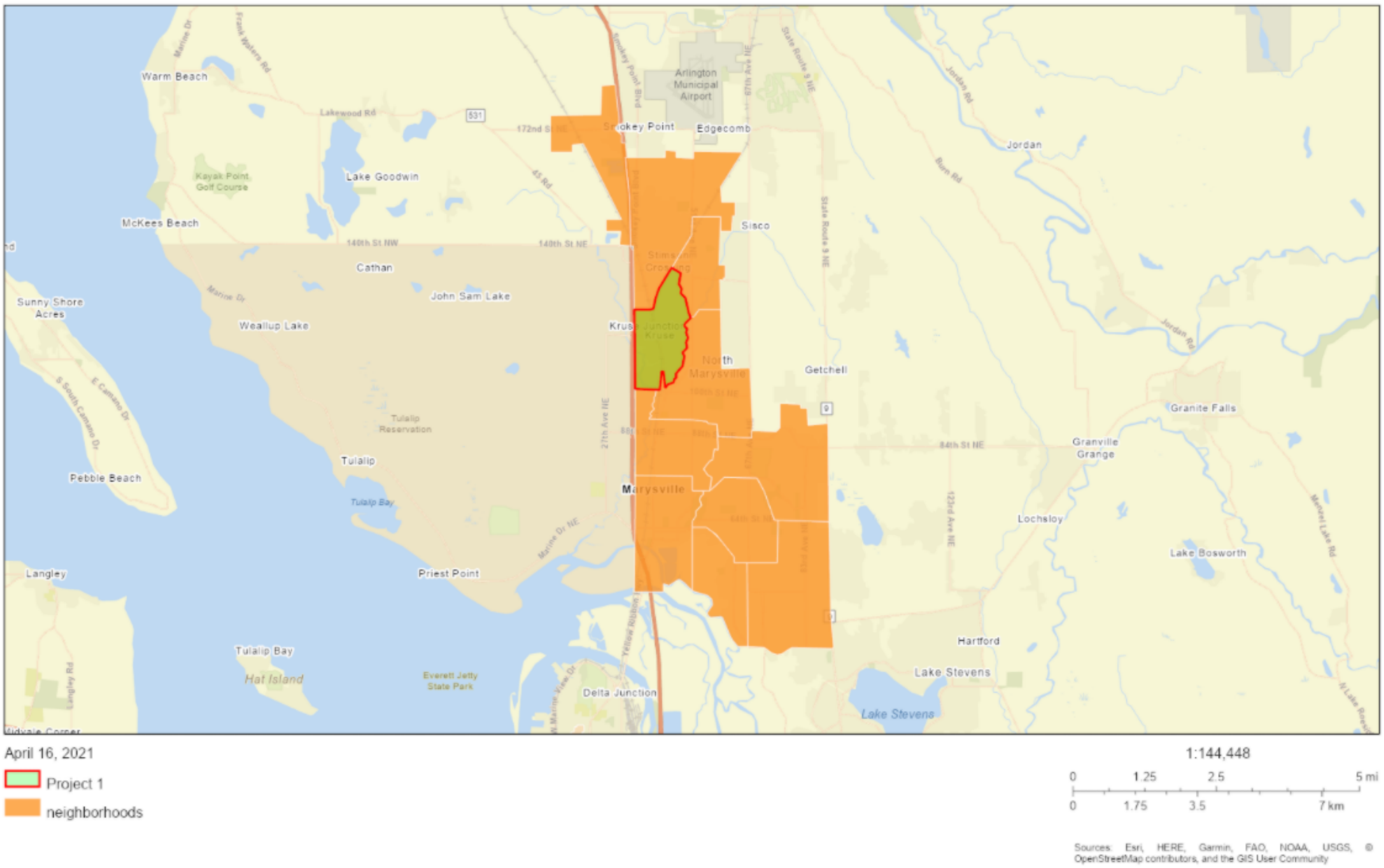
This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 4,532

Input Area (sq. miles): 1.42



Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

Ecology listed Toxics Program Cleanup Sites	1

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 4,532

Input Area (sq. miles): 1.42

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m^3)	7.4	8.21	28	8.52	21	8.55	18
Ozone (ppb)	33.5	37.3	26	39.1	16	42.9	6
NATA* Diesel PM (µg/m^3)	0.42	0.585	42	0.481	50-60th	0.478	50-60th
NATA* Cancer Risk (lifetime risk per million)	36	34	55	31	60-70th	32	60-70th
NATA* Respiratory Hazard Index	0.49	0.5	45	0.46	50-60th	0.44	60-70th
Traffic Proximity and Volume (daily traffic count/distance to road)	720	610	77	510	81	750	75
Lead Paint Indicator (% Pre-1960 Housing)	0.071	0.23	36	0.22	36	0.28	33
Superfund Proximity (site count/km distance)	0.022	0.19	10	0.13	24	0.13	20
RMP Proximity (facility count/km distance)	0.16	0.63	37	0.65	37	0.74	30
Hazardous Waste Proximity (facility count/km distance)	2	1.9	72	1.5	77	5	65
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	2.8E-06	0.0091	64	3.1	58	9.4	42
Demographic Indicators							
Demographic Index	16%	29%	21	29%	20	36%	20
People of Color Population	18%	31%	30	28%	37	39%	34
Low Income Population	14%	27%	26	30%	21	33%	21
Linguistically Isolated Population	1%	4%	44	3%	49	4%	47
Population With Less Than High School Education	13%	9%	78	9%	77	13%	65
Population Under 5 years of age	6%	6%	49	6%	48	6%	49
Population over 64 years of age	17%	15%	66	15%	64	15%	63

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

For additional information, see: www.epa.gov/environmentaljustice

EJSCREEN Report (Version 2020)

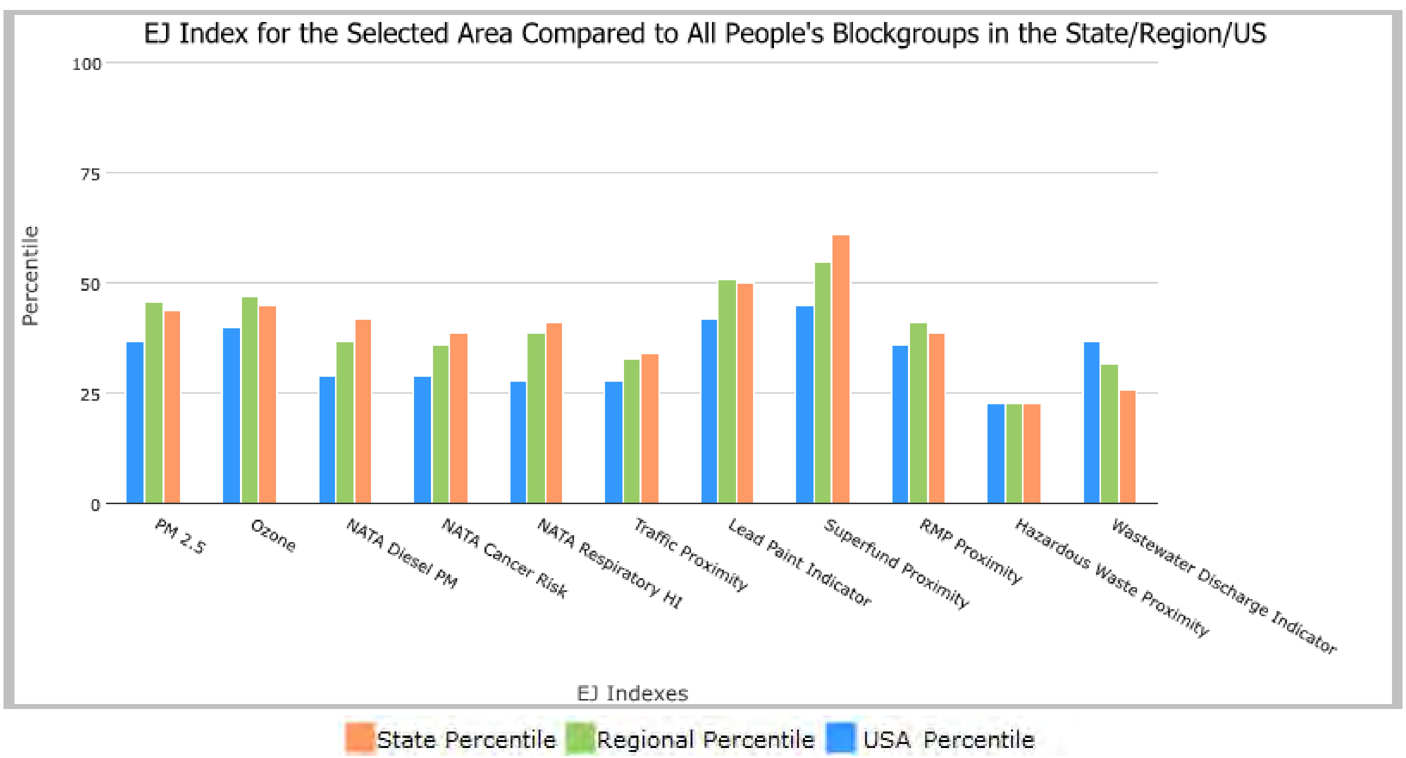
the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 10,238

Input Area (sq. miles): 2.22

Kellogg Marsh

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	44	46	37
EJ Index for Ozone	45	47	40
EJ Index for NATA* Diesel PM	42	37	29
EJ Index for NATA* Air Toxics Cancer Risk	39	36	29
EJ Index for NATA* Respiratory Hazard Index	41	39	28
EJ Index for Traffic Proximity and Volume	34	33	28
EJ Index for Lead Paint Indicator	50	51	42
EJ Index for Superfund Proximity	61	55	45
EJ Index for RMP Proximity	39	41	36
EJ Index for Hazardous Waste Proximity	23	23	23
EJ Index for Wastewater Discharge Indicator	26	32	37



