Water Year 2023 (Oct. 2022 – Sept. 2023) Island County Surface Water Quality Report

ISLAND COUNTY DEPARTMENT OF PUBLIC HEALTH
DIVISION OF NATURAL RESOURCES
SURFACE WATER QUALITY MONITORING PROGRAM

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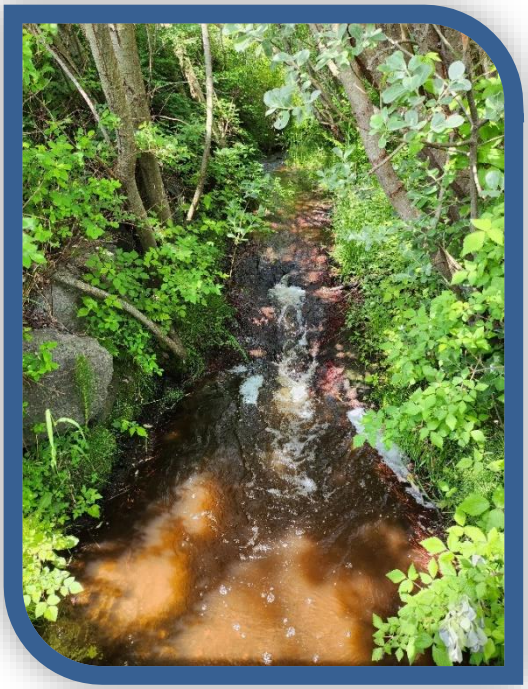
INTRODUCTION



Island County is known for its exceptional scenery, abundant natural resources, and plentiful recreational opportunities. The county has a unique mix of shoreline with private and commercial shellfish areas, and private and public lakes and beaches. Water Resources Inventory Area (WRIA) 6 encompasses all islands and water within Island County's geographic boundary. Centrally located within the Salish Sea at the junction of Puget Sound and the Strait of Juan de Fuca and Georgia Straight, Whidbey and Camano Islands encompass more than 200 watersheds that contribute to surface water flow. Most of the watersheds are small and experience seasonal flow, but they all play an important role in local ecosystems with several watersheds having streams that demonstrate year-round flow. Monitoring the water quality of these watersheds is essential for protecting public health and community resources.

Island County's population is approximately 87,000 according to the 2020 census. Apart from those who live in three incorporated municipalities, most island residents live in rural settings or small, unincorporated communities. While only about 20% of U.S. homes are served by decentralized wastewater (onsite septic) systems (Ground Water 2022), the vast majority of Island County residents (more than 72%) utilize a septic system (*Onsite* n.d.). Although these systems can provide an effective means to treat wastewater, for many homeowners the systems are outdated or non-compliant. For more information visit this link: https://www.islandcountywa.gov/190/Onsite-Sewage-Septic-Systems.

The main goal of the Island County Surface Water Quality Monitoring Program (SWQMP) is to "protect human health and critical areas by monitoring water quality" by using local, state, and federal funding effectively and efficiently. Surface water quality resources are monitored throughout the year to produce consistent and high-quality data reports that can be used in evaluating habitat and impacts to human health. In the past, surface water data has been used in combination with the groundwater monitoring data; water quality monitoring efforts in recent times have been focused on regular monitoring of streams for non-point source pollution and coliform bacteria and are summarized in Source ID evaluations and Water Year annual reports. These water year reports can be used by outside agencies and other departments within Island County in their review of future development and projects, as well as in the evaluation of shellfish, salmon, and water recreational areas.

The U.S. Geological Survey (USGS) uses the term "water year" in reports that deal with surface-water supply. Water year is defined as the 12-month period beginning October 1st for any given year through September 30th of the following year. The water year is designated by the calendar year in which it ends, so the year ending September 30, 2023, is called the "2023" water year or WY2023 (Jian et al. 2022). The current Island County SWQMP has been in effect since 2006, so Water Year 2023 from October of 2022 to September of 2023 represents the 17th year of reporting (WY17). In previous years, Island County has used the latter naming convention, however, beginning this water year and going forward, Island County will adopt the widely accepted approach of naming water years based on the ending year (e.g. WY2023).

A water year is different than a calendar year because precipitation that happens at the end of a calendar year, perhaps as snowfall, often doesn't affect the level or flow of water in streams until the next spring or summer. Starting the water year a little earlier allows scientists to study how much water cycles through an area throughout a year. Locally, the water year impacts may be different from the USGS water year depending on ground conditions, such as Island County experiencing more rain than snow melt. Island County SWQ team is evaluating weather patterns and conditions to

understand and possibly use a local water year in the future, but the convention is to use the nationwide standard water year from October to September.

During Water Year 17 (WY2023), Island County SWQ staff conducted routine surface water quality monitoring in more than 16 separate watersheds representing a range of land uses and ecological functions. Each sample site was sampled once per month, except when surface flow was not present or when additional samples were required. Each site was assessed for temperature, pH, conductivity, dissolved oxygen, turbidity, *Escherichia coli* (*E. coli*) bacteria, and discharge.

This report provides descriptions of each sample site as well as site-specific results from WY2023. Results are presented in terms of annual and seasonal Geometric Means (explained below) for *E. coli*. The bacterium *E. coli* is a type of fecal coliform bacteria associated with feces from warm-blooded animals and is considered a more effective indicator of fecal pollution than fecal coliform. Changes to surface water quality standards from Washington State Department of Ecology (ECY) required a change in reporting from fecal coliform to *E. coli* starting in October of 2020 (WY15/2021) to present day. SWQ staff have completed the transition to collecting *E. coli* data and will present in-depth analyses of the data once the state releases the standardized formulas.

Data analysis and reporting for the SWQMP involves the creation of the annual water quality report to be made available for State agency review and made easily accessible to the public by posting online and by presenting to the Board of Island County Commissioners. Annual reports include site monitoring data, summary statistics and description of any data collection issues. These reports are encouraged to be used by other departments and as part of the Adaptive Management Process. Data analysis also includes submitting data to the ECY Environmental Information Management database (EIM). EIM is an ECY run program that "contains environmental monitoring data collected by our scientists and partners." (*EIM* n.d.). This publicly accessible database contains historical data from 2006 forward that Island County SWQ staff submit annually.

Washington State Water Quality Assessment

The Federal Clean Water Act, adopted in 1972, requires all states to restore their waters to be "fishable and swimmable" (*Assessment* n.d.*;* Encyclopedia 2012). Washington State Department of Ecology's (ECY) Water Quality Assessment lists the water quality status for all water bodies in the state. This assessment meets the federal requirements for a report under Sections 303(d) and 305(b) of the Clean Water Act, which is submitted to the federal Environmental Protection Agency (EPA). The assessment divides waterbodies into 5 different categories based on impairment. These impairments may result from high bacteria levels, increased temperature, and/or low dissolved oxygen. Some impairments require a Total Maximum Daily Load (TMDL) plan, otherwise known as a water quality improvement project (ECY TMDL, n.d.). The most current assessment was finalized and approved by the EPA in December 2012, with the new assessment, including statewide data analysis through 2021, to be finalized sometime in 2024. Additional information about the State's assessment may be found at http://www.ecy.wa.gov/programs/wq/303d/index.html. The five categories are as follows:

- Category 1: meets standard for clean waters
- Category 2: waters of concern (some evidence of problems)
- Category 3: insufficient data
- Category 4A: impaired waterbodies that have an approved TMDL in place and are actively being implemented
- Category 4B: impaired water that has a pollution control program other than a TMDL
- Category 4C: impaired water that cannot be addressed through a TMDL plan (non-pollutant)
- Category 5: polluted waters that require a TMDL; traditionally known as the 303(d) list

Holmes Harbor within WRIA 6 is an important shellfish area and has been classified as a Category 1 for Temperature, Category 2 for pH, and a Category 5 waterbody based on Dissolved Oxygen levels (updated Oct-2023). The data, as presented in the Water Quality Atlas, is shown in the table below.

Visit the ECY Water Quality Atlas website for more information:
https://apps.ecology.wa.gov/ApprovedWQA/ApprovedPages/ApprovedSearch.aspx

Search parameters used: Location: Holmes Harbor, or choose Island County for a full list of all affected Island County areas.

	Listing ID	AU ID	Medium	Parameter	Category	Waterbody Name	WRIA	WQ Improvement Pro
View	10127	48122A5G3_01_01	Water	Dissolved Oxygen	5	HOLMES HARBOR	6-Island	
View	10128	48122A5G3_01_01	Water	pH	2	HOLMES HARBOR	6-Island	
View	10129	48122A5G3_01_01	Water	Temperature	1	HOLMES HARBOR	6-Island	

Site Selection and Monitoring

Several types of monitoring can be utilized to evaluate surface water quality: Core, Reconnaissance, Effectiveness, and Source ID. Each of these types of monitoring was conducted based on area of need and data interpretation. Sample sites were chosen based on watershed prioritization which will be discussed in separate sections of this report.

Core and Rotational Monitoring Sites

The core monitoring sites are generally located at watershed pour points (the point where the surface water meets the Puget Sound). Core monitoring sites were established in 2006 during the development of the Surface Water Monitoring Program (SWQMP) for Island County and were chosen to represent watersheds that were predominantly developed, used for agricultural, or had natural land uses (Adamus & Eilers 2006). Rotational sites are randomly chosen on a three-year cycle; each site is sampled for one year, and again in three years. Table 1 outlines the sampling sites and their classification, and Figure 1 shows priority watersheds and sampling locations for WY2023. These sites have often moved upland over time in relation to private property, shoreline development, and tidal influences impacting access, as well as sediment load and salinity. Core and rotational sites are revised and updated with each newly submitted sampling plan. Efforts are made to include all major streams and at least one location in all major watersheds. Core sites are traditionally conducted at previously established baseline sites that have the most consistent flow throughout the year, as well as being related to sensitive resources such as susceptible aquifers, shellfish beds, swim beaches, and salmon habitat.

Reconnaissance Monitoring Sites

Reconnaissance monitoring is conducted in areas based on risk of degradation of valuable resources. These resources include anadromous fish habitat, pocket estuaries, wetlands, swim-beaches, and shellfish beds. Over time, the goal is to conduct monitoring in every watershed in Island County and ensure that Washington State water quality standards are being met (Adamus & Eilers 2006).

Reconnaissance monitoring is conducted to explore water quality outside of the regular core watersheds and identify areas with water quality impairments that may need further investigation. Reconnaissance monitoring occurs at sampling locations containing priority resources and follows an estimation of the current risk of pollution and availability of resources. Examples of reconnaissance monitoring from WY2023 (WY17) include Maple Grove Boat Launch - an Island County Park which has important recreational shellfish beds and historically high levels of *E. coli,* the Strawberry Point area, Race Road, and Dave Mackie Park.

Effectiveness Monitoring Sites

Effectiveness monitoring is conducted to evaluate the impact of infrastructure modifications (i.e., implementation of Best Management Practices (BMPs), Island County Public Works projects, or a septic repair) on water quality. Monitoring is also conducted at potential future project areas where outdated culverts are scheduled to be replaced by fish passage culverts. In areas where there are opportunities to look at the impacts of restoration or development, the goal is to collect and evaluate water quality samples prior to and after changes have taken place. Effectiveness monitoring was intended to be used in coordination with other Island County departments: Public Works, Environmental Health, and other partners like local conservation districts to evaluate the effectiveness of a project. There are several projects currently under consideration: Race Road culvert replacements, Keystone Farm restoration projects, Cornet Bay restoration projects, Crescent Harbor Land Trust salmon restoration, and the Ala Spit restoration.

Source Identification Monitoring Sites

Source ID monitoring is conducted when a sample site demonstrates exceedances in water quality conditions based on parameters set by Washington State Department of Ecology (ECY) and the Environmental Protection Agency (EPA). Source ID is used to identify possible sources of pollution within a targeted watershed and usually a specific waterbody. This is accomplished by a process known as bracketing, where samples are progressively collected up a water body from a point of known contamination to determine potential point sources of bacteria. Additional *E. coli* samples are taken when an exceedance of 320 MPN/100 mL or higher and/or a 90-day *E. coli* Geometric Mean (Geomean) greater than 100 MPN/100 mL was reported.

While swim beaches are not regularly sampled as part of the SWQ monitoring plan, water quality and *E. coli* levels upstream of swim beaches are often documented. According to the ECY, “the geometric mean at swim beaches should not exceed 30 enterococci/100 mL, based on results from a minimum of five weekly samples and a maximum of 12 weekly samples. The statistical threshold value should not exceed 110 enterococci/100 mL, based on results from a minimum of five weekly samples and a maximum of 12 weekly samples. If either of these criteria is exceeded, a local health jurisdiction may consider issuing a permanent advisory at a particular beach” (*Swimming* n.d*.)*. The ECY issues a public swimming advisory when the *Enterococcus* levels exceed 104 enterococci/100 mL of water. Even though SWQ team members do not sample marine waters, upstream areas are highly important since they connect surface water with marine water and often contribute to sources of pollution that affect fish-bearing streams, shellfish growing areas, or marine water recreational use.