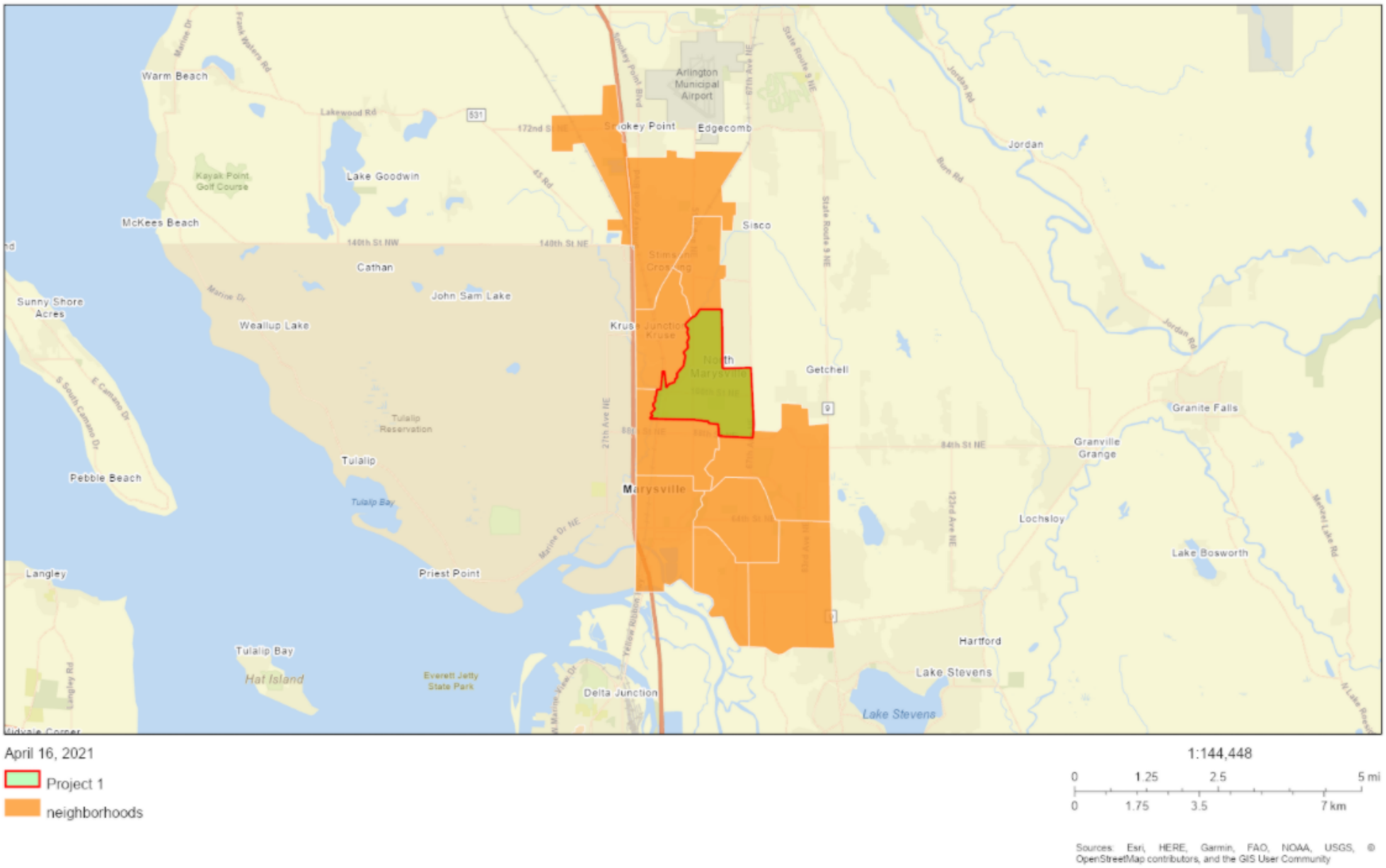
This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 10,238

Input Area (sq. miles): 2.22



Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

Ecology listed Toxics Program Cleanup Sites 0

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 10,238

Input Area (sq. miles): 2.22

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m³)	7.44	8.21	30	8.52	22	8.55	18
Ozone (ppb)	33.6	37.3	27	39.1	17	42.9	6
NATA* Diesel PM (µg/m³)	0.402	0.585	40	0.481	<50th	0.478	50-60th
NATA* Cancer Risk (lifetime risk per million)	36	34	55	31	60-70th	32	60-70th
NATA* Respiratory Hazard Index	0.49	0.5	45	0.46	50-60th	0.44	60-70th
Traffic Proximity and Volume (daily traffic count/distance to road)	130	610	39	510	42	750	39
Lead Paint Indicator (% Pre-1960 Housing)	0.052	0.23	29	0.22	30	0.28	28
Superfund Proximity (site count/km distance)	0.021	0.19	9	0.13	23	0.13	19
RMP Proximity (facility count/km distance)	0.2	0.63	45	0.65	45	0.74	37
Hazardous Waste Proximity (facility count/km distance)	1.1	1.9	60	1.5	65	5	52
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	1.6E-07	0.0091	58	3.1	49	9.4	33
Demographic Indicators							
Demographic Index	24%	29%	45	29%	45	36%	39
People of Color Population	30%	31%	57	28%	63	39%	49
Low Income Population	18%	27%	38	30%	31	33%	30
Linguistically Isolated Population	4%	4%	70	3%	74	4%	69
Population With Less Than High School Education	10%	9%	66	9%	64	13%	52
Population Under 5 years of age	5%	6%	45	6%	45	6%	46
Population over 64 years of age	11%	15%	40	15%	37	15%	37

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

For additional information, see: www.epa.gov/environmentaljustice

EJSCREEN Report (Version 2020)

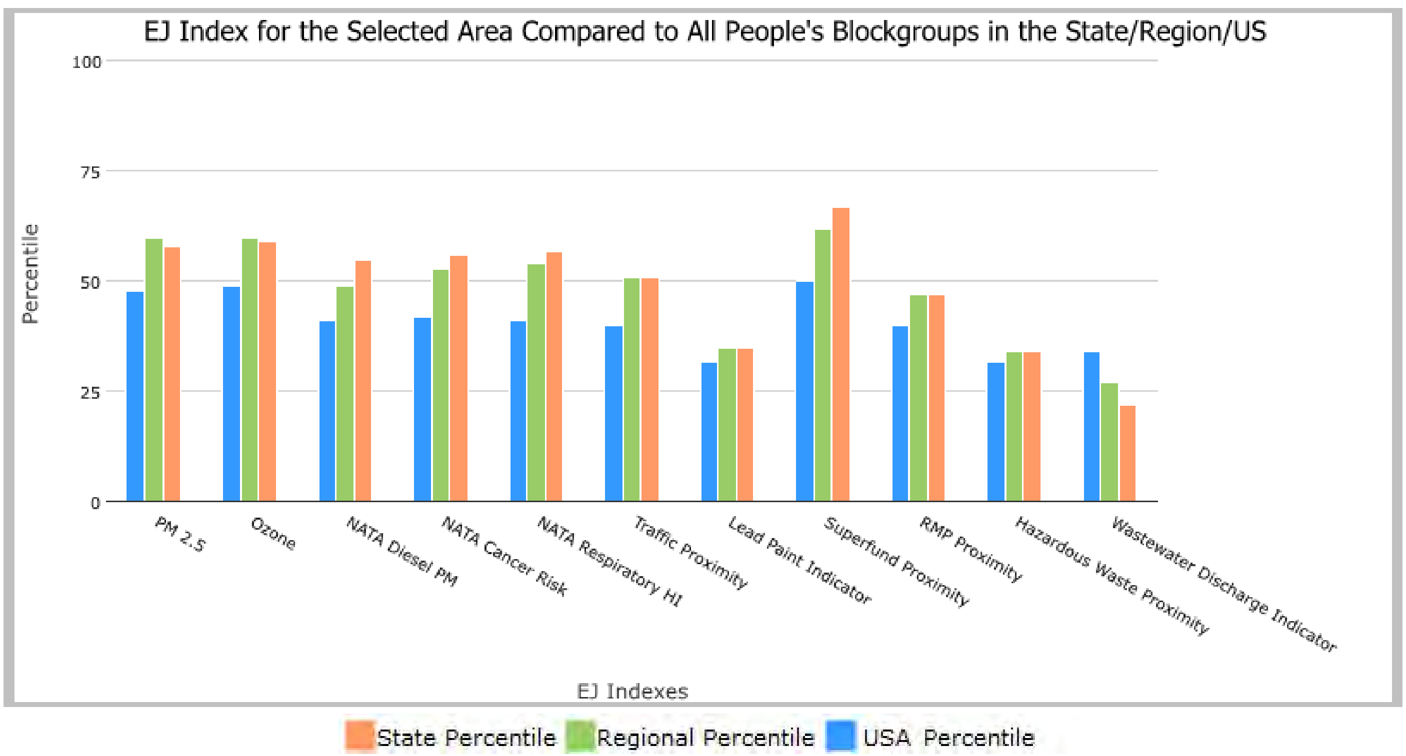
the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 7,000

Input Area (sq. miles): 1.58

Pinewood

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	58	60	48
EJ Index for Ozone	59	60	49
EJ Index for NATA* Diesel PM	55	49	41
EJ Index for NATA* Air Toxics Cancer Risk	56	53	42
EJ Index for NATA* Respiratory Hazard Index	57	54	41
EJ Index for Traffic Proximity and Volume	51	51	40
EJ Index for Lead Paint Indicator	35	35	32
EJ Index for Superfund Proximity	67	62	50
EJ Index for RMP Proximity	47	47	40
EJ Index for Hazardous Waste Proximity	34	34	32
EJ Index for Wastewater Discharge Indicator	22	27	34



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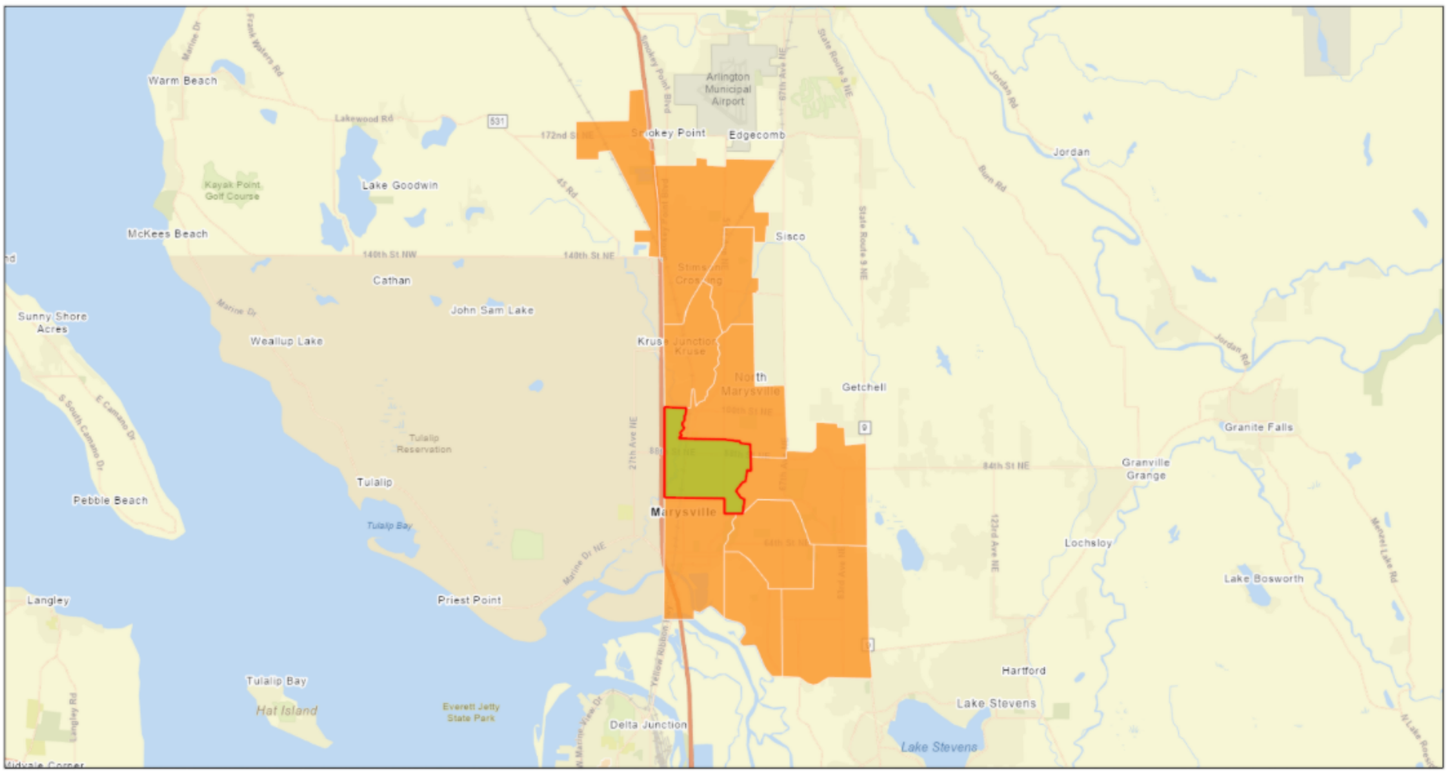
EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 7,000