The goal for Source ID is to conduct monitoring in watersheds that, due to the number of coliform exceedances and the presence of valuable resources such as shellfish protection priority areas, swim beaches, and salmon habitat, are considered priority watersheds of concern. These watersheds include Maxwelton, watersheds surrounding Penn Cove, and watersheds in the Holmes Harbor area. In the past, considerable time and resources have been spent identifying the source of contamination to determine if the coliform originated from wildlife, septic or sewer systems, and/or agriculture through approved Pollution Identification and Correction (PIC) programs.

This report focuses mainly on Core and Rotational monitoring results and provides descriptions of each site as well as site-specific results from WY2023. Results are presented in terms of Washington Water Quality Standards and include both annual and 90-day seasonal geomeans of *E. coli*, Maximum Temperature, and Minimum Dissolved Oxygen. Summaries of Reconnaissance, Source ID, and Effectiveness monitoring conducted during the water year are included in the discussion section of this report.

Table 1. List of Water Year 2023 (WY17) Sample Site Types and Locations

Camano Island		Whidbey Island	
Core		Core	
55a Carp Creek 69a Chapman Creek 74a Cavalero Creek KC1 Kristoferson Creek	82a Bonnie Ln 70a Sunset W. Camano	13a Crescent Creek 58a Ebey's Reserve 134a Freeland at dock Hhab Freeland marsh MWA2- Maxwelton Creek 157a Scatchet Creek 149a Glendale Creek	119a S Whidbey State Park 150a Cultus Creek QCA Quade Creek
Reconnaissance	Effectiveness	Reconnaissance	Effectiveness
81a Cama Beach 108a S Camano 188b Simonson Park TC5 Triangle Cove	KC1 upstream and downstream 36d Livingston MG5 Maple Grove 38a Arrowhead 48a Sunset TC19 Kristoferson Pour Pt	112a Wilbert Trail 71a Race Road MWBeach Maxwelton Beach 132a Outdoor Classroom DM Mackie Park MWRdOutfall 158a Wanamaker Rd 18a N Strawberry Pt 23a Strawberry Pt	5a Ala Spit 147a Columbia Beach (Deer Creek) 14a Green Rd 177a Goss Creek

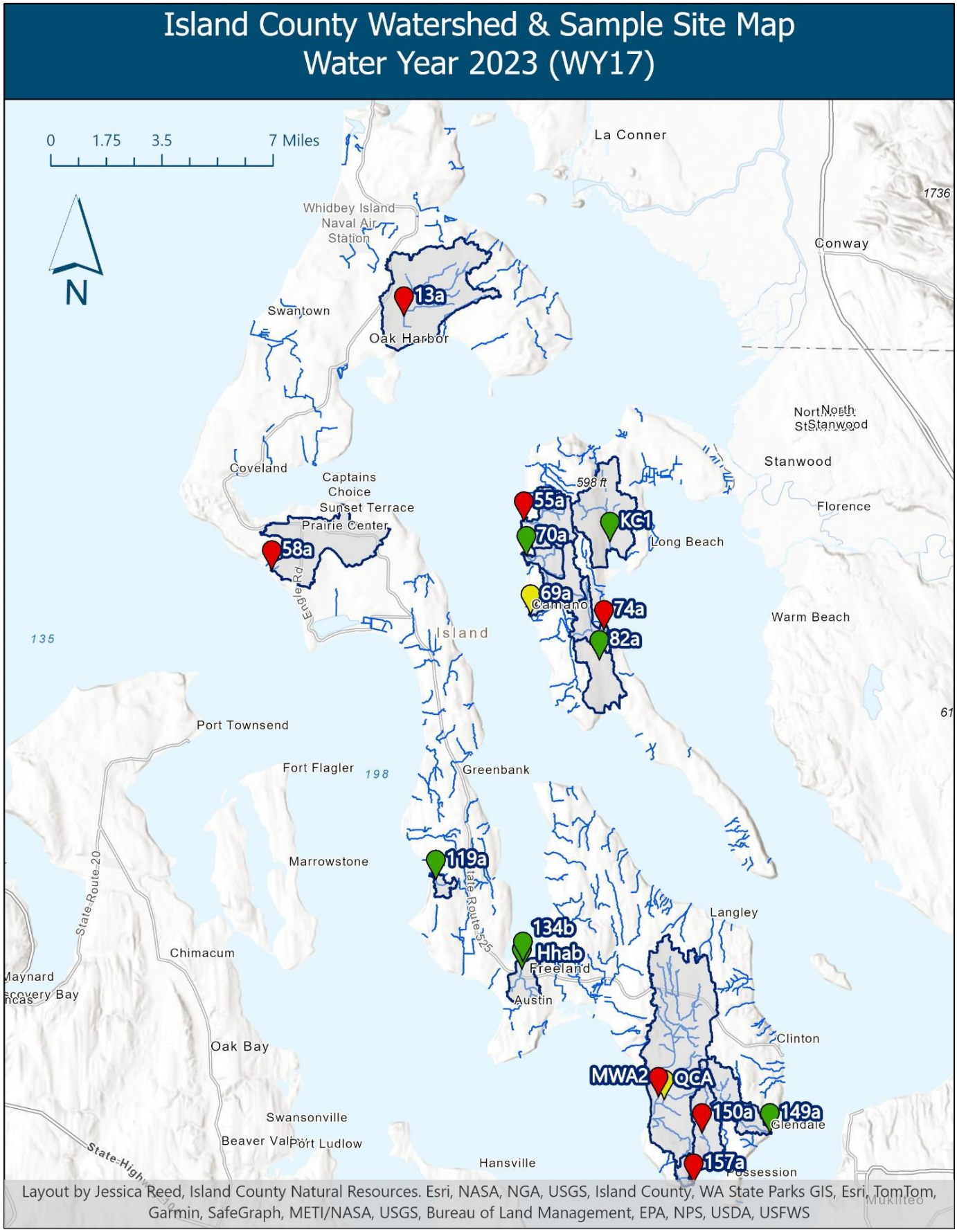


Figure 1. Island County Watershed and Sample Site Map for WY2023 (WY17)

METHODS

Standard water quality monitoring methods are used in the Island County Surface Water Quality Monitoring Program (SWQMP). The methods are standardized sampling procedures based on guidance from Washington State Department of Ecology (ECY) and the EPA. A short summary of monitoring protocols follows; however, detailed procedures can be found in Island County SWQ Standard Operating Procedures (SOPs) or in the newly revised Island County SWQ Quality Assurance Project Plan (QAPP) set to be published in the upcoming year.

Each site in the SWQMP is sampled monthly for pH, temperature, conductivity, dissolved oxygen (DO), turbidity, salinity, *E. coli*., and characteristics of stream discharge. The sample routes are planned so that each site is visited at approximately the same time of day each month to minimize discrepancies in water quality data caused by diurnal variation. Data is collected on field data sheets as backup to the handheld sensor data that is uploaded electronically and checked for accuracy against the original data sheets.

The goal of the program is to generate reliable surface water quality data. Data analysis is conducted using reports from Microsoft Excel and SQL spreadsheets and quality control completed utilizing standard procedures related to accuracy, representativeness, and comparability.

Geometric Mean of *E. coli* and Washington State Water Quality Standard

A site's annual Geometric Mean (geomean or GM) is calculated by multiplying monthly *E. coli* levels (n) and setting that product to the 1/nth power. The GM is a measure of the central tendency of a series of data and has been used to report coliform levels (measured in colony forming units (CFU)/100 mL) at Island County water quality sample sites.

Beginning in 2020, Washington state switched the requirements of reporting from fecal coliform to *E. coli*. Because the third year of *E. coli* data collected was only just completed, state standards and statewide percentiles have not yet been established; Water Quality Index (WQI) scores and *E. coli* Letter Grades cannot yet be determined. Once the state has published the curves and formulas for *E. coli*, Island County SWQ staff will review prior years' water quality data and submit a comprehensive report of WQI and Coliform Letter grades from Water Years 2020 to present.

In place of WQI or Letter Grades, Island County SWQ team is reporting trends of annual and seasonal GMs for water quality parameters including *E. coli*. These annual and seasonal guidelines have been adapted from guidelines used by neighboring Washington areas such as Jefferson, Kitsap, Skagit and King counties. Stream quality is then classified as either Good, Moderate or Poor based on meeting or failing the two parts of the Washington State Water Quality Standard for *E. coli*.

Washington State Water Quality Standards

The Washington State Department of Ecology (ECY) is required by the Clean Water Act to adopt water quality standards to provide protection from bacteria in water bodies sufficient for full-immersion swimming. The appropriate surface waters in Island County are assigned a designation for recreational use, to compare water quality monitoring results to these ECY surface water quality standards (See Table 2).

Table 2. Washington Water Quality Standards Designated Use (WAC 173-201A-200)

Designated Use	Parameter	Standard
Core summer Salmonid habitat	Temperature	7-day average of the daily maximum temperatures no greater than 16°C (60.8°F)
	Dissolved Oxygen (DO)	9.5 mg/L minimum*
	pH	Between 6.5 and 8.5
	Turbidity	Shall not exceed 5 NTU over background when background turbidity is 50 NTU or less
Salmonid spawning, rearing and migration	Temperature	7-day average of the daily maximum temperatures no greater than 17.5°C (63.5°F)
	Dissolved Oxygen (DO)	8.0 mg/L minimum*
	pH	Between 6.5 and 8.5
	Turbidity	Shall not exceed 5 NTU over background when background turbidity is 50 NTU or less
Primary Contact Recreation	*E. coli* (Most Probable Number MPN)	*E. coli* organism levels within an averaging period must not exceed a geometric mean value of 100 CFU or MPN per 100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained within the averaging period exceeding 320 CFU or MPN per 100 mL.

The ECY establishes standards for surface water quality. The state standard for *E. coli* contamination in primary contact recreation in freshwater is based on the geometric mean value (GMV) of the Most Probable Number (MPN) of *E. coli* bacteria identified in 100 milliliter (100 mL) water samples (*Swimming* n.d.). Since bacterial concentrations can be highly variable, the geometric mean is useful for assessing trends in water quality and is more representative of overall fecal pollution in streams.

There are two parts to the State Water Quality Standard:

Part 1: *E. coli* organism levels within an averaging period must not exceed geomean of 100 MPN/100 mL
Part 2: No more than 10% of all samples collected shall exceed 320 MPN/100 mL

Watershed Prioritization for Sample Sites

Watershed prioritization is carried out annually by SWQ staff to determine the following water year's sample monitoring sites. The first step in prioritizing watersheds for annual monitoring is identifying all waterbodies with demonstrated water quality impairments. Water quality data from the previous two water years is used to rank these watersheds, and they are then assessed and further ranked based upon risk and value (contain important or sensitive resources) attributes. Core and rotational sites are sampled on a three-year rotation cycle and are chosen based on the following criteria:

- Monitoring data from SWQMP showing that the water body does not meet the Washington State Primary Contact Standard for *E. coli*
- Areas listed as conditionally approved or restricted for commercial shellfish harvest by the Washington State Department of Health (WADOH) and/or the Island County Public Health
- An ongoing or intermittent health advisory issued by WADOH or Island County Public Health for recreational shellfish harvest or swimming restrictions
- Island County Pollution Identification and Correction (PIC) program focus

These prioritized watersheds are then assigned water quality points based upon data pertaining to the following:

4 points: Stream fails Part 1 of Primary Contact Standard for *E. coli* during previous two water years.
3 points: Stream fails Part 1 of Primary Contact Standard for *E. coli* during previous two dry seasons (Apr-Sept).
2 points for each of the following:

- Stream fails Part 1 of Primary Contact Standard for *E. coli* during a storm event (>/=0.25 in.) during the previous two water years.
- Stream fails Part 1 of Primary Contact Standard for *E. coli* during previous two wet seasons (Oct-Mar).

1 point for each of the following:

- Stream fails Part 2 of the Primary Contact Standard for *E. coli* during the previous two water years.
- Stream fails Part 2 of the Primary Contact Standard for *E. coli* during the previous two wet seasons.
- Stream fails Part 2 of the Primary Contact Standard for *E. coli* during the previous two dry seasons.

Once water quality points are assigned to each site, special circumstances and other ranking considerations are applied. Each special circumstance applicable receive an additional point towards the ranking. These circumstances include, but are not limited to:

- WADOH Shellfish Classification Impairment
- Downgraded quality classification by WADOH
- "Threatened" list
- Salmon recovery priority areas
- DOH initial "prohibited" classification
- "Unclassified" based on WADOH shoreline survey data
- Health Advisory posting
- Total Maximum Daily Load (TMDL) Study (303d or 4B listed site)
- Onsite sewage system failures or violations
- Major land use changes

Prioritization requires coordination with other departments or partners to obtain or evaluate data outside the scope of the SWQMP. The resulting ranked list of sites are used as a tool for updating the Monitoring Plan annually (coinciding with the water year), including budget availability. If there are more priority sites than the program has capacity for, the higher priority sites are selected for sampling in the current water year, and the remaining sites are addressed as funding becomes available.