Input Area (sq. miles): 1.58



April 16, 2021

Project 1

neighborhoods

1:144,448

0 1.25 2.5 5 mi

0 1.75 3.5 7 km

Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	1

Ecology listed Toxics Program Cleanup Sites 4

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 7,000

Input Area (sq. miles): 1.58

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m^3)	7.48	8.21	32	8.52	23	8.55	19
Ozone (ppb)	33.5	37.3	26	39.1	16	42.9	6
NATA* Diesel PM (µg/m^3)	0.522	0.585	52	0.481	60-70th	0.478	60-70th
NATA* Cancer Risk (lifetime risk per million)	35	34	54	31	60-70th	32	60-70th
NATA* Respiratory Hazard Index	0.49	0.5	46	0.46	50-60th	0.44	60-70th
Traffic Proximity and Volume (daily traffic count/distance to road)	1000	610	84	510	87	750	82
Lead Paint Indicator (% Pre-1960 Housing)	0.16	0.23	55	0.22	55	0.28	47
Superfund Proximity (site count/km distance)	0.021	0.19	9	0.13	23	0.13	18
RMP Proximity (facility count/km distance)	0.33	0.63	57	0.65	56	0.74	51
Hazardous Waste Proximity (facility count/km distance)	1.4	1.9	64	1.5	69	5	56
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	0.0001	0.0091	81	3.1	72	9.4	54
Demographic Indicators							
Demographic Index	28%	29%	56	29%	56	36%	46
People of Color Population	24%	31%	44	28%	51	39%	42
Low Income Population	32%	27%	66	30%	59	33%	55
Linguistically Isolated Population	1%	4%	50	3%	55	4%	52
Population With Less Than High School Education	11%	9%	71	9%	69	13%	57
Population Under 5 years of age	5%	6%	46	6%	45	6%	47
Population over 64 years of age	19%	15%	74	15%	73	15%	73

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

For additional information, see: www.epa.gov/environmentaljustice

EJSCREEN Report (Version 2020)

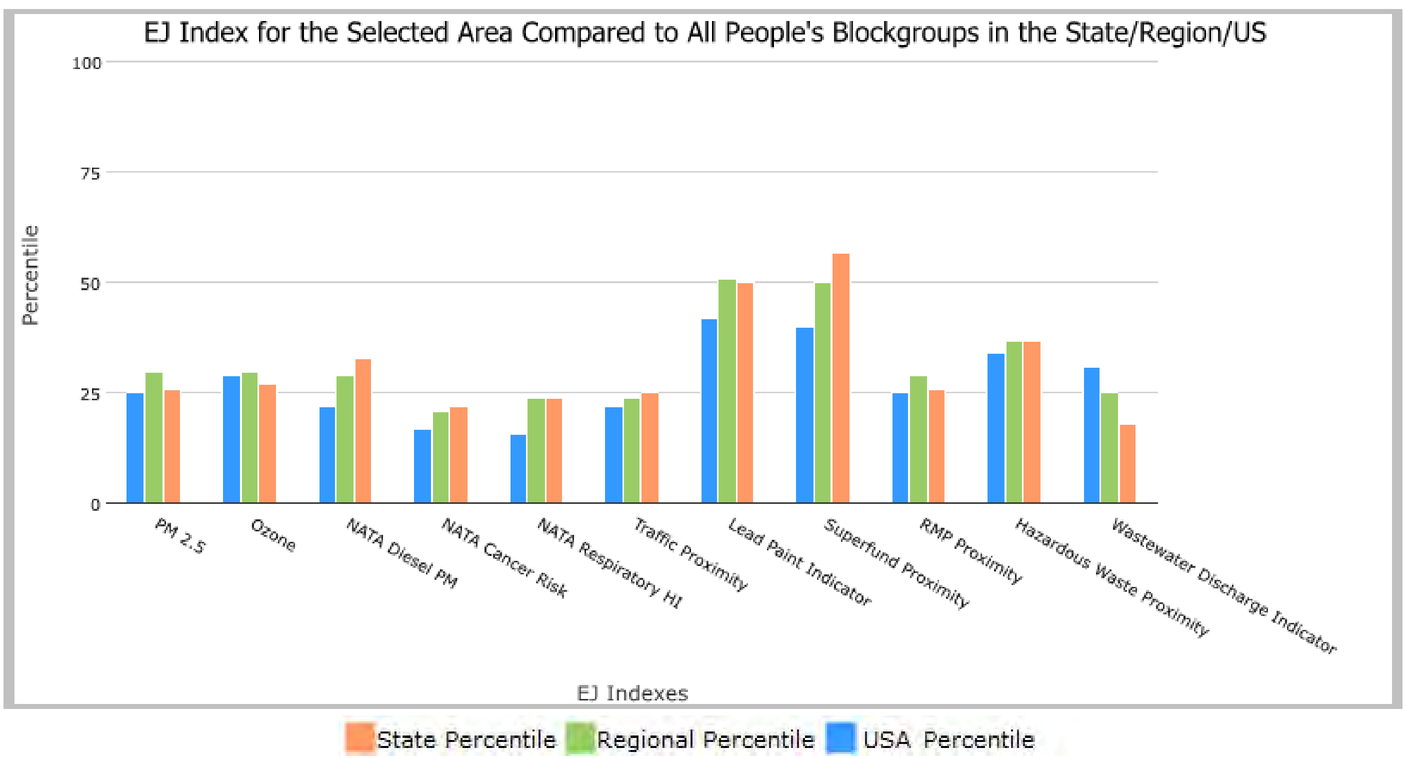
the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 11,157

Input Area (sq. miles): 2.68

Getchell

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	26	30	25
EJ Index for Ozone	27	30	29
EJ Index for NATA* Diesel PM	33	29	22
EJ Index for NATA* Air Toxics Cancer Risk	22	21	17
EJ Index for NATA* Respiratory Hazard Index	24	24	16
EJ Index for Traffic Proximity and Volume	25	24	22
EJ Index for Lead Paint Indicator	50	51	42
EJ Index for Superfund Proximity	57	50	40
EJ Index for RMP Proximity	26	29	25
EJ Index for Hazardous Waste Proximity	37	37	34
EJ Index for Wastewater Discharge Indicator	18	25	31



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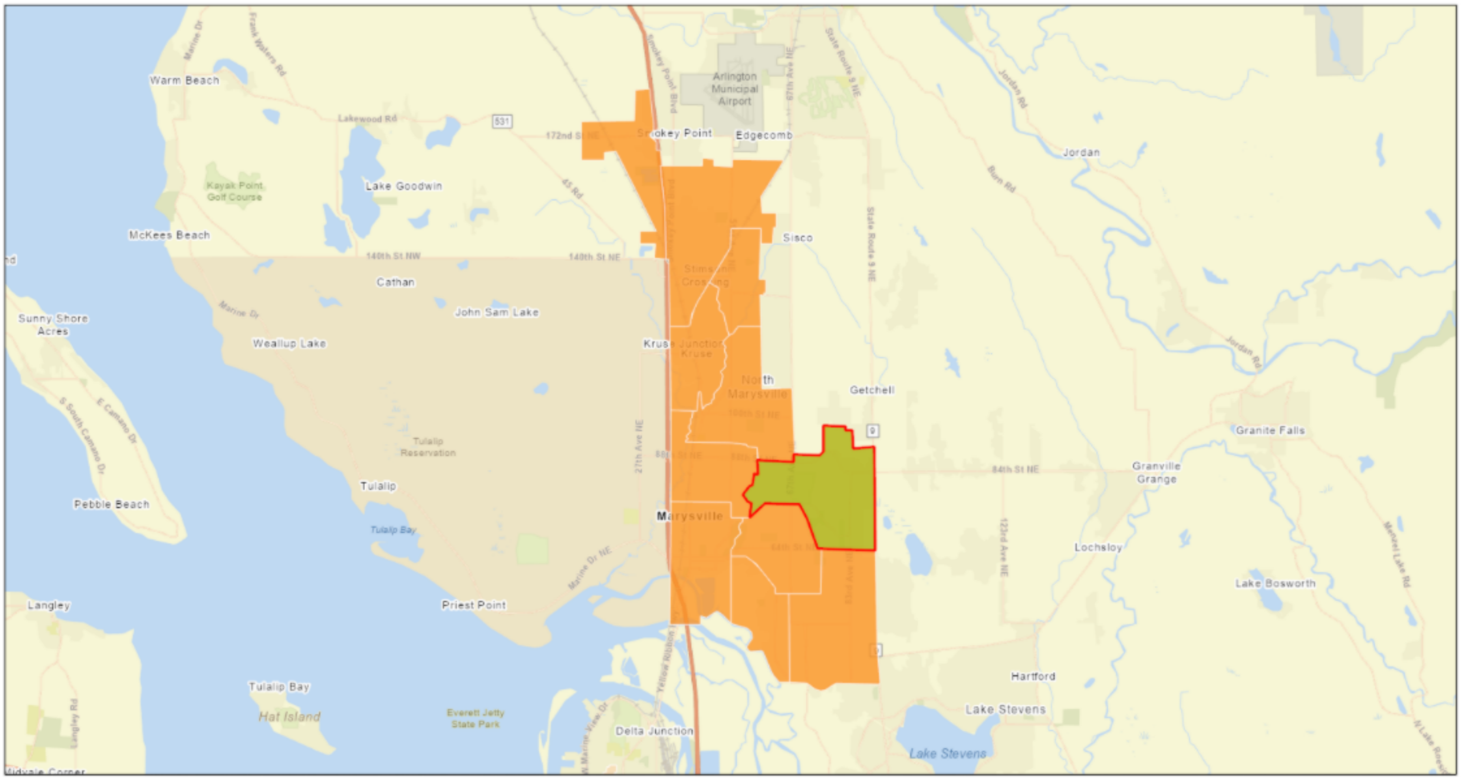
EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 11,157