Also of importance to watershed prioritization listings are forage fish survey maps and salmon priority areas (See Figures 2a and 2b). These areas are often found at the pour points of watersheds and are of critical importance to juvenile salmon habitat and overall Puget Sound and Washington State salmon restoration efforts. Attention is given to these watersheds by way of reporting their contributions to salmon recovery and identifying connections between their health and possible sources of pollution found during Source ID and future Pollution Identification and Correction (PIC) investigations.

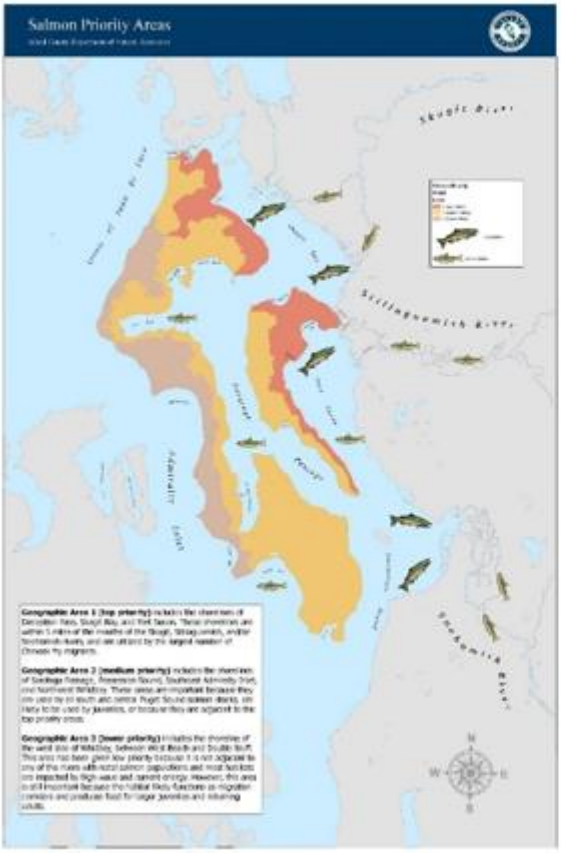


Figure 2a & 2b: a) Island County salmon priority area map; b) WDFW forage fish survey area map

RESULTS

Results for key data collected for WY2023 are listed below. Included are various tables displaying *E. coli* geomean data for the past 6 years, as well as exceedances. Additionally, there are tables highlighting overall stream health and parameters such as temperature, dissolved oxygen, and flow data.

Escherichia coli (*E. coli*)

Tables 3 and 4 show the past six years through WY2023 (WY17) annual and seasonal *E. coli* geomeans (MPN/100 mL) for core and rotational sampling sites. Due to a change in Washington state standards, there was a change from reporting levels of fecal coliform to levels of *E. coli* starting in 2020; annual geomeans are reported in Fecal coliform for 2018 thru 2020, and *E. coli* for years 2021 to present. Seasonal (three-month) geomeans were calculated based on conditions observed during the water years. During Water Year 2023, several sample site locations had acceptable **annual** geomeans, but many had **seasonal** 90-day geomeans higher than 100 MPN/100mL, causing them to fail Part 1 of the Water Quality Standard. As shown in Table 5, other sites showed exceedances of 320 MPN/100 mL for more than 10% of the samples, causing them to fail Part 2 of the standard.

Seasonal geomeans for Water Year 2023 (Table 6) showed definite trends during certain times of the year for select sites, and these will be discussed in each specific site's data summary. Four sites were unable to be sampled every month in the water year due to dry, low flow or tidally influenced conditions, and are indicated. Sites with *E. coli* levels that repeatedly exceeded state water quality standards were bracketed for Source ID and referred to the Adaptive Management Action Team (AMAT). The results for these sites and their Source ID investigations will be discussed further in subsequent sections of this report.

Table 3. Trends in Annual Fecal coliform and E. coli Geomeans (GM) for Island County Sampling Sites
Trend data for the last six years. Cells shaded green met the state standard for Primary Contact Recreation.

Site Name	Site#	2018 (WY12)	2019 (WY13)	2020 (WY14)	2021 (WY15)	2022 (WY16)	2023 (WY17)	State Standard
S Whidbey State Park	**119a**	NA	NA	FC 4	NA	NA	7	**100**
Crescent Creek*	**13a**	FC 42	FC 53	FC 8	384	57	119	**100**
Freeland Park	**134a**	FC 8	FC 34	NA	NA	19	6	**100**
Glendale Creek	**149a**	FC 80	FC 138	FC 116	35	88	31	**100**
Cultus Creek	**150a**	NA	NA	FC 98	NA	NA	210	**100**
Scatchet Creek	**157a**	FC 123	FC 113	FC 148	28	99	56	**100**
Carp Creek	**55a**	FC 20	FC 112	FC 30	17	28	50	**100**
Ebey's Reserve	**58a**	FC 91	FC 37	FC 54	43	77	218	**100**
Chapman Creek	**69a**	FC 33	FC 12	FC 15	25	49	29	**100**
Sunset W Camano*	**70a**	NA	NA	NA	NA	NA	14	**100**
Cavalero Creek	**74a**	FC 37	FC 28	FC 28	26	40	94	**100**
Bonnie Ln*	**82a**	NA	NA	NA	NA	NA	15	**100**
E Freeland Park*	**Hhab**	FC 16	FC 59	FC 85	177	121	35	**100**
Kristoferson Creek*	**KC1**	FC 22	FC 21	FC 23	14	37	32	**100**
Maxwelton Creek	**MWA2**	FC 41	FC 32	FC 48	23	86	98	**100**
Quade Creek	**QCA**	NA	NA	FC 15	NA	NA	29	**100**
***Seasonal Flow**		**FC = Fecal Coliform**			**NA=Not Assessed**			

Table 4. Trends in Maximum Seasonal Fecal coliform and E. coli Geomeans (GM) for Island County Sampling Sites

Trend data for the last six years. Cells shaded green met Part 1 of the state standard for Primary Contact Recreation.

Site Name	Site#	2018 (WY12)	2019 (WY13)	2020 (WY14)	2021 (WY15)	2022 (WY16)	2023 (WY17)	State Standard
S Whidbey State Park	119a	NA	NA	24	NA	NA	10	<100
Crescent Creek*	13a	430	155	49	502	119	395	<100
Freeland Park	134a	410	600	NA	NA	55	9	<100
Glendale Creek	149a	272	244	449	79	273	79	<100
Cultus Creek	150a	NA	NA	855	NA	NA	761	<100
Scatchet Creek	157a	364	398	553	205	245	321	<100
Carp Creek	55a	55	210	65	46	55	274	<100
Ebey's Reserve	58a	130	702	190	57	263	821	<100
Chapman Creek	69a	75	32	75	38	178	122	<100
Sunset W Camano*	70a	NA	NA	NA	NA	NA	25	<100
Cavalero Creek	74a	116	289	143	64	120	193	<100
Bonnie Ln*	82a	NA	NA	NA	NA	NA	5	<100
E Freeland Park*	Hhab	417	175	418	1616	377	86	<100
Kristoferson Creek*	KC1	171	51	54	28	304	80	<100
Maxwelton Creek	MWA2	183	225	150	151	461	463	<100
Quade Creek	QCA	NA	NA	39	NA	NA	101	<100
*Seasonal Flow		NA=Not Assessed						

Table 5. Trends in Percent Exceedances for Island County Sampling Sites

Trend data for the last six years. Cells shaded green met Part 2 of the state standard for Primary Contact Recreation, results shown in percent (%) of samples above 320 MPN/100mL.

Site Name	Site#	2018 (WY12)	2019 (WY13)	2020 (WY14)	2021 (WY15)	2022 (WY16)	2023 (WY17)	State Standard
S Whidbey State Park	119a	NA	NA	0	NA	NA	0	<10
Crescent Creek*	13a	10	13	14	50	0	33	<10
Freeland Park	134a	13	33	NA	NA	17	0	<10
Glendale Creek	149a	24	20	30	0	14	0	<10
Cultus Creek	150a	NA	NA	25	NA	NA	50	<10
Scatchet Creek	157a	32	33	36	7	6	19	<10
Carp Creek	55a	0	32	0	0	0	22	<10
Ebey's Reserve	58a	24	18	38	0	39	43	<10
Chapman Creek	69a	0	0	0	17	0	5	<10
Sunset W Camano*	70a	NA	NA	NA	NA	NA	0	<10
Cavalero Creek	74a	0	14	7	0	0	18	<10
Bonnie Ln*	82a	NA	NA	NA	NA	NA	0	<10
E Freeland Park*	Hhab	17	8	29	25	11	0	<10
Kristoferson Creek*	KC1	5	4	0	0	0	0	<10
Maxwelton Creek	MWA2	4	7	8	13	33	46	<10
Quade Creek	QCA	NA	NA	0	NA	NA	7	<10
*Seasonal Flow		NA=Not Assessed						

Table 6. Monthly/Seasonal Geomeans (GM) and Number of Exceedances WY2023.

Cells shaded green met the state standard for Primary Contact Recreation. "# >STV" in Red indicates number of samples exceeding state threshold value of 320 MPN/mL during those time periods.

Site Name	Site#	Oct	Nov	Dec	Qtr1 GM	Jan	Feb	Mar	Qtr2 GM	# >STV	Apr	May	Jun	Qtr3 GM	Jul	Aug	Sep	Qtr4 GM	# >STV
S Whidbey State Park	**119a**	5	5	5	**5**	5	10	5	**6**	**0**	5	20	10	**10**	5	10	20	**10**	**0**
Crescent Creek*	**13a**	NA	5	5	**5**	10	2603	399	**217**	**2**	2539	712	109	**395**	NA	NA	NA	**NA**	**2**
Freeland Park	**134a**	5	5	5	**5**	5	10	5	**6**	**0**	30	5	NA	**9**	5	5	NA	**5**	**0**
Glendale Creek	**149a**	121	10	10	**34**	5	10	5	**6**	**0**	63	5	187	**39**	10	189	211	**79**	**0**
Cultus Creek	**150a**	108	74	20	**54**	52	31	134	**32**	**0**	41	512	3441	**209**	24196	3654	537	**761**	**5**
Scatchet Creek	**157a**	185	5	5	**27**	5	5	5	**5**	**0**	5	146	187	**51**	345	857	275	**321**	**3**
Carp Creek	**55a**	657	2909	20	**274**	74	4	5	**11**	**2**	5	5	414	**35**	63	41	74	**31**	**1**
Ebey's Reserve	**58a**	1281	30	10	**85**	5	573	1376	**178**	**3**	183	75	616	**81**	2247	7701	122	**821**	**3**
Chapman Creek	**69a**	5	10	10	**8**	10	52	5	**13**	**0**	31	74	85	**56**	86	120	512	**122**	**1**
Sunset W Camano*	**70a**	NA	NA	5	**5**	97	5	5	**13**	**0**	31	NA	NA	**25**	NA	NA	NA	**NA**	**0**
Cavalero Creek	**74a**	573	309	30	**150**	161	5	41	**16**	**1**	20	158	279	**120**	243	801	408	**193**	**2**
Bonnie Ln*	**82a**	NA	NA	10	**10**	63	169	5	**38**	**0**	5	5	NA	**5**	NA	NA	NA	**NA**	**0**
E Freeland Park*	**Hhab**	NA	NA	NA	**NA**	NA	NA	86	**86**	**0**	10	52	NA	**23**	NA	NA	NA	**NA**	**0**
Kristoferson Creek*	**KC1**	NA	NA	5	**5**	122	52	NA	**80**	**0**	NA	NA	NA	**NA**	NA	NA	NA	**NA**	**NA**
Maxwelton Creek	**MWA2**	1017	10	171	**109**	10	10	5	**9**	**1**	5	121	369	**74**	4106	4884	1439	**463**	**5**
Quade Creek	**QCA**	30	20	5	**14**	5	41	5	**10**	**0**	10	10	10	**10**	41	839	135	**101**	**1**

***Seasonal flow**

Overall Water Quality Status

Table 7 details how Island County streams were evaluated for WY2023 based on whether they met all or part of the Washington State Water Quality Standard for *E. coli.* Streams received either a "Met" or "Failed" status for the standard and were categorized as follows:

- Met standards: Good. Stream had low bacteria levels and met both parts of the standard.
- Met one part of standard: Moderate. The stream had either periodic high bacteria levels or a 90-day seasonal geomean over 100.
- Failed both standards: Poor. Stream had high bacteria levels and failed both parts of the standard.

Table 7. Water Quality Status of Island County Streams WY2023
Stream health evaluated by Averaging Period Geomean and Percent Exceedances.

Site Name	Site#	Part 1 (Failed if GM during 90-day averaging period >100)	Part 2 (Failed if >10% of samples above 320)	Water Quality Status
Crescent Creek*	13a	Failed	Failed	Poor*
Ebey's Reserve	58a	Failed	Failed	Poor
South Whidbey State Park	119a	Met	Met	Good
Freeland Park*	134a	Met	Met	Good*
Glendale Creek	149a	Met	Met	Good
Cultus Creek	150a	Failed	Failed	Poor
Scatchet Creek	157a	Failed	Failed	Poor
E Freeland Park*	Hhab	Met*	Met*	Good*
Maxwelton Creek	MWA2	Failed	Failed	Poor
Quade Creek	QCA	Failed	Met	Moderate
Carp Creek	55a	Failed	Failed	Poor
Chapman Creek	69a	Failed	Met	Moderate
Sunset W Camano*	70a	Met*	Met*	Good*
Cavalero Creek	74a	Failed	Failed	Poor
Bonnie Ln*	82a	Met*	Met*	Good*
Kristoferson Creek*	KC1	Met*	Met*	Good*
*Seasonal flow				

Seven of the sixteen of Island County's streams sampled in WY2023 met the Washington State Water Quality standard for *E. coli*. Two streams met one part of the standard, while seven streams failed both parts of the standard and were categorized as *Poor*. Streams that repeatedly did not meet water quality standards were further investigated and referred to Source ID and Adaptive Management.

Table 8 shows the trends over the past six years of water quality status for all of Island County streams. Six of the sixteen of Island County's streams showed improvement in water quality, moving up from *Poor* or *Moderate* or showing relatively consistent *Good* water quality. Five streams showed a decrease in water quality moving from *Good* or *Moderate* to *Moderate* or *Poor*. Five streams experienced varying water quality levels.

Table 8. Trends in Water Quality Status of Island County Streams
Six Year Trend in Water Quality: WY2018-WY2020 based on WQI, WY2021-WY2023 based on State Standard for E. coli

Site Name	Site#	2018 (WY12)	2019 (WY13)	2020 (WY14)	2021 (WY15)	2022 (WY16)	2023 (WY17)
Crescent Creek	13a	Moderate	Moderate	Good	Poor	Moderate	Poor
Ebeys Landing	58a	Poor	Poor	Moderate	Good	Poor	Poor
Glendale Creek	149a	Moderate	Moderate	Moderate	Good	Poor	Good
Scatchet Creek	157a	Moderate	Poor	Moderate	Moderate	Moderate	Poor
Cultus Creek	150a	NA	NA	Moderate	NA	NA	Poor
Maxwelton Creek	MWA2	Moderate	Moderate	Moderate	Poor	Poor	Poor
Quade Creek	QCA	NA	NA	Good	NA	NA	Moderate
E Freeland Park	Hhab	Moderate	Moderate	Moderate	Poor	Poor	Good
Freeland Park	134a	Moderate	Moderate	NA	NA	Moderate	Good
S Whidbey State Park	119a	NA	NA	Good	NA	NA	Good
Carp Creek	55a	Moderate	Poor	Good	Good	Good	Poor
Chapman Creek	59a	Moderate	Good	Moderate	Moderate	Moderate	Moderate
Sunset Creek	70a	NA	NA	NA	NA	NA	Good
Kristoferson Creek	KC1	Moderate	Good	Good	Good	Moderate	Good
Bonnie Ln	82a	NA	NA	NA	NA	NA	Good
Cavalero Creek	74a	Moderate	Moderate	Moderate	Good	Moderate	Poor

Additional Parameters

Although not used to determine water quality status, other parameters are important in assessing overall stream health and trends over time. These parameters are identified in the Puget Sound Salmon recovery Plan and the Island County Salmon Recovery Plan update and are used by the SWQ team in the prioritization process. Results below may not reflect the exact maximum or minimum condition experienced at sampling sites and are therefore not directly comparable to the state standard. Instead, they are shown as an indicator of relative conditions for each of the sample sites and are used to demonstrate trends over past years.

Temperature

Water temperature is a critical habitat component for fish (especially salmonids), amphibians, and invertebrates and extreme temperatures can stress aquatic species to the point of being lethal. Temperature also influences natural decomposition rates, the mobility of several pollutants, and the amount of dissolved oxygen in the water (as temperature increases, dissolved oxygen decreases). Water temperature fluctuates throughout the day and is primarily influenced by solar radiation and can also increase with the slowing of stream flow as water has more time to warm before it moves downstream. Streams with banks dominated by trees or tall shrubs tend to be cooler than those with banks covered in grass or short vegetation. Cooling can occur with shading, increased turbulence, or the influx of groundwater into the stream channel.

As many of Island County streams are designated as fish streams and provide important habitat for native fish species and juvenile salmon, state standards of a maximum temperature of 17.5 ˚C for salmonid spawning, rearing and migration have been applied. Table 9 shows results for annual maximum temperatures over the past six years at core samples sites. Results are based on the recorded maximum temperatures during the monthly sampling schedule to analyze trends.

Table 9. Trends in Maximum surface water temperatures °C for Island County Sampling Sites
Recorded from monthly sampling. Cells shaded green meet the state standard for salmonid spawning, rearing and migration.

Site Name	Site#	2018 (WY12)	2019 (WY13)	2020 (WY14)	2021 (WY15)	2022 (WY16)	2023 (WY17)	State Standard
S Whidbey State Park	119a	NA	NA	10.2	NA	NA	12.66	17.5
Crescent Creek*	13a	15.80	11.75	8.57	9.96	15.21	12.72	17.5
Freeland Park	134a	8.44	13.41	NA	NA	12.09	20.36	17.5
Glendale Creek	149a	13.71	13.83	13.27	14.28	14.48	14.88	17.5
Cultus Creek	150a	NA	NA	14.00	NA	NA	18.7	17.5
Scatchet Head Creek	157a	14.37	14.44	13.40	14.27	15.43	15.85	17.5
Carp Creek	55a	12.84	13.10	10.43	11.29	15.41	21.31	17.5
Ebey's Landing	58a	12.81	16.49	8.52	8.49	12.80	17.61	17.5
Chapman Creek	69a	16.28	16.86	17.62	16.84	17.50	20.01	17.5
Sunset W Camano*	70a	NA	NA	NA	NA	NA	7.24	17.5
Cavalero Creek	74a	15.85	16.55	12.57	13.63	17.23	22.25	17.5
Bonnie Ln*	82a	NA	NA	NA	NA	NA	19.51	17.5
E Freeland Park*	Hhab	18.31	18.41	14.96	6.25*	22.85	21.93	17.5
Kristoferson Creek*	KC1	18.25	15.29	12.66	15.88	17.01	7.10	17.5
Maxwelton Creek	MWA2	18.01	15.98	15.78	16.64	17.13	17.31	17.5
Quade Creek	QCA	NA	NA	12.37	NA	NA	15.89	17.5

***Seasonal flow** **NA = Not assessed**

Dissolved Oxygen

Dissolved oxygen (DO) is the amount of free oxygen available to fish and other aquatic organisms and can influence the mobility of several contaminants. Excessive loading of sewage or other organic material, reduced water turbulence, warmer temperatures, and high salinity reduce the availability of DO. Dissolved oxygen tends to fluctuate throughout the day with changes in air temperature and photosynthetic processes such as algal blooms.

Table 10 shows the results for Water Year 2023 annual mean and minimum DO for surface water at core samples sites while Table 11 lists the annual means for DO over the past six years. Since many of Island County streams are designated as fish streams and can provide important habitat for juvenile salmon that are adapting to salt water and migrating to ocean waters, state minimum standards of 8.0 mg/L for salmonid rearing and migration have been applied to the results.

Table 10. Minimum Dissolved Oxygen measurements for WY2023

Recorded from monthly sampling. Cells shaded green meet the state standard for salmonid spawning, rearing and migration.

Site Name	Site#	WY2023 Minimum DO (mg/L)	WY2023 Mean DO (mg/L)	Minimum Standard
S Whidbey State Park	119a	9.53	10.66	8.0
Crescent Creek*	13a	5.66	9.70	8.0
Freeland Park	134a	3.45	8.49	8.0
Glendale Creek	149a	9.61	11.21	8.0
Cultus Creek	150a	8.79	10.72	8.0
Scatchet Head Creek	157a	9.41	11.01	8.0
Carp Creek	55a	8.01	10.31	8.0
Ebey's Landing	58a	7.25	10.62	8.0
Chapman Creek	69a	8.55	10.85	8.0
Sunset at W Camano*	70a	8.08	9.58	8.0
Cavalero Creek	74a	8.20	10.75	8.0
Bonnie Ln*	82a	6.88	10.37	8.0
E Freeland Park*	Hhab	6.80	10.38	8.0
Kristoferson Creek*	KC1	11.49	12.03	8.0
Maxwelton Creek	MWA2	6.81	10.11	8.0
Quade Creek	QCA	8.87	10.79	8.0
***Seasonal flow**				

Table 11. Trends in Annual Geomeans for Dissolved Oxygen for Island County Sampling Sites

Recorded from monthly sampling and calculated for yearly geomean. Cells shaded green met the state standard for salmonid spawning, rearing and migration.

Site	Site#	Dissolved Oxygen Geomeans (mg/L)						Minimum Standard
		2018 (WY12)	2019 (WY13)	2020 (WY14)	2021 (WY15)	2022 (WY16)	2023 (WY17)	
S Whidbey State Park	119a	NA	NA	11.02	NA	NA	10.66	8.0
Crescent Creek*	13a	9.86	11.38	10.28	11.44	10.02	9.70	8.0
Freeland Park	134a	11.93	11.75	NA	NA	10.10	8.49	8.0
Glendale Creek	149a	12.10	12.27	12.22	12.04	11.26	11.21	8.0
Cultus Creek	150a	NA	NA	11.44	NA	NA	10.70	8.0
Scatchet Creek	157a	12.08	12.23	12.21	11.85	11.22	11.01	8.0
Carp Creek	55a	11.32	12.23	11.75	11.56	11.01	10.31	8.0
Ebey's Landing	58a	11.30	12.77	12.29	12.82	11.50	10.62	8.0
Chapman Creek	69a	11.61	11.97	12.07	11.61	10.72	10.85	8.0
Sunset W Camano*	70a	NA	NA	NA	NA	NA	9.58	8.0
Cavalero Creek	74a	11.78	12.01	12.15	12.19	10.80	10.75	8.0
Bonnie Ln*	82a	NA	NA	NA	NA	NA	10.37	8.0
E Freeland Park*	Hhab	11.55	11.73	10.12	11.87	8.74	10.38	8.0
Kristoferson Creek*	KC1	10.17	11.13	11.75	11.50	8.97	12.03	8.0
Maxwelton Creek	MWA2	10.87	11.34	11.12	10.89	10.02	10.11	8.0
Quade Creek	QCA	NA	NA	11.56	NA	9.36	10.79	8.0

***Seasonal flow NA = Not assessed**

Stream Discharge

Some of Island County streams are seasonal or intermittent, but there are many perennial and year-round streams that have a more consistent flow period. The source of the flow is from smaller upstream waters such as wetlands, or groundwater springs with supplemental runoff from rainfall or other precipitation. During dry periods, seasonal streams may not have flowing surface water, but they are still streams and are vital components of the local ecosystem.

According to the EPA, seasonal streams:

- are hydrologically and biologically connected to downstream waters and provide many of the same functions and values as rivers and larger streams.
- provide many upstream and downstream benefits; protection against floods, filter pollutants, recycle potentially harmful nutrients, and provide food and habitat for many types of fish and other creatures.
- play a critical role in maintaining the quality and supply of our drinking water, ensure a continual flow of water to surface waters, and help recharge underground aquifers.

Table 12 below shows the discharge for Island County streams for Water Year 2023. Streams with seasonal flow or that could not be sampled for that month are noted. In future reports, all available years of discharge data will be analyzed to determine trends due to the changing climate and its effect on stream flow.

Table 12. Monthly Stream Discharge (cfs) WY2023

Sites that demonstrated seasonal flow are referenced with the following codes:

Site Information		Stream Discharge in cubic ft/sec (cfs)											
Site Name	**Site#**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
S Whidbey State Park	**119a**			0.15	0.12	0.17	0.29	0.23	0.32	0.15	0.02	0.20	0.20
Crescent Creek	**13a**	FS	0.05	0.51	6.93	11.0	3.06	2.18	0.06	0.03	FS	FS	FD
Freeland Park	**134a**	0.001	0.001	0.01	1.11	1.91	0.84	0.25	0.02	FS	0.01	0.01	FS
Glendale Creek	**149a**	2.03	5.91	3.54	6.63	4.61	4.20	2.08	3.59	2.46	0.98	0.86	1.75
Cultus Creek	**150a**	0.30	0.59	0.49	8.87	0.75	1.11	1.42	0.54	0.17	0.06	0.03	0.08
Scatchet Creek	**157a**	1.30	0.95	0.97	1.21	0.91	1.13	0.96	0.75	0.52	1.21	1.29	1.25
Carp Creek	**55a**	0.04	0.11	0.43	1.70	2.49	1.81	2.01	0.48	0.23	0.01	0.03	0.04
Ebey's Reserve	**58a**	0.02	0.05	0.01	0.11	2.17	0.85	0.35	0.09	FS	0.01	FS	0.01
Chapman Creek	**69a**	0.60	0.68	1.40	1.68	1.39	2.63	1.30	0.91	0.86	0.82	0.27	0.69
Sunset W Camano*	**70a**	FD	FD	FD	0.26	0.14	0.34	0.11	FD	FD	FD	FD	FD
Cavalero Creek	**74a**	0.22	0.71	0.54	2.22	1.63	0.85	2.38	0.47	0.43	0.02	0.15	0.39
Bonnie Ln*	**82a**	FD	FD	0.48	1.96	1.36	1.72	0.51	0.01	FD	FD	FD	FD
E Freeland Park*	**Hhab**	FS	FT	FT	FT	FT	0.16	0.36	0.26	0.03	FS	FS	0.04
Kristoferson Creek*	**KC1**	FD	FS	1.9	7.13	4.01	FS	FS	FS	FS	FS	FS	FD
Maxwelton Creek	**MWA2**	2.37	4.86	12.94	15.99	8.45	3.71	8.45	2.66	1.36	0.08	0.09	1.86
Quade Creek	**QCA**	0.46	0.34	0.18	0.81	0.49	0.99	1.09	0.87	0.61	0.88	0.63	0.73
*Seasonal Flow		FD – Dry		FS – Stagnant			FT – Tidal influence						

SAMPLE SITE SUMMARIES

The following sections summarize the results of surface water quality parameters monitored at all core and rotational sample sites for WY2023. The sixteen monitored sites are organized by geographic area: North Whidbey (Figure 3), South Whidbey (Figure 4), and Camano Island (Figure 5). Additional information on conditions observed at Rotational, Effectiveness, and Source ID sites will be discussed in further sections of this report.