Input Area (sq. miles): 2.68



April 16, 2021

Project 1

neighborhoods

1:144,448

0 1.25 2.5 5 mi

0 1.75 3.5 7 km

Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

Ecology listed Toxics Program Cleanup Sites 0

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 11,157

Input Area (sq. miles): 2.68

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m^3)	7.45	8.21	31	8.52	22	8.55	19
Ozone (ppb)	33.9	37.3	31	39.1	19	42.9	7
NATA* Diesel PM (µg/m^3)	0.369	0.585	37	0.481	<50th	0.478	<50th
NATA* Cancer Risk (lifetime risk per million)	35	34	54	31	60-70th	32	60-70th
NATA* Respiratory Hazard Index	0.49	0.5	44	0.46	50-60th	0.44	60-70th
Traffic Proximity and Volume (daily traffic count/distance to road)	180	610	46	510	50	750	46
Lead Paint Indicator (% Pre-1960 Housing)	0.03	0.23	20	0.22	21	0.28	22
Superfund Proximity (site count/km distance)	0.02	0.19	8	0.13	21	0.13	17
RMP Proximity (facility count/km distance)	0.25	0.63	52	0.65	51	0.74	44
Hazardous Waste Proximity (facility count/km distance)	0.3	1.9	37	1.5	42	5	31
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	8.4E-06	0.0091	69	3.1	62	9.4	44
Demographic Indicators							
Demographic Index	21%	29%	36	29%	35	36%	32
People of Color Population	27%	31%	52	28%	59	39%	46
Low Income Population	14%	27%	28	30%	22	33%	22
Linguistically Isolated Population	0%	4%	43	3%	48	4%	45
Population With Less Than High School Education	8%	9%	59	9%	56	13%	45
Population Under 5 years of age	6%	6%	46	6%	46	6%	47
Population over 64 years of age	9%	15%	29	15%	27	15%	27

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

For additional information, see: www.epa.gov/environmentaljustice

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

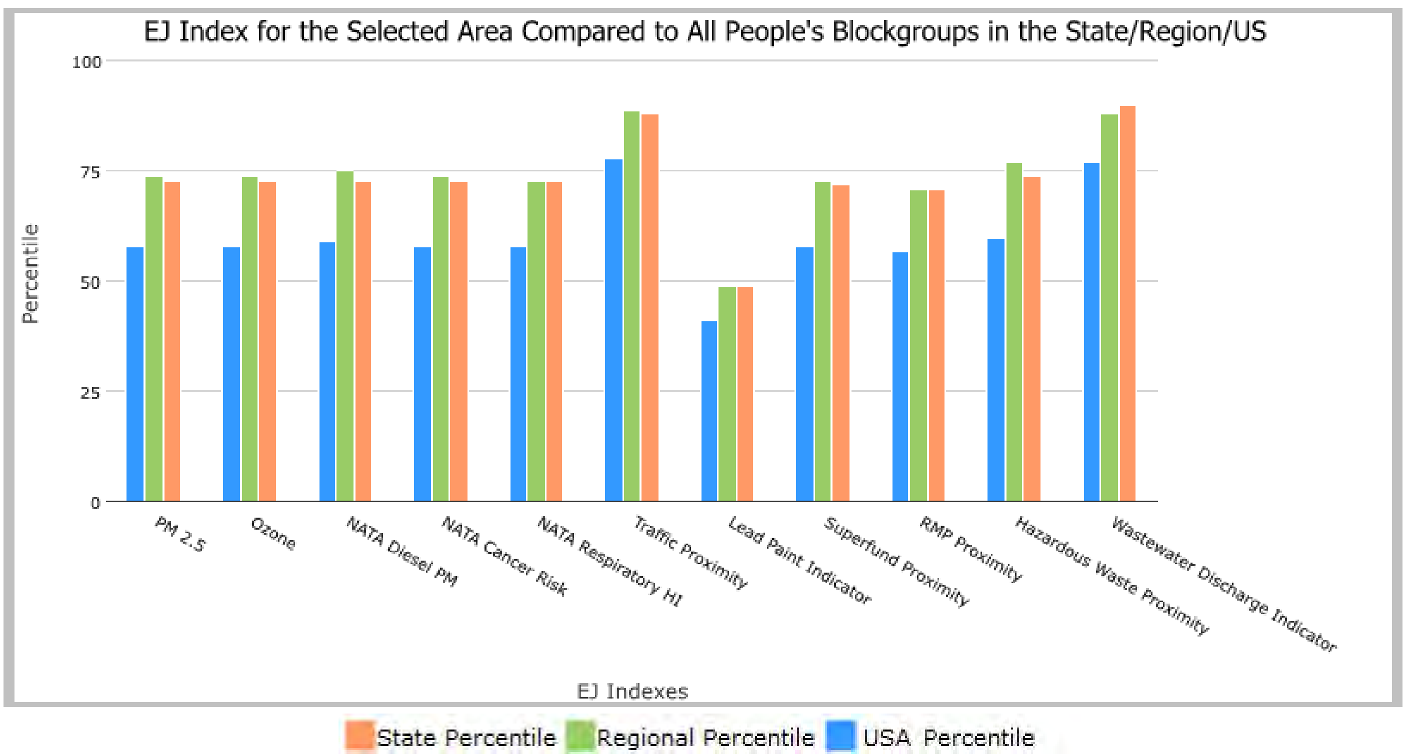
Approximate Population: 5,594

Input Area (sq. miles): 2.04

Downtown

These are higher than any other neighborhood

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	73	74	58
EJ Index for Ozone	73	74	58
EJ Index for NATA* Diesel PM	73	75	59
EJ Index for NATA* Air Toxics Cancer Risk	73	74	58
EJ Index for NATA* Respiratory Hazard Index	73	73	58
EJ Index for Traffic Proximity and Volume	88	89	78
EJ Index for Lead Paint Indicator	49	49	41
EJ Index for Superfund Proximity	72	73	58
EJ Index for RMP Proximity	71	71	57
EJ Index for Hazardous Waste Proximity	74	77	60
EJ Index for Wastewater Discharge Indicator	90	88	77



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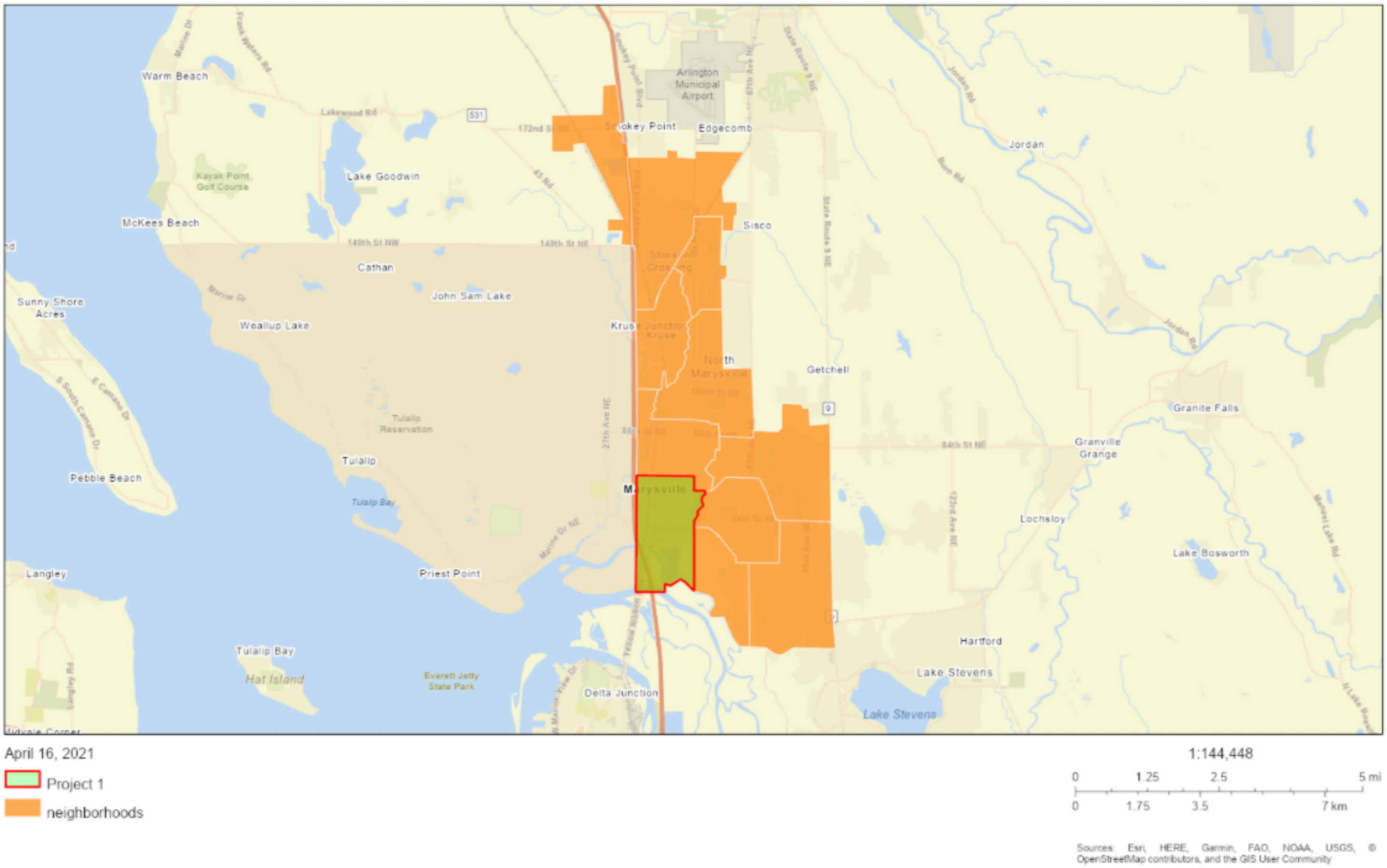
EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 5,594

Input Area (sq. miles): 2.04



Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

Ecology listed Toxics Program Cleanup Sites 13

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 5,594

Input Area (sq. miles): 2.04

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m^3)	7.53	8.21	35	8.52	25	8.55	20
Ozone (ppb)	33.5	37.3	25	39.1	16	42.9	6
NATA* Diesel PM (µg/m^3)	0.704	0.585	65	0.481	70-80th	0.478	80-90th
NATA* Cancer Risk (lifetime risk per million)	34	34	50	31	60-70th	32	60-70th
NATA* Respiratory Hazard Index	0.49	0.5	45	0.46	50-60th	0.44	60-70th
Traffic Proximity and Volume (daily traffic count/distance to road)	1500	610	90	510	92	750	87
Lead Paint Indicator (% Pre-1960 Housing)	0.27	0.23	69	0.22	69	0.28	60
Superfund Proximity (site count/km distance)	0.021	0.19	9	0.13	22	0.13	18
RMP Proximity (facility count/km distance)	0.74	0.63	73	0.65	72	0.74	69
Hazardous Waste Proximity (facility count/km distance)	0.55	1.9	46	1.5	51	5	39
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	0.00039	0.0091	86	3.1	78	9.4	61
Demographic Indicators							
Demographic Index	38%	29%	76	29%	76	36%	61
People of Color Population	30%	31%	57	28%	64	39%	49
Low Income Population	45%	27%	83	30%	80	33%	73
Linguistically Isolated Population	3%	4%	62	3%	67	4%	63
Population With Less Than High School Education	17%	9%	85	9%	84	13%	73
Population Under 5 years of age	9%	6%	77	6%	77	6%	77
Population over 64 years of age	11%	15%	36	15%	34	15%	33

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

For additional information, see: www.epa.gov/environmentaljustice

EJSCREEN Report (Version 2020)