North Whidbey Area Results

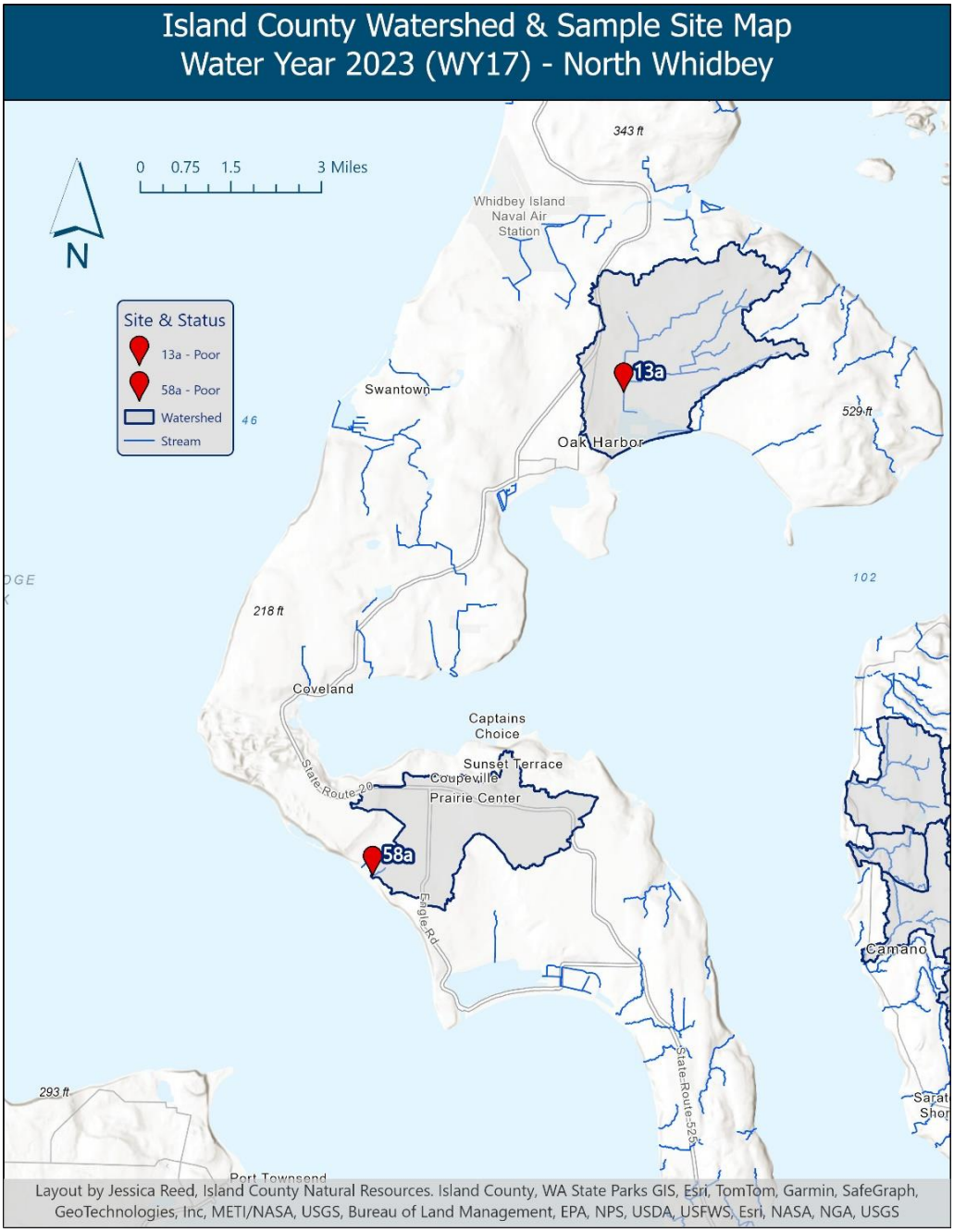


Figure 3. Location of North Whidbey samples sites and their water quality status

Figure 3 shows the location of North Whidbey samples sites and their water quality status.

Subsequent pages provide greater detail for each site within the North Whidbey area, including a brief description of the monitoring site.

Crescent Creek
Annual GM: 119

Ebey's Landing
Annual GM: 218

Stream Report Card: 13a – Crescent Creek (North Crescent Bay)

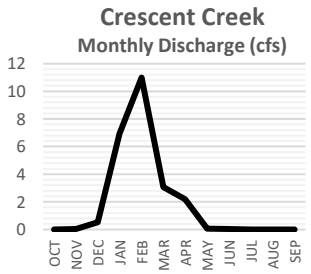
Site Description

Samples taken for the North Crescent Bay site are pulled upstream from the main channel that flows under Crescent Harbor Road, west of the intersection with Hunt Road. The area immediately upstream from the sampling site is zoned for rural commercial agricultural use. Proposals have been submitted for habitat restoration in this area and salmon restoration projects near the sample site are ongoing.

Crescent Creek Summary Statistics *Cells filled with light green meet state standards

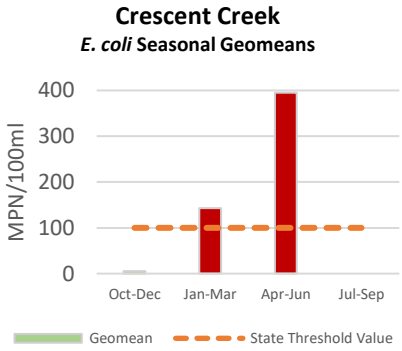
Six Year Trends	2018	2019	2020	2021	2022	2023	State Standard
Water Quality Status	Moderate	Moderate	Good	Poor	Moderate	Poor	
Pt 1: Max GM FC / *E. coli*	FC 430	FC 155	FC 49	502	119	395	<100
Pt 2:% Exceedances	10	13	14	50	0	33	<10

** WY2018-WY2020, WQI used to evaluate water quality status, WY2021-WY2023 *E. coli* data used **



Key Takeaways:

- Water quality was Poor based on E. coli data collected in WY2023.
- Annual and seasonal geomeans exceeded standards; 33% of annual samples exceeded 320 (5 out of 15 samples)
- Annual E. coli levels have increased, site failed both parts of state standard.
- Maximum temperatures consistent, somewhat lower than 6 years ago, limited sampling during the hotter, dry summer months.
- Minimum Dissolved Oxygen for WY2023 failed state standard: 5.66 mg/L, annual geomean for DO consistent over past six years, met minimum of 8.00.
- Stream Flow: 8 out of 12 months, Max discharge: 11 cfs, Min: Stagnant/Dry



Sampling Summary:

This site was inconsistently sampled due to water stagnation and dry conditions during Quarters 3 and 4. A beaver dam was found above the sample site; property owners observed the beaver dams have helped to extend the duration of flow in the drier summer months. *E. coli* levels have increased since the prior water year and continue to show seasonal high hits. During the winter and spring months (November through July) *E. coli* levels often exceeded the state standard. SWQ staff bracketed above the sample site with inconclusive results so the source of the highs hits will continue to be investigated.

Stream Report Card 58a – Ebey's Landing

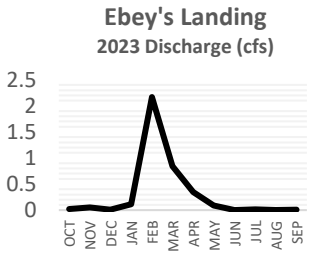
Site Description

Surface waters are captured in roadside catch basins and field drain tiles then piped, subsurface, across agricultural fields before daylighting in a ravine where it forms a stream channel that outfalls on Ebey's Landing beach. The area immediately upstream of the sampling location is zoned for commercial agriculture and is currently being used for agriculture.

Ebey's Landing Summary Statistics *Cells filled with light green meet state standards

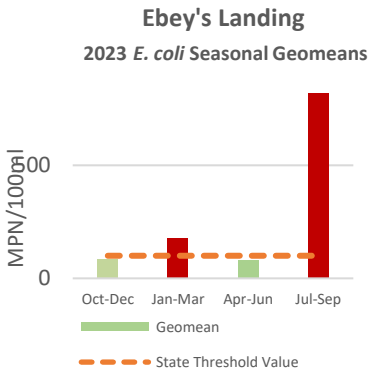
Six Year Trends	2018	2019	2020	2021	2022	2023	State Standard
Water Quality Status	Poor	Poor	Moderate	Good	Poor	Poor	
Pt 1: Max GM FC / *E. coli*	FC 130	FC 702	FC 190	57	263	821	<100
Pt 2: % Exceedances	24	18	38	0	39	43	<10

** WY2018-WY2021, WQI used to evaluate water quality status, WY2022-WY2023 only *E. coli* data used **



Key Takeaways:

- Water quality was Poor based on *E. coli* data collected in WY2023.
- Annual and seasonal geomeans exceeded standards; 43% of samples exceeded 320 (10 out of 23 samples).
- *E. coli* levels higher than previous year, failed both Parts of state standard with high hits observed in Quarter 2 and Quarter 4.
- Maximum stream temperatures over WY2018-WY2023 ranged from 8.49 to 17.61; WY2023 max temperature was 17.61°C, which was above the state standard.
- Minimum Dissolved Oxygen below state standard: 7.25 mg/L, but annual geomeans met standard
- Stream Flow: All 12 months, Max discharge: 2.2 cfs, Min: 0.01 cfs



Sampling Summary:

This location was able to be consistently sampled except for March when high conductivity levels were recorded due to tidal influence. Multiple high hits for *E. coli* led to Source ID bracketing upstream at culverts along and near the conservation easement as well as along Engle Rd with inconclusive results. Water quality based on levels of *E. coli* levels has worsened since the previous water year, and seasonal geomeans show distinct trends of high hits during the spring and summer months, April through September. Historically this site has shown high levels of fecal coliform during these months. Additional Source ID bracketing will be required to identify the source of fecal pollution.

South Whidbey Area Results

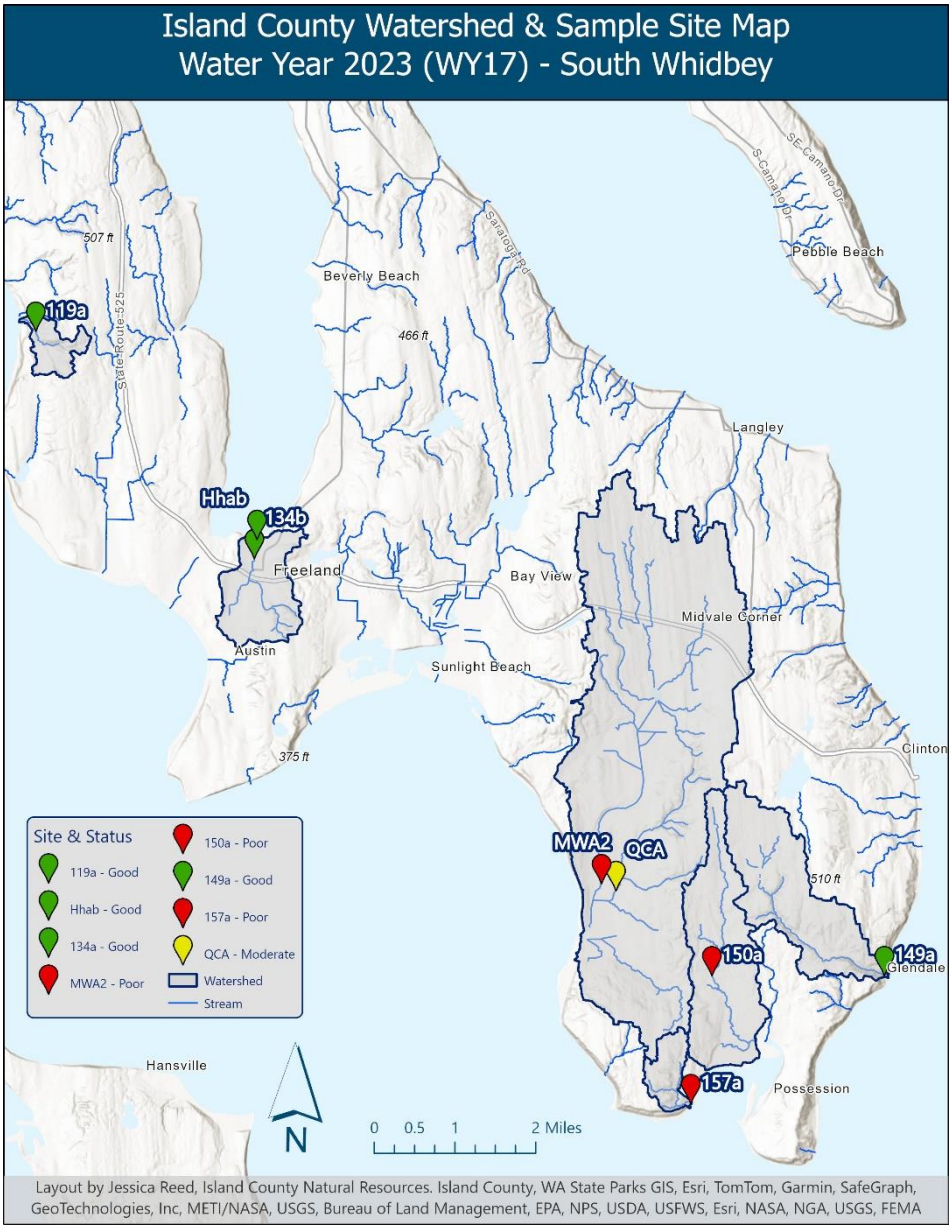


Figure 4. South Whidbey sample sites and their water quality status

Figure 4 shows the location of South Whidbey samples sites and their water quality status.

Subsequent pages provide greater detail for each site within the South Whidbey area, including a brief description of the monitoring site.

- 119a S Whidbey State Park
  Annual GM: 7
- 134a Freeland Park
  Annual GM: 6
- Hhab E Freeland Park
  Annual GM: 35
- 150a Cultus Creek
  Annual GM: 210
- 149a Glendale Creek
  Annual GM: 31
- 157a Scatchet Creek
  Annual GM: 56
- MWA2 Maxwelton Creek
  Annual GM: 98
- QCA Quade Creek
  Annual GM: 29

Stream Report Card: 149a – Glendale Creek

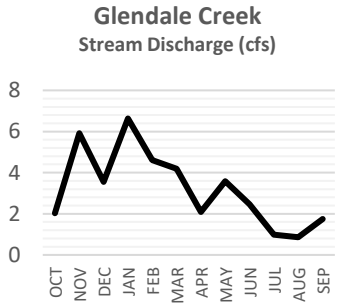
Site Description

The sample location for Glendale Creek is located above the second driveway crossing up from Humphrey Road. This is a historical salmon bearing stream that is immediately bordered by roads and houses at the pour point. The area immediately upstream of the sampling location is zoned rural designated for rural land use.

Glendale Creek Summary Statistics *Cells filled with light green meet state standards

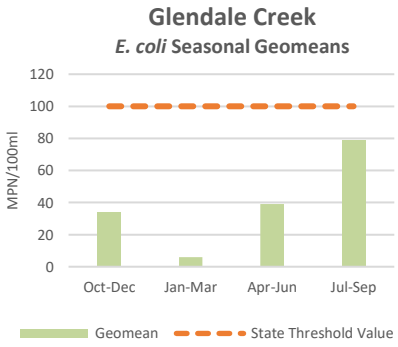
Six Year Trends	2018	2019	2020	2021	2022	2023	State Standard
Water Quality Status	Moderate	Moderate	Moderate	Good	Poor	Good	
Pt 1: Max GM FC / *E. coli*	FC 272	FC 244	FC 449	79	273	79	<100
Pt 2: % Exceedances	24	20	30	0	14	0	<10

** WY2018-WY2021, WQI used to evaluate water quality status, WY2022-WY2023 only E. coli data used **



Key Takeaways:

- Water quality was Good based on data collected in WY2023.
- Annual and seasonal geomeans met state standards; 0% of samples exceeded the state limit of 320 (0 out of 14 samples).
- *E. coli* levels less than previous year, WY2023 levels met both Parts of state standard
- Temperatures consistent, WY2023 annual geomean under maximum temperature standard.
- Dissolved Oxygen levels constant over past five years, minimum for 2023 met state standard: 9.61 mg/L
- Stream Flow: all 12 months , Max discharge: 6.64 cfs, Min: 0.98 cfs



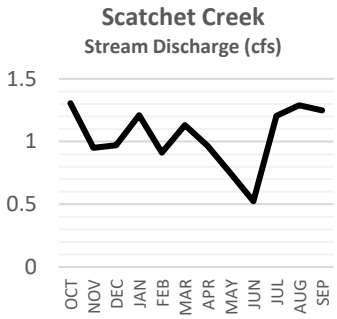
Sampling Summary:

The SWQ Team was able to consistently sample at this site. Additional sampling was not required WY2023 due to no exceedances observed. Annual geomeans show a trend towards improved water quality since WY2022. The *E. coli* annual geomean was 31 MPN/100 mL which is under state limits and seasonal geomeans did not exceed state standards. The site did show slightly higher levels of *E. coli* during the summer months.

Stream Report Card: 157a – Scatchet Creek

Site Description

This site location is a stream that runs through the Scatchet Head Community Park. It then enters a culvert under Driftwood Road before draining into Puget Sound. The area immediately upstream of the sampling location is zoned rural and its designated use is rural land.



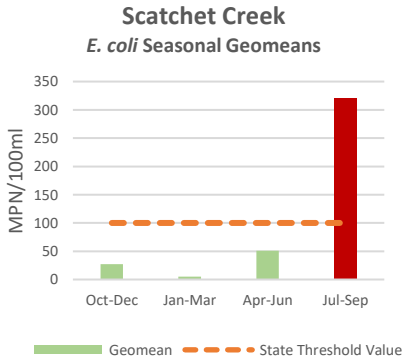
Scatchet Creek Summary Statistics *Cells filled with light green meet state standards

Six Year Trends	2018	2019	2020	2021	2022	2023	State Standard
Water Quality Status	Moderate	Poor	Moderate	Moderate	Moderate	Poor	
Pt 1: Max GM FC / *E. coli*	FC 364	FC 398	FC 553	205	245	321	<100
Pt 2: % Exceedances	32	33	36	7	6	19	<10

** WY2018-WY2021, WQI used to evaluate water quality status, WY2022-WY2023 only E. coli data used **

Key Takeaways:

- Water quality was Poor based on data collected in WY2023.
- Seasonal geomeans exceeded the state standard, percentage of samples that exceeded 320 MPN/100 mL was 17% (3 out of 17 samples)
- Annual E. coli levels lower than previous year, but much higher during July – Sept with repeated high hits; site failed both Parts of state standard.
- Temperatures consistent over the years, annual geomean under maximum: 15.85 °C
- Dissolved Oxygen over past years constant, 2023 met minimum state standard: 9.41 mg/L
- Stream Flow: 8 out of 12 months, Max discharge: 1.3 cfs, Min: 0.52 cfs



Sampling Summary:

Repeated high hits in July instigated bracketing upstream, however, a clear source could not be identified before levels decreased. The current site has formerly tested high for fecal coliform and there is a history of bracketing at sites upstream. This site has a history of septic challenges related to pumping of effluent to different parcels. In the past dye tests have been performed in the community to identify possible sources of pollution through the PIC program.

Stream Report Card: 150a – Cultus Creek

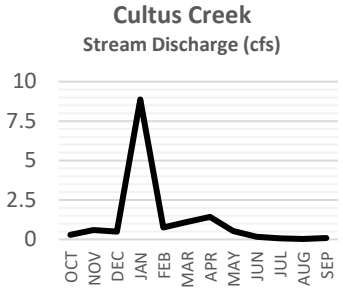
Site Description

Cultus Creek is a fish stream that runs through a culvert that passes under Bailey Road in Langley. The sample site is located on the north side of Bailey Road, a quarter mile west of Cultus Bay Road. Cultus Creek is a rotational site that has been sampled in 2020 and 2023 on a three-year sampling cycle.

Cultus Creek Summary Statistics *Cells filled with light green meet state standards

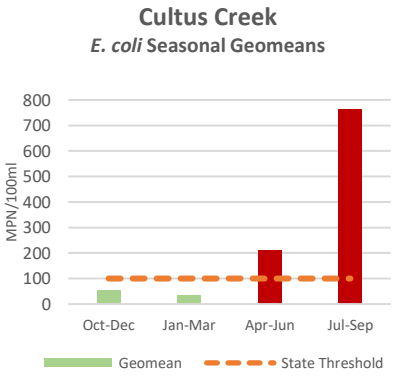
Six Year Trends	2018	2019	2020	2021	2022	2023	State Standard
Water Quality Status	NA	NA	Moderate	NA	NA	Poor	
Pt 1: Max GM FC / *E. coli*	NA	NA	FC 855	NA	NA	761	<100
Pt 2: % Exceedances	NA	NA	25	NA	NA	50	<10

** WY2018-WY2021, WQI used to evaluate water quality status, WY2022-WY2023 only E. coli data used **



Key Takeaways:

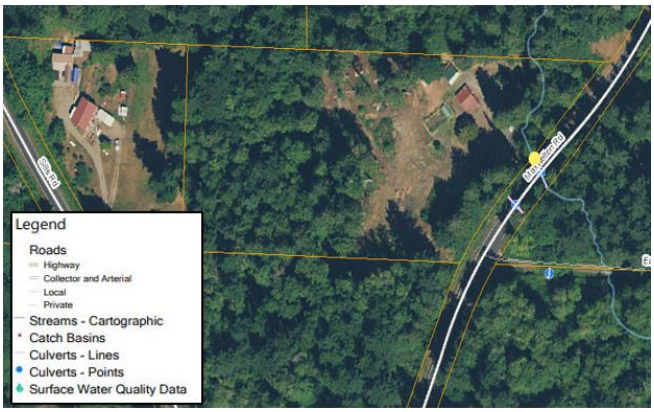
- Water quality was Poor based on data collected in WY2023.
- Annual and seasonal 90-day geomeans exceeded state standard, percentage of samples that exceeded 320 MPN/100 mL was 50% (12 of 24 samples)
- E. coli levels high April through September, site failed both Parts of the state standard.
- Temperatures have increased since 2020, annual geomean for 2023 above maximum temperature standard: 18.7 °C
- Minimum Dissolved Oxygen just above state standard: 8.79 mg/L
- Stream Flow: 12 out of 12 months, Max discharge: 8.87 cfs, Min: 0.03 cfs



Sampling Summary:

The annual geomean was 86 MPN/100 mL which was not over state limit, but seasonal geomeans exceeded state standards during the months of April through September. Due to the many high hits at this site, Source ID was conducted at three sites upstream. Two culverts located on Adobe Road were sampled, and when results showed additional high hits, another culvert on Springwater Lane was sampled. Resampling showed consistent high hits, but additional Source ID could not be conducted due to dry conditions upstream. Since the main site still showed higher hits, the area was referred to AMAT and letters were sent to surrounding property owners advising them of the exceedances and encouraging them to have their septic systems inspected according to Island County Code. Even though not on the rotation cycle until 2026, this site will periodically be sampled as part of the Source ID process, with any ongoing issues referred to the Environmental Health department for any potential enforcement actions.

Stream Report Card: MWA2- Maxwelton Creek



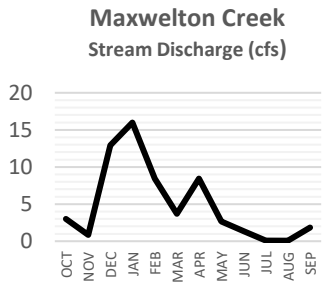
Site Description

This sampling location is on the north side of French Road on Maxwelton Creek. This site has extensive riparian vegetation cover and year-round flow. The area immediately upstream of the sampling location is zoned rural and designated to be rural lands.