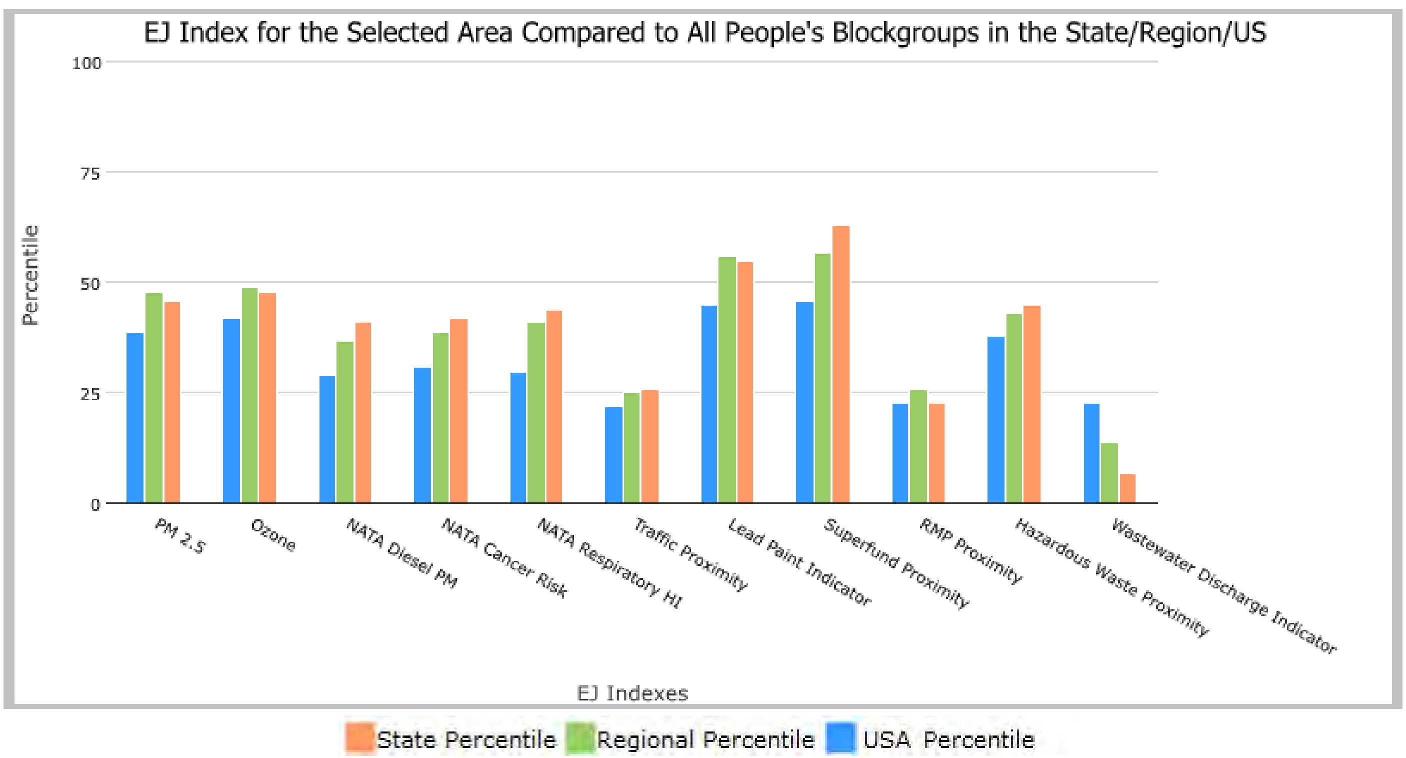
the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 7,944

Input Area (sq. miles): 1.54

Jennings Park

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	46	48	39
EJ Index for Ozone	48	49	42
EJ Index for NATA* Diesel PM	41	37	29
EJ Index for NATA* Air Toxics Cancer Risk	42	39	31
EJ Index for NATA* Respiratory Hazard Index	44	41	30
EJ Index for Traffic Proximity and Volume	26	25	22
EJ Index for Lead Paint Indicator	55	56	45
EJ Index for Superfund Proximity	63	57	46
EJ Index for RMP Proximity	23	26	23
EJ Index for Hazardous Waste Proximity	45	43	38
EJ Index for Wastewater Discharge Indicator	7	14	23



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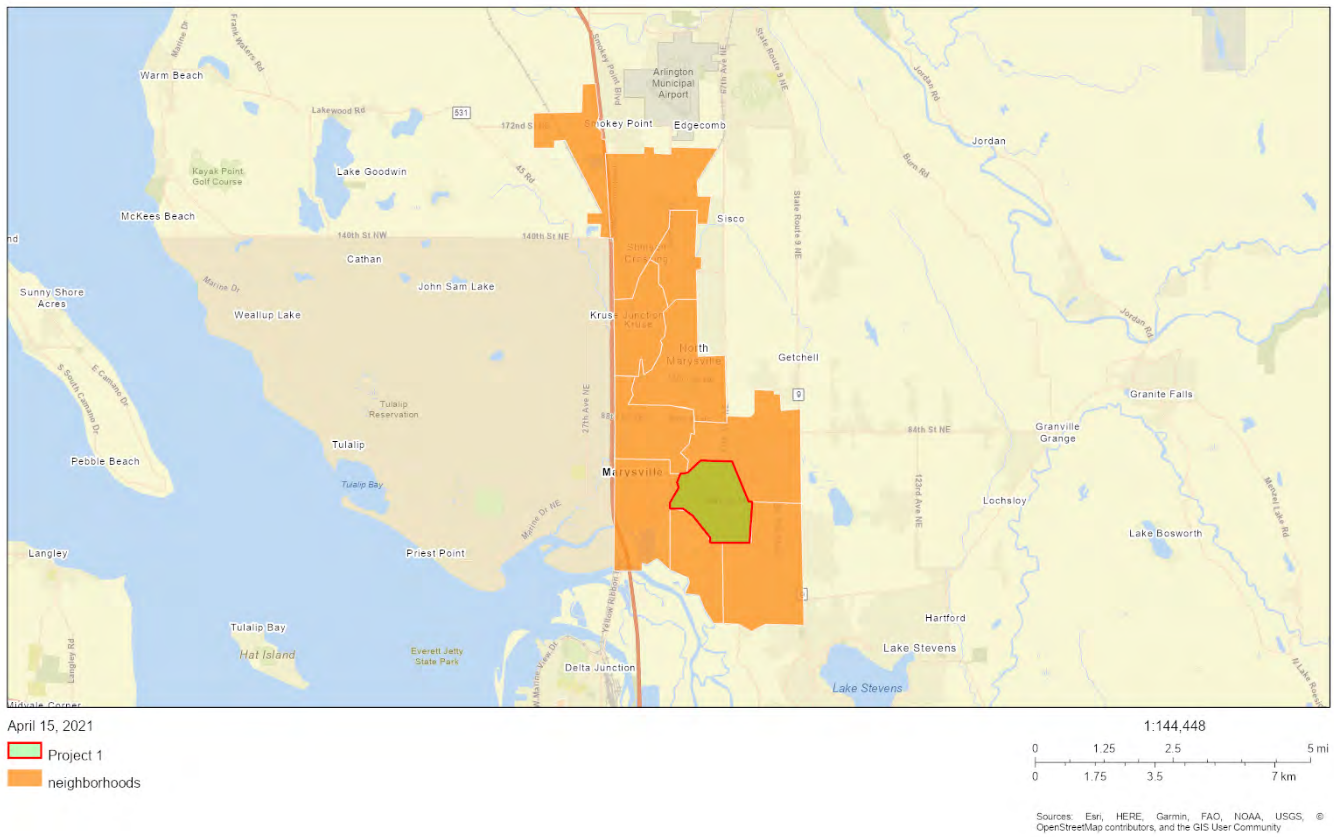
EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 7,944

Input Area (sq. miles): 1.54



Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

Ecology listed Toxics Program Cleanup Sites 0

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 7,944

Input Area (sq. miles): 1.54

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m^3)	7.49	8.21	32	8.52	23	8.55	19
Ozone (ppb)	33.8	37.3	30	39.1	18	42.9	7
NATA* Diesel PM (µg/m^3)	0.428	0.585	43	0.481	50-60th	0.478	50-60th
NATA* Cancer Risk (lifetime risk per million)	36	34	57	31	70-80th	32	70-80th
NATA* Respiratory Hazard Index	0.5	0.5	47	0.46	50-60th	0.44	60-70th
Traffic Proximity and Volume (daily traffic count/distance to road)	290	610	55	510	59	750	56
Lead Paint Indicator (% Pre-1960 Housing)	0.03	0.23	20	0.22	21	0.28	22
Superfund Proximity (site count/km distance)	0.02	0.19	8	0.13	21	0.13	17
RMP Proximity (facility count/km distance)	0.46	0.63	63	0.65	62	0.74	58
Hazardous Waste Proximity (facility count/km distance)	0.3	1.9	37	1.5	42	5	31
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	0.00036	0.0091	86	3.1	78	9.4	60
Demographic Indicators							
Demographic Index	21%	29%	36	29%	36	36%	32
People of Color Population	20%	31%	37	28%	44	39%	37
Low Income Population	22%	27%	46	30%	38	33%	37
Linguistically Isolated Population	2%	4%	56	3%	61	4%	58
Population With Less Than High School Education	7%	9%	56	9%	53	13%	42
Population Under 5 years of age	5%	6%	45	6%	45	6%	46
Population over 64 years of age	16%	15%	62	15%	60	15%	59

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

For additional information, see: www.epa.gov/environmentaljustice

EJSCREEN Report (Version 2020)

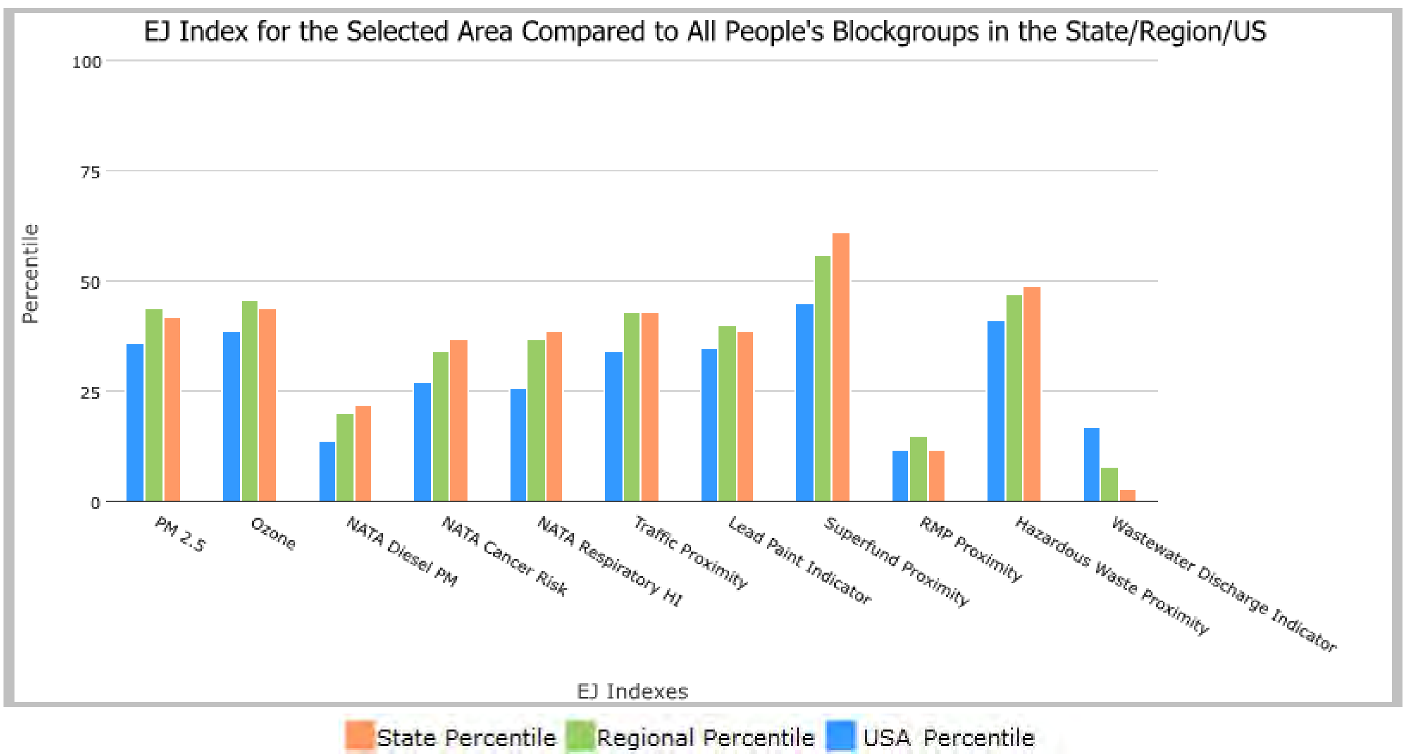
the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 2,799