Maxwelton Creek Summary Statistics *Cells filled with light green meet state standards

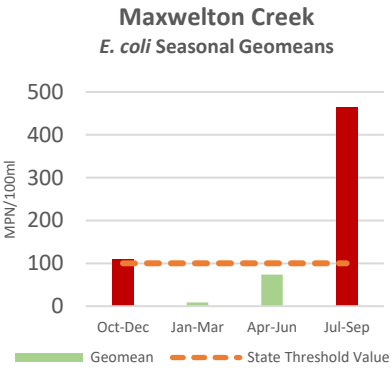
Six Year Trends	2018	2019	2020	2021	2022	2023	State Standard
Water Quality Status	Moderate	Moderate	Moderate	Poor	Poor	Poor	
Pt 1: Max GM FC / E. coli	FC 183	FC 225	FC 150	151	461	463	<100
Pt 2: % Exceedances	4	7	8	13	33	46	<10

** WY2018-WY2021, WQI used to evaluate water quality status, WY2022-WY2023 only E. coli data used **



Key Takeaways:

- Water quality was Poor based on data collected in WY2023.
- The percentage of samples that exceeded the state limit of 320 MPN/100 mL was 46% (12 out of 26 samples)
- E. coli levels higher than previous year, WY2023 levels failed both Parts 1 and 2 of the state standard, high hits during summer and fall months.
- Temperatures consistent, maximum temperature recorded 2023 close to but under standard: 17.31 °C
- Minimum Dissolved Oxygen failed standard: 6.81 mg/L
- Stream flowed all 12 months of the year; discharge (cfs) Max: 15.99, Min: 0.08



Sampling Summary:

Water quality has decreased since WY2022; the annual geomean was 86 MPN/100 mL but seasonal geomeans showed a distinct trend towards higher hits during the summer and fall months. Repeated high hits that exceeded standards at this site instigated bracketing upstream. Review of bracket site data led to the search being narrowed down to six possible parcels that were the most probable source of pollution. Working collaboratively with AMAT led to discussions with OSS enforcement who identified the surrounding six parcels for septic compliance and sent letters to those property owners.

The Maxwelton watershed area is an important location for shellfish projects incorporating PIC and is a prime opportunity for education and outreach to local property owners. The site pours out to a commercial shell fishing prohibited zone; hence in the past it has been a targeted area of the PIC program and continues to be of interest to the Department of Health shellfish program and possible TMDL proposals.

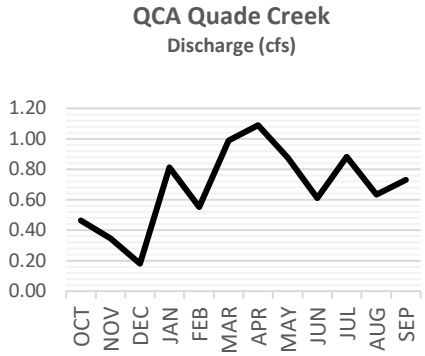
Stream Report Card: QCA Quade Creek

Site Description
Quade Creek is a fish stream that runs through a culvert passing under French Road in Langley. Eventually the water from Quade Creek Runs into Maxwelton Creek's outlet. This site has year-round flow.

Quade Creek Summary Statistics *Cells filled with light green meet state standards

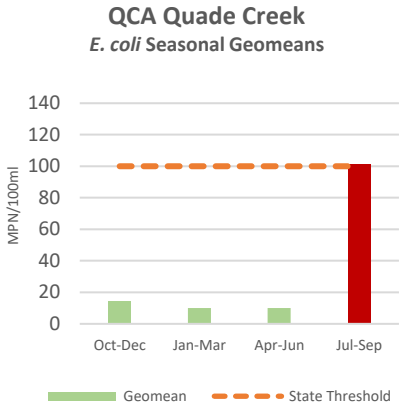
Six Year Trends	2018	2019	2020	2021	2022	2023	State Standard
Water Quality Status	NA	NA	Good	NA	NA	Moderate	
Pt 1: Max GM FC / E. coli	NA	NA	FC 39	NA	NA	101	<100
Pt 2: % Exceedances	NA	NA	0	NA	NA	7	<10

** WY2018-WY2021, WQI used to evaluate water quality status, WY2022-WY2023 only E. coli data used **



Key Takeaways:

- Water quality was Moderate based on data collected in WY2023.
- The E. coli annual geomean was 29 MPN/100 mL which is under state limits but the seasonal geomeans exceeded state standards from July to September, failed Part 1 of the state standard.
- The percentage of samples that exceeded the state limit of 320 MPN/100 mL was 7%, (1 out of 14 samples)
- Temperatures somewhat higher, maximum temperature recorded in 2023 still under standard: 15.89 °C
- Annual geomean met the standard but minimum Dissolved Oxygen neared limit: 8.87 mg/L
- This stream flowed all year, Max discharge: 1.09 cfs, Min: 0.18 cfs



Sampling Summary:
This is a rotational site that was sampled in WY2020 and again in WY2023. The SWQ Team was able to consistently sample at this site during the current water year and identified trends of higher hits during the summer months. We will continue to sample periodically in non-rotational years to monitor the health of the stream.

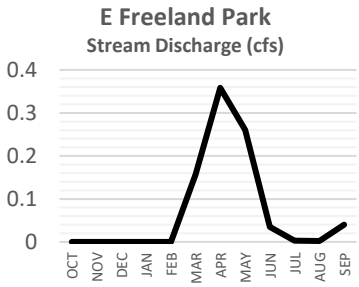
Stream Report Card: Hhab- East Freeland Park

Site Description
This sampling location is in a tidally influenced stream near the parking lot of Freeland Park. The area immediately upstream from the sampling site is zoned for rural residential and designated to be an urban area.

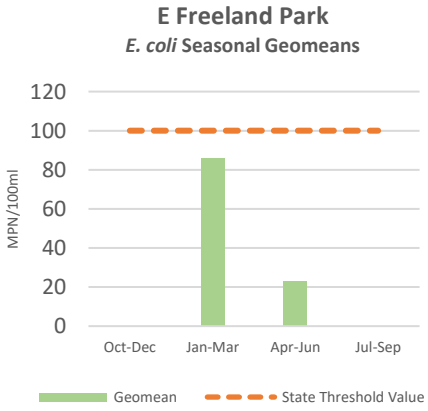
E Freeland Park Summary Statistics *Cells filled with light green meet state standards

Six Year Trends	2018	2019	2020	2021	2022	2023	State Standard
Water Quality Status	Moderate	Moderate	Moderate	Poor	Poor	Good	
Pt 1: Max GM FC / E. coli	FC 417	FC 175	FC 418	1616	377	86	<100
Pt 2: % Exceedances	17	8	29	25	11	0	<10

** WY2018-WY2021, WQI used to evaluate water quality status, WY2022-WY2023 only E. coli data used **



Key Takeaways:
- Water quality was Good based on reduced sampling in WY2023.
- The percentage of samples that exceeded the state limit of 320 MPN/100 mL was 0%.
- E. coli levels improved from previous year, but limited sampling due to tidal influence and low flow conditions may have affected results.
- Temperatures above state threshold are common, maximum temperature recorded in 2023 over standard: 21.93 ˚C
- Dissolved Oxygen annual geomeans generally met standards but WY2023 minimum DO fell below standard: 6.8 mg/L
- Stream flowed 10 out of 12 months of the year but tidal conditions Oct – Dec and dry Jul – Sep. Max discharge: 0.3584 cfs, Min: No flow



Sampling Summary:
The sampling at this site was inconsistent with tidal influence and low flow which led to upstream bracketing. Hhab had issues with high salinity and tidal exchange, and many samples fell outside the conductivity threshold making most of them inviable based on definitions of surface water vs. marine water. Water quality has improved since WY16 with the annual geomean of 35 MPN/100 mL, but seasonal geomeans show a trend towards higher hits during the winter months. Data for this location may not have been representative of ambient water quality due to the inability to collect samples year-round. This area is also the focus of Swim Beach sampling reported to ECY.

Stream Report Card: 134a- Freeland Park

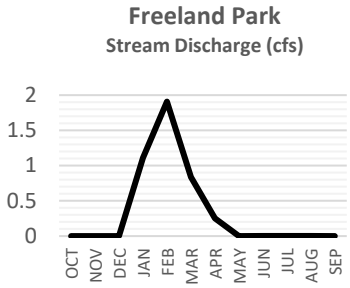
Site Description

This sampling site is at the stormwater outfall in Freeland Park. The area immediately upstream from the sampling site is zoned for rural residential and designated to be an urban area. The site is located near a beach and swim site called Freeland County Park which is placed under a swimming advisory due to high Enterococcus levels from Memorial Day to Labor Day.

Freeland Park Summary Statistics *Cells filled with light green meet state standards

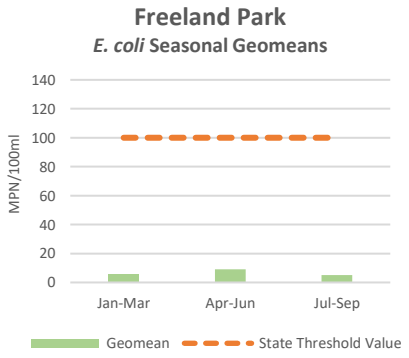
Six Year Trends	2018	2019	2020	2021	2022	2023	State Standard
Water Quality Status	Good	Moderate	NA	NA	Moderate	Good	
Pt 1: Max GM FC / *E. coli*	FC 410	FC 600	NA	NA	55	9	<100
Pt 2: % Exceedances	13	33	NA	NA	17	0	<10

** WY2018-WY2021, WQI used to evaluate water quality status, WY2022-WY2023 only E. coli data used **



Key Takeaways:

- Water quality was Good based on sample data collected in WY2023
- The annual and seasonal geomeans met state standards: 0% of samples exceeded.
- E. coli levels improved from previous year, but limited sampling due to tidal influence and low flow conditions affected results.
- Temperatures mostly below state threshold, however maximum temperature recorded in 2023 over standard: 20.36 ˚C
- Dissolved Oxygen annual geomeans met standard but 2023 minimum DO fell below standard: 3.45 mg/L
- Stream Flow: 11 out of 12 months, Max discharge :1.9 cfs, Min: No flow



Sampling Summary:

Water flowed most during wet season storm events and slowed down significantly in the dry season. Data for this location may not have been representative of ambient water quality due to the inability to collect samples year-round. The stream had issues with tidal influence, salinity, and intermittent flow. The annual geomeans was 6 MPN/100 mL which is under the state limit. The seasonal geomeans show low *E. coli* levels throughout the year. The site was able to be sampled 10 out of the 12 months and ran extremely low DO levels in June and was deemed stagnant and was also stagnant in September.

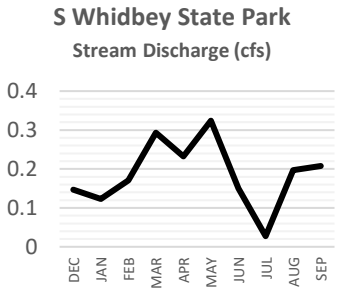
Stream Report Card: 119a- South Whidbey State Park

Site Description
This is a rotational site on the boundary of South Whidbey State Park. The stream runs through primary conifer forests and is zoned rural. Stream conditions are designated as natural with native vegetation shading the stream.

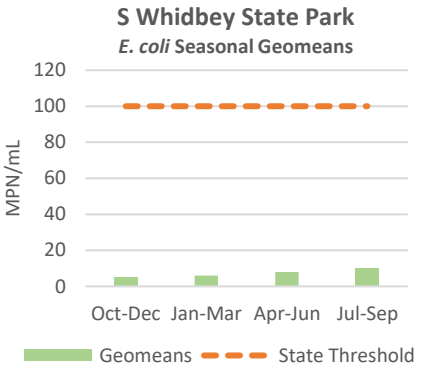
S Whidbey State Park Summary Statistics *Cells filled with light green meet state standards

Six Year Trends	2018	2019	2020	2021	2022	2023	State Standard
Water Quality Status	NA	NA	Good	NA	NA	Good	
Pt 1: Max GM FC / *E. coli*	NA	NA	FC 24	NA	NA	10	<100
Pt 2: % Exceedances	NA	NA	0	NA	NA	0	<10

** WY2018-WY2021, WQI used to evaluate water quality status, WY2022-WY2023 only E. coli data used **



Key Takeaways:
- Water quality was Good based on data collected in WY2023.
- The annual and seasonal geomeans met state standards: 0% of samples exceeded.
- Fecal and E. coli levels minimal, below threshold for both sampling years.
- Temperatures below state threshold, sampled early morning so maximum temperature not likely recorded: 12.66 ˚C
- Dissolved Oxygen annual geomeans met standard, WY2023 minimum DO above standard: 9.53 mg/
- Stream Flow: 10 out of 10 months sampling, Max discharge: 0.32 cfs, Min: 0.03 cfs



Sampling Summary:
This stream flowed all ten months of sampling and was able to be sampled consistently throughout the year. This is a rotational site sampled in WY2020 and again in WY2023, site conditions are considered natural. Both annual and seasonal geomeans were well under the state limit. The seasonal geomeans show minimal *E. coli* levels throughout the year.