Input Area (sq. miles): 1.29

Sunnyside

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	42	44	36
EJ Index for Ozone	44	46	39
EJ Index for NATA* Diesel PM	22	20	14
EJ Index for NATA* Air Toxics Cancer Risk	37	34	27
EJ Index for NATA* Respiratory Hazard Index	39	37	26
EJ Index for Traffic Proximity and Volume	43	43	34
EJ Index for Lead Paint Indicator	39	40	35
EJ Index for Superfund Proximity	61	56	45
EJ Index for RMP Proximity	12	15	12
EJ Index for Hazardous Waste Proximity	49	47	41
EJ Index for Wastewater Discharge Indicator	3	8	17



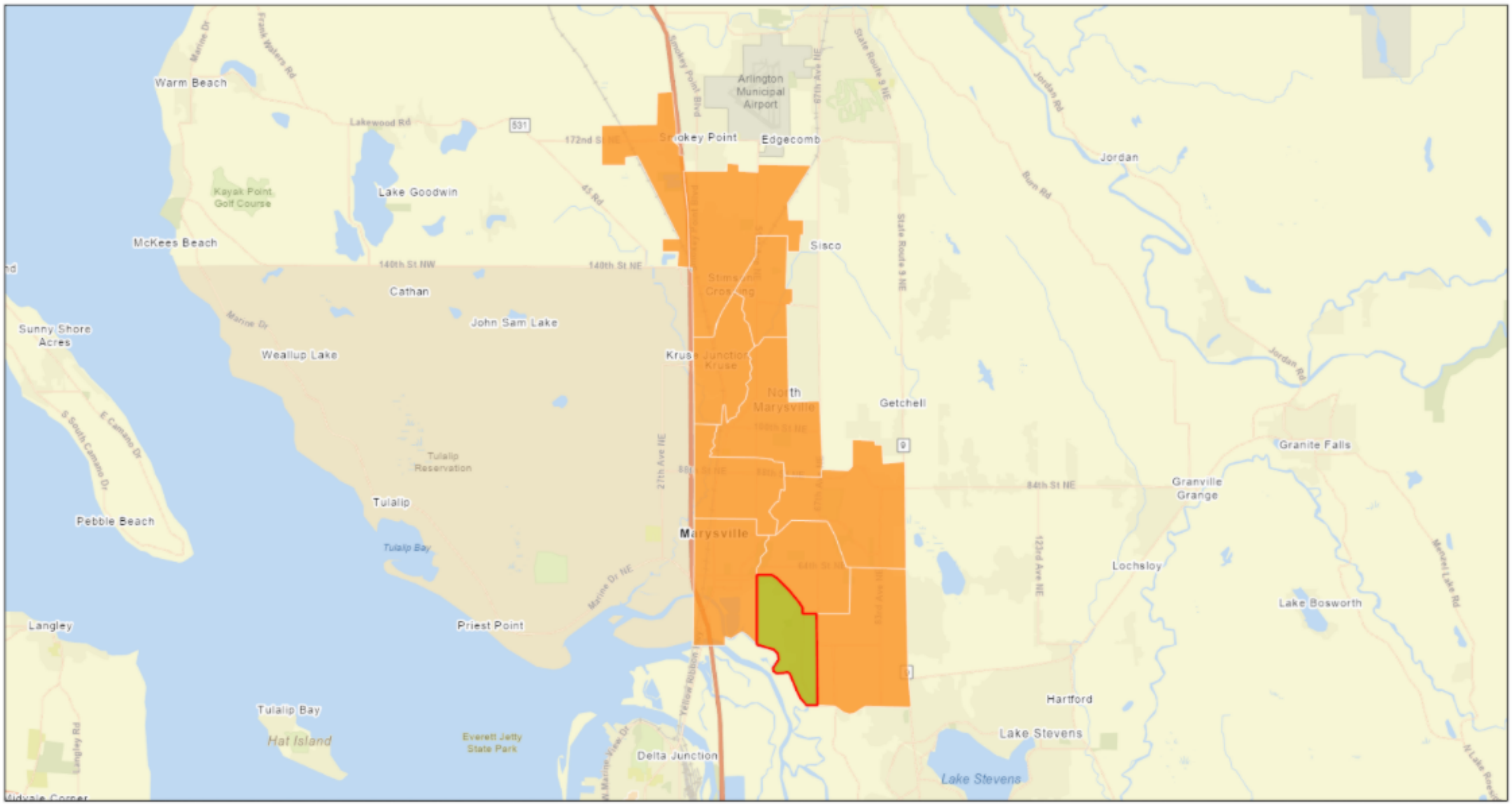
This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 2,799

Input Area (sq. miles): 1.29



April 16, 2021

Project 1

neighborhoods

1:144,448

0 1.25 2.5 5 mi

0 1.75 3.5 7 km

Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

Ecology listed Toxics Program Cleanup Sites 0

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 2,799

Input Area (sq. miles): 1.29

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m^3)	7.57	8.21	38	8.52	27	8.55	21
Ozone (ppb)	33.7	37.3	28	39.1	17	42.9	6
NATA* Diesel PM (µg/m^3)	0.762	0.585	70	0.481	70-80th	0.478	80-90th
NATA* Cancer Risk (lifetime risk per million)	36	34	57	31	70-80th	32	70-80th
NATA* Respiratory Hazard Index	0.5	0.5	49	0.46	50-60th	0.44	60-70th
Traffic Proximity and Volume (daily traffic count/distance to road)	81	610	32	510	34	750	31
Lead Paint Indicator (% Pre-1960 Housing)	0.096	0.23	42	0.22	42	0.28	38
Superfund Proximity (site count/km distance)	0.02	0.19	7	0.13	20	0.13	17
RMP Proximity (facility count/km distance)	0.87	0.63	76	0.65	75	0.74	73
Hazardous Waste Proximity (facility count/km distance)	0.22	1.9	32	1.5	36	5	27
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	0.0019	0.0091	94	3.1	87	9.4	70
Demographic Indicators							
Demographic Index	24%	29%	44	29%	44	36%	38
People of Color Population	31%	31%	59	28%	66	39%	50
Low Income Population	16%	27%	32	30%	25	33%	26
Linguistically Isolated Population	3%	4%	60	3%	65	4%	61
Population With Less Than High School Education	4%	9%	34	9%	31	13%	24
Population Under 5 years of age	7%	6%	58	6%	58	6%	59
Population over 64 years of age	9%	15%	24	15%	22	15%	23

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

For additional information, see: www.epa.gov/environmentaljustice

EJSCREEN Report (Version 2020)

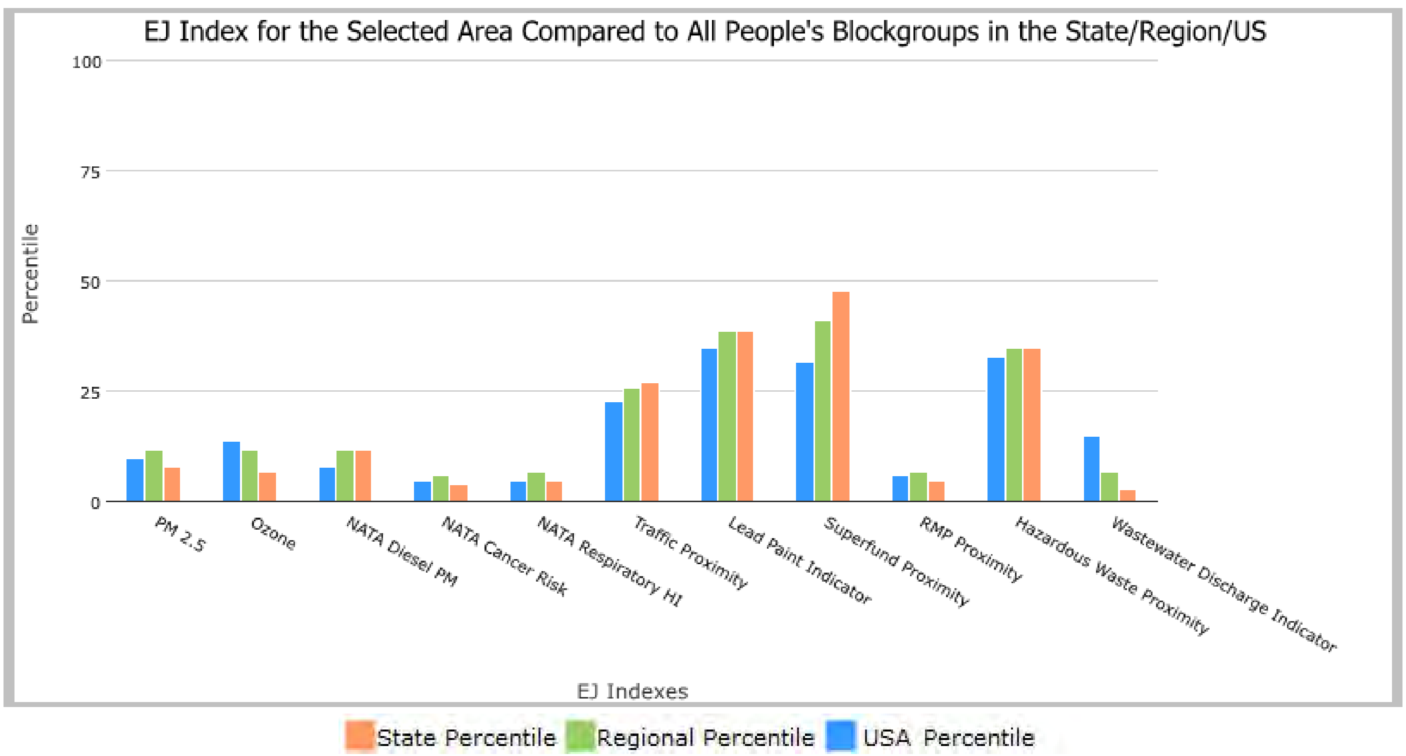
the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 7,445

Input Area (sq. miles): 2.85

East Sunnyside

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	8	12	10
EJ Index for Ozone	7	12	14
EJ Index for NATA* Diesel PM	12	12	8
EJ Index for NATA* Air Toxics Cancer Risk	4	6	5
EJ Index for NATA* Respiratory Hazard Index	5	7	5
EJ Index for Traffic Proximity and Volume	27	26	23
EJ Index for Lead Paint Indicator	39	39	35
EJ Index for Superfund Proximity	48	41	32
EJ Index for RMP Proximity	5	7	6
EJ Index for Hazardous Waste Proximity	35	35	33
EJ Index for Wastewater Discharge Indicator	3	7	15



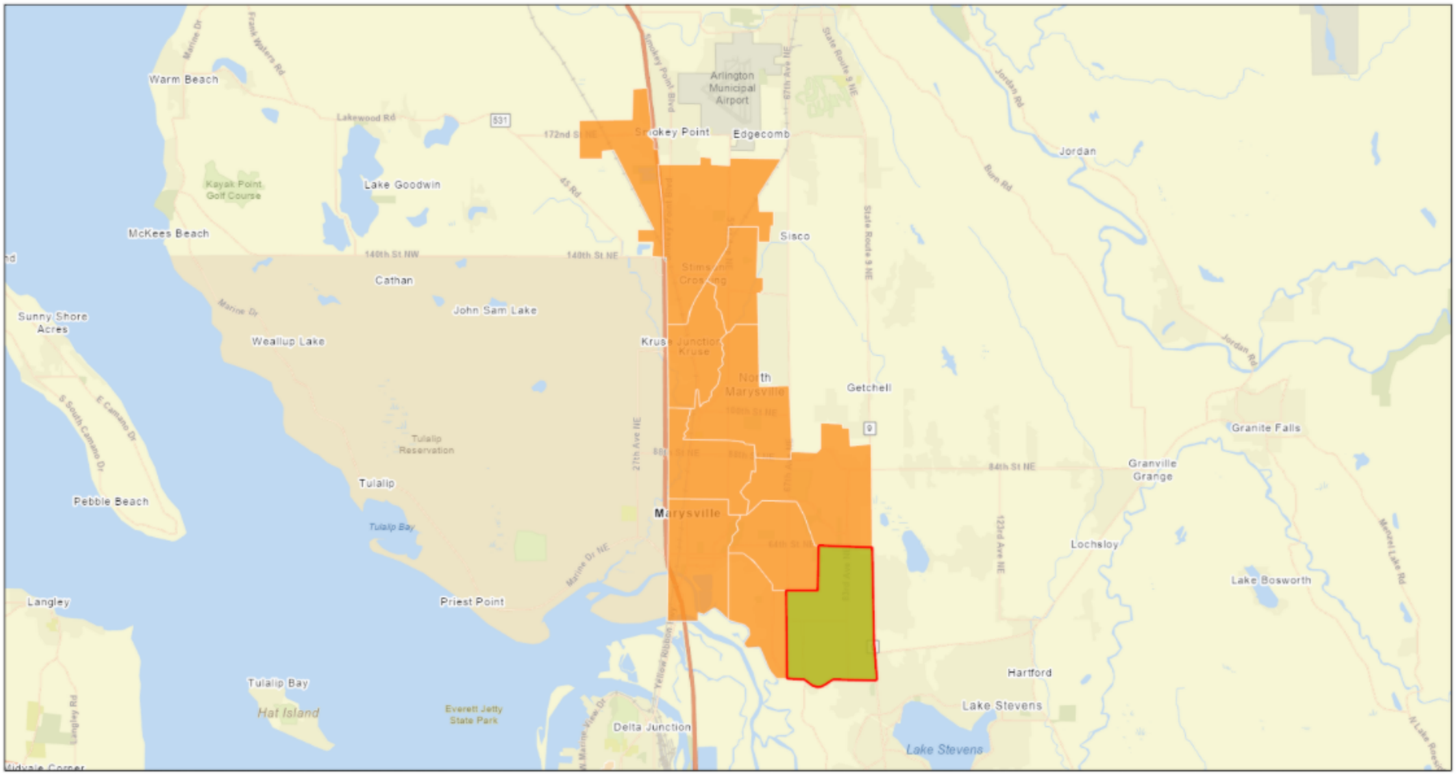
This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 7,445

Input Area (sq. miles): 2.85



April 16, 2021

Project 1

neighborhoods

1:144,448

0 1.25 2.5 5 mi

0 1.75 3.5 7 km

Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

Ecology listed Toxics Program Cleanup Sites 0

EJSCREEN Report (Version 2020)

the User Specified Area, WASHINGTON, EPA Region 10

Approximate Population: 7,445

Input Area (sq. miles): 2.85

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m^3)	7.48	8.21	31	8.52	23	8.55	19
Ozone (ppb)	34	37.3	32	39.1	20	42.9	7
NATA* Diesel PM (µg/m^3)	0.431	0.585	43	0.481	50-60th	0.478	50-60th
NATA* Cancer Risk (lifetime risk per million)	36	34	56	31	70-80th	32	70-80th
NATA* Respiratory Hazard Index	0.49	0.5	45	0.46	50-60th	0.44	60-70th
Traffic Proximity and Volume (daily traffic count/distance to road)	110	610	37	510	40	750	37
Lead Paint Indicator (% Pre-1960 Housing)	0.04	0.23	25	0.22	25	0.28	25
Superfund Proximity (site count/km distance)	0.019	0.19	7	0.13	19	0.13	17
RMP Proximity (facility count/km distance)	0.61	0.63	68	0.65	68	0.74	64
Hazardous Waste Proximity (facility count/km distance)	0.18	1.9	26	1.5	31	5	23
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	0.0011	0.0091	92	3.1	84	9.4	66
Demographic Indicators							
Demographic Index	16%	29%	20	29%	19	36%	20
People of Color Population	24%	31%	46	28%	53	39%	42
Low Income Population	7%	27%	10	30%	7	33%	8
Linguistically Isolated Population	1%	4%	49	3%	54	4%	52
Population With Less Than High School Education	3%	9%	28	9%	25	13%	20
Population Under 5 years of age	6%	6%	52	6%	51	6%	52
Population over 64 years of age	9%	15%	26	15%	24	15%	24

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

For additional information, see: www.epa.gov/environmentaljustice

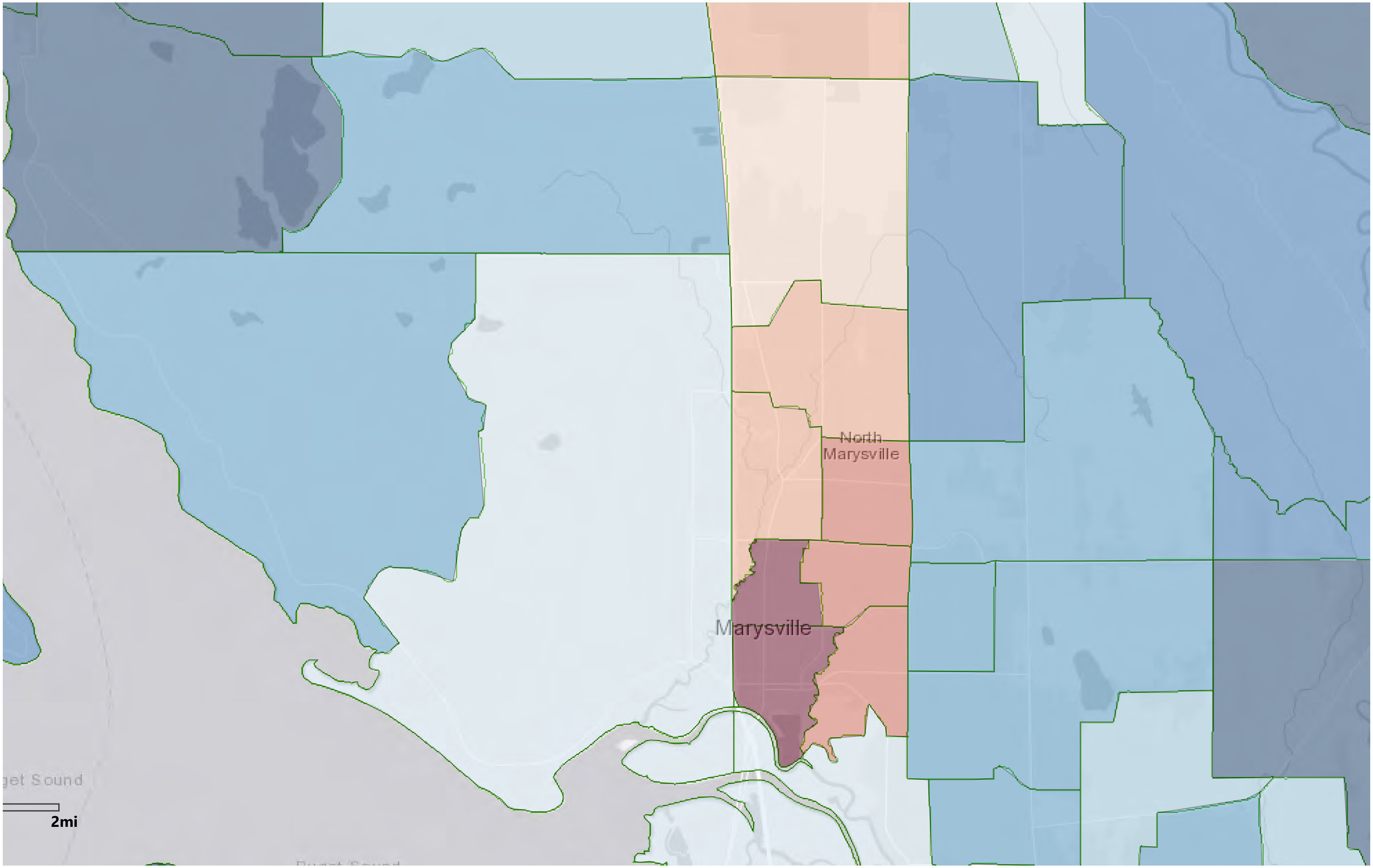
Washington State Department of Health

Selection: Diesel Pollution and Disproportionate Impact

Date: 05/20/2021 at 3:02 PM

Diesel Pollution Burden, Priority Populations

Legend: (High) 10 9 8 7 6 5 4 3 2 1 **(Low)**

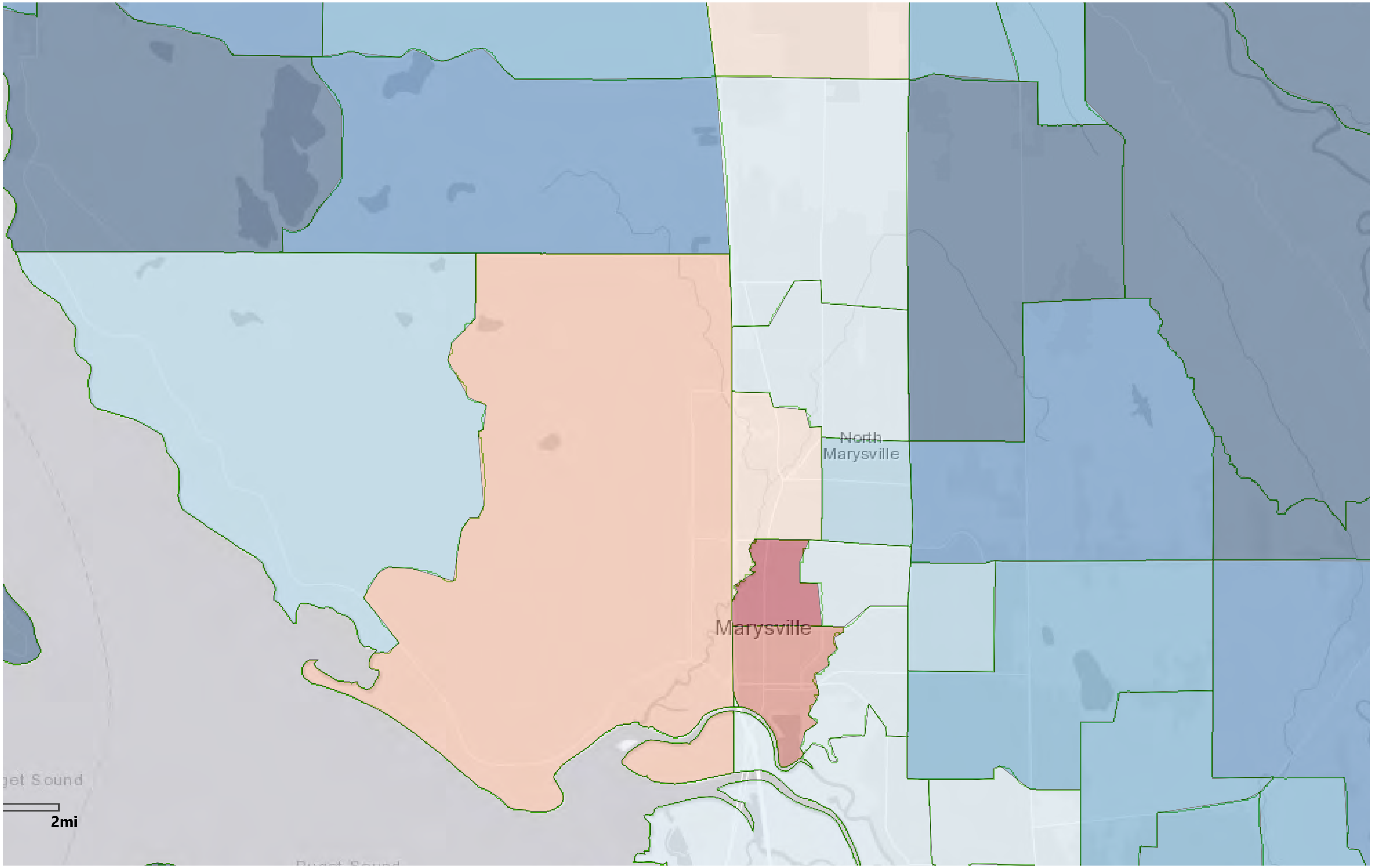


Washington State Department of Health

Selection: Environmental Health Disparities V 1.1 **Date: 05/20/2021 at 3:06 PM**

Environmental Exposures, Environmental Effects, Socioeconomic Factors, Sensitive Populations

Legend: (High) 10 9 8 7 6 5 4 3 2 1 **(Low)**



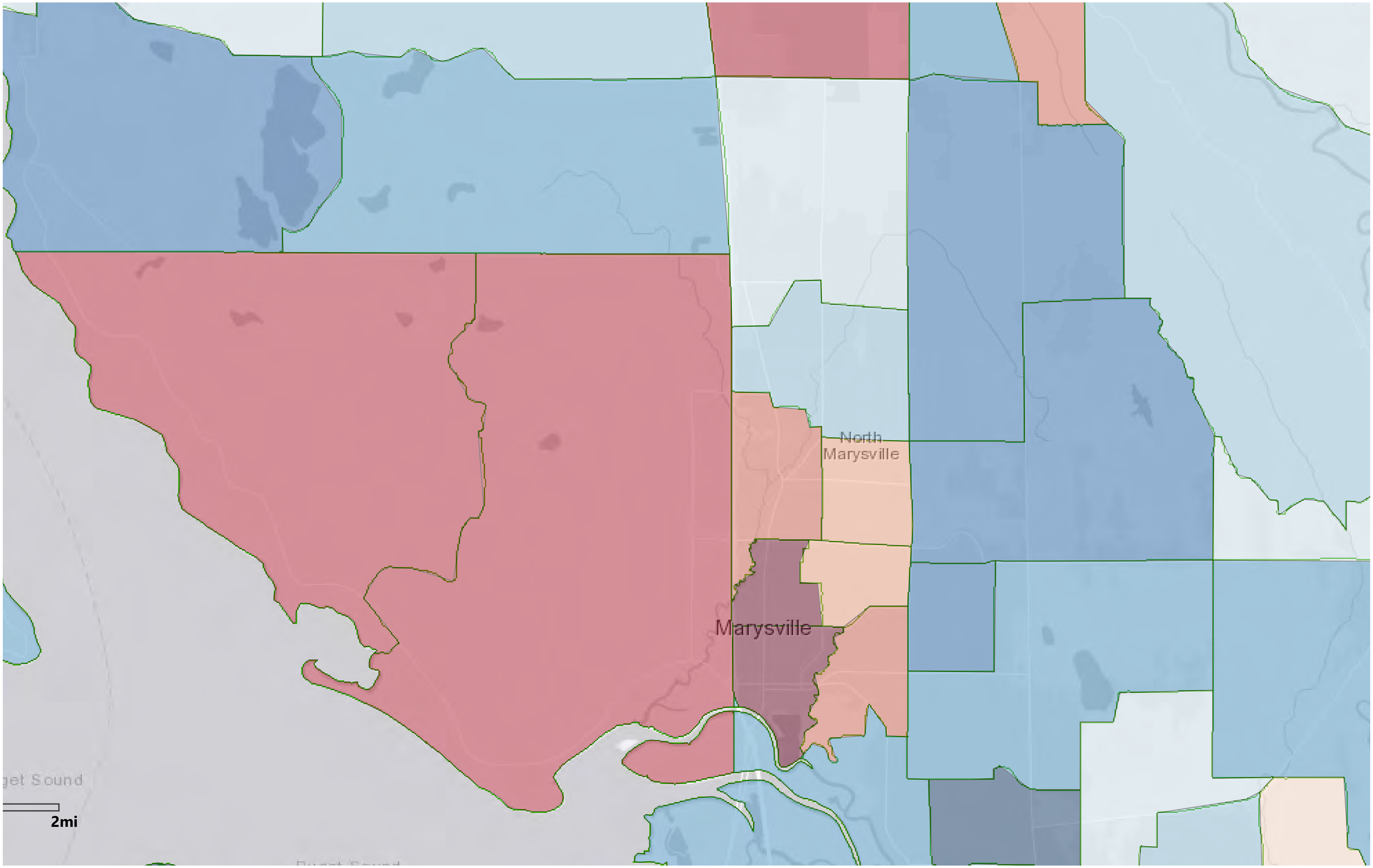
Washington State Department of Health

Selection: Health Disparities

Date: 05/20/2021 at 3:06 PM

Social Determinants, Economic Determinants, Poor Health Outcomes

Legend: (High) 10 9 8 7 6 5 4 3 2 1 **(Low)**



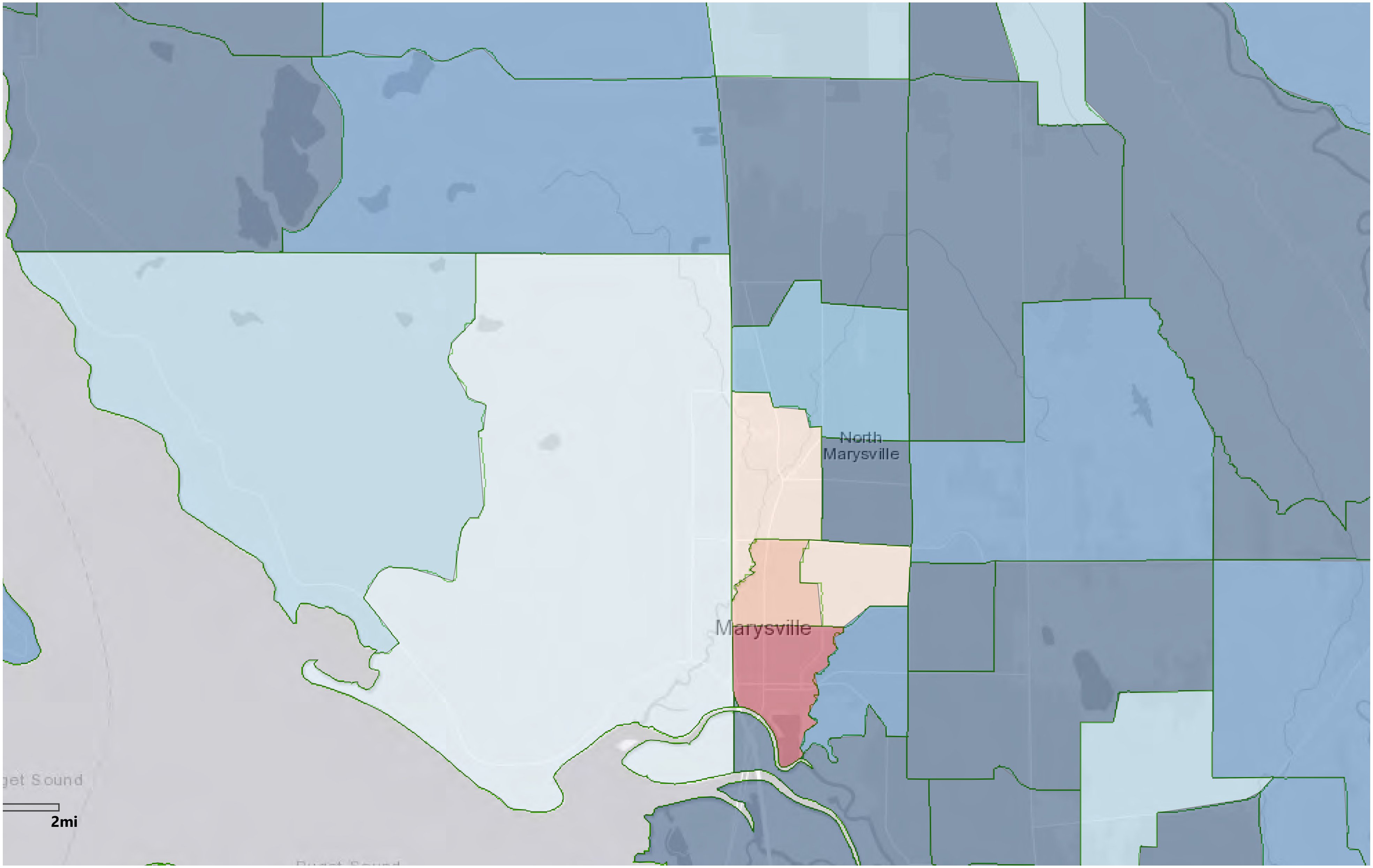
Washington State Department of Health

Selection: Lead Exposure Risk

Lead Exposure Risk

Date: 05/20/2021 at 3:05 PM

Legend: (High) 10 9 8 7 6 5 4 3 2 1 **(Low)**



Washington State Department of Health

Selection: Social Vulnerability to Hazards

Household , Housing, SocioEconomic

Date: 05/20/2021 at 3:05 PM

Legend: (High) 10 9 8 7 6 5 4 3 2 1 **(Low)**