Camano Island Results

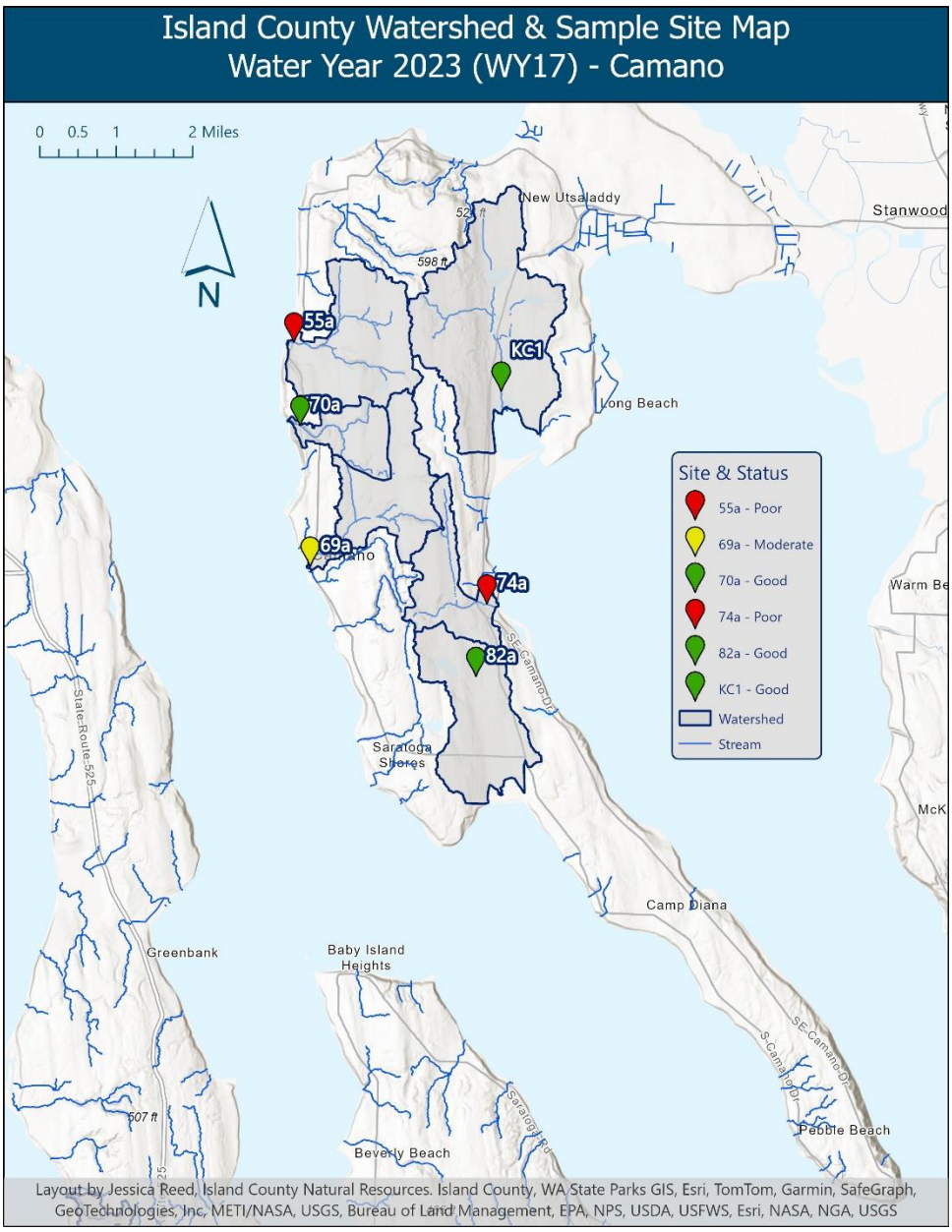


Figure 5. Camano Island sample sites and their water quality status

Figure 5 shows the location of Camano Island samples sites and their water quality status.

Subsequent pages provide greater detail for each site within the Camano area, including a brief description of the monitoring site.

- 55a Carp Creek
  Annual GM: 50
- KC1 Kristoferson Creek
  Annual GM: 32
- 70a Sunset
  Annual GM: 14
- 69a Chapman Creek
  Annual GM: 29
- 74a Cavalero Creek
  Annual GM: 94
- 82a Bonnie Lane
  Annual GM: 15

Stream Report Card: 55a- Carp Creek

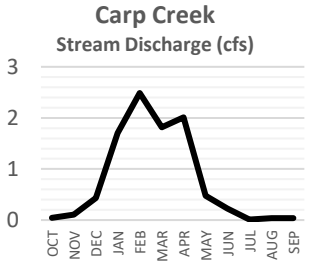
Site Description

The sampling site for Carp Creek is located at the junction of two streams that flow into ditches near Sunset and Olympic Road. One stream is feed from mostly wetlands and the other is feed from Carp Lake and other wetlands. Carp Lake drains through mostly privately owned forested lands to developed waterfront properties.

Carp Creek Summary Statistics *Cells filled with light green meet state standards

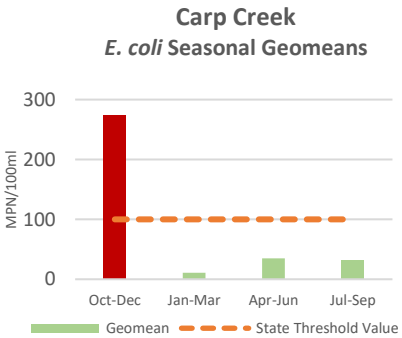
Six Year Trends	2018	2019	2020	2021	2022	2023	State Standard
Water Quality Status	Moderate	Poor	Good	Good	Good	Poor	
Pt 1: Max GM FC / *E. coli*	FC 55	FC 210	FC 65	46	55	274	<100
Pt 2: % Exceedances	0	32	0	0	0	22	<10

** WY2018-WY2021, WQI used to evaluate water quality status, WY2022-WY2023 only E. coli data used **



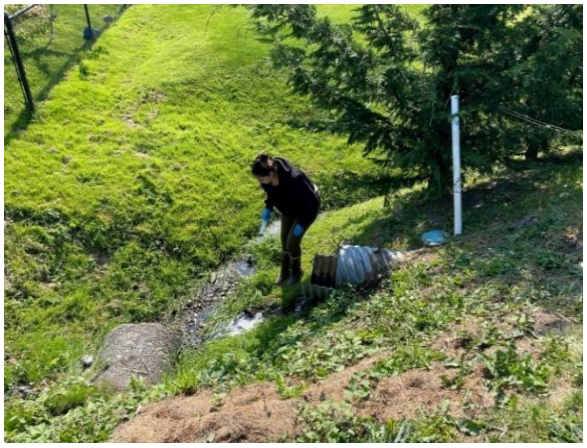
Key Takeaways:

- Water quality was Poor based on data collected in WY2023.
- The percentage of samples that exceeded the state limit of 320 MPN/100 mL was 22% (4 out of 18 samples)
- E. coli levels higher than previous year, high hits during Oct to Dec.
- Temperatures mostly below state threshold, however maximum temperature recorded in 2023 over standard: 21.31˚C
- Dissolved Oxygen annual geomeans met standard, 2023 minimum DO barely met standard: 8.01 mg/L
- Stream flowed 12 out of 12 months, Max Discharge: 2.49 cfs, Min: 0.01 cfs



Sampling Summary:

The geomean was 50 MPN/100 mL which is under state limits but the seasonal geomeans did exceed state standards. This stream flowed consistently throughout the year with lower flows seen in summer and fall months. Higher E. coli levels were seen in Quarter 1. SWQ Team bracketed this stream several times this year due to repeated high hits. Historically this site has shown higher hits of fecal coliform all throughout the year, but WY2023 showed the majority of high hits Oct thru December. Water quality has decreased since WY2022.



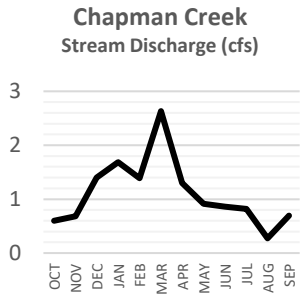
Stream Report Card: 69a- Chapman Creek

Site Description
This sampling site is located on the upstream (east) side of Sandy Beach Road, just before the stream flows in culverts into Saratoga Passage. The designated land use upstream from the sampling site is zoned for rural residential.

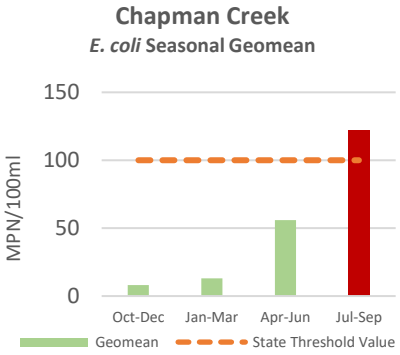
Chapman Creek Summary Statistics *Cells filled with light green meet state standards.

Six Year Trends	2018	2019	2020	2021	2022	2023	State Standard
Water Quality Status	Moderate	Good	Moderate	Moderate	Moderate	Moderate	
Pt 1: Max GM FC / *E. coli*	FC 75	FC 32	FC 75	38	178	122	<100
Pt 2: % Exceedances	0	0	0	17	0	5	<10

** WY2018-WY2021, WQI used to evaluate water quality status, WY2022-WY2023 only E. coli data used **



Key Takeaways:
- Water quality was Moderate based on data collected in WY2023.
- The percentage of samples that exceeded the state limit was 6% (1 of 18 samples)
- Annual E. coli levels higher than previous year, high hits during July to Sept. Failed Part 1 of standard.
- Temperatures mainly at or below state threshold, however maximum temperature recorded in 2023 was over standard: 20.01˚C
- Dissolved Oxygen annual geomeans met standard, WY2023 minimum DO met standard: 8.55 mg/L
- Stream flowed year-round, Max discharge: 2.63 cfs, Min: 0.27 cfs



Sampling Summary:
The annual geomean was 29 MPN/100 mL which is under the state limit of 100 MPN/100 mL but the seasonal geomeans during July-September exceeded state standards. A high hit recorded in August led to bracketing upstream; however, no additional high hits were reported and by September *E. coli* numbers had gone down to below state thresholds. The SWQ team worked with Environmental Health at this site to attempt to identify the source of high hits through AMAT.

Stream Report Card: 70a- Sunset Creek

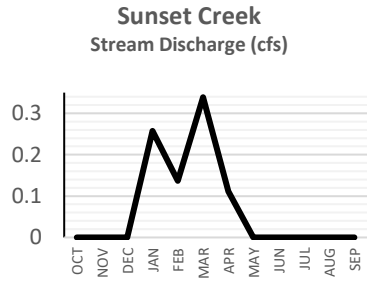
Site Description

Along the southern portion of Sunset drive, just before West Camano Drive. Site is on southern side of private driveway, in ravine shaded area with large numbers of tall trees. The land upstream (southeast) of the sampling location was cleared for a new housing development beginning April, 2007. An upstream site was also monitored to determine possible effects from the development or the wetland above the site.

Sunset Creek Summary Statistics *Cells filled with light green meet state standards

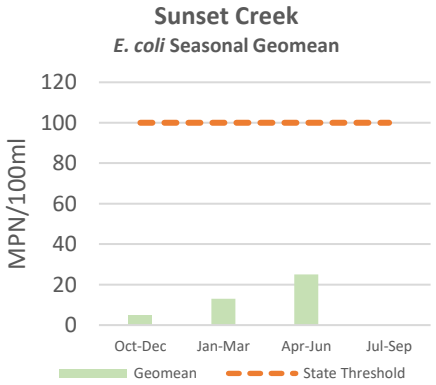
Six Year Trends	2018	2019	2020	2021	2022	2023	State Standard
Water Quality Status	NA	NA	NA	NA	NA	Good	
Pt 1: Max GM FC / *E. coli*	NA	NA	NA	NA	NA	25	<100
Pt 2: % Exceedances	NA	NA	NA	NA	NA	0	<10

** WY2018-WY2021, WQI used to evaluate water quality status, WY2022-WY2023 only E. coli data used **



Key Takeaways:

- Water quality was Good based on data collected in WY2023.
- The percentage of samples that exceeded the state limit 320 MPN/100 mL was 0% (0 out of 6 samples).
- This is a rotational site that has been sampled in the past, last year of sampling was WY2015 but will be on the rotation for the updated SWQMP
- E. coli levels low, no high hits observed, met both parts of standard.
- Temperature below state threshold, maximum temperature recorded in 2023 below standard: 7.24 ˚C
- Dissolved Oxygen annual geomean met standard, 2023 minimum barely met standard: 8.08 mg/L
- This stream flowed 5 out of 12 months, Max discharge: 0.34 cfs, Min: Dry



Sampling Summary:

The annual geomean for WY2023 was 14 MPN/100 mL under the state limits and the seasonal geomeans met state standards of 100 MPN/100ml. Due to the stream not flowing in the first and fourth quarter, sampling was restricted by lack of stream flow and only conducted for four months from late December to April. Stream channel observed with defined stream edges.

Stream Report Card: KC1- Kristoferson Creek

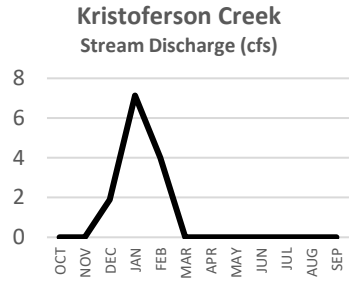
Site Description

This site is on the north side of Russell Road at Kristoferson Creek main stem culvert. It has a long history of restoration and is considered a priority fish-bearing stream. The designated land use upstream from the sampling site is mixed use, zoned rural, and designated for agriculture and light manufacturing.

Kristoferson Creek Summary Statistics *Cells filled with light green meet state standards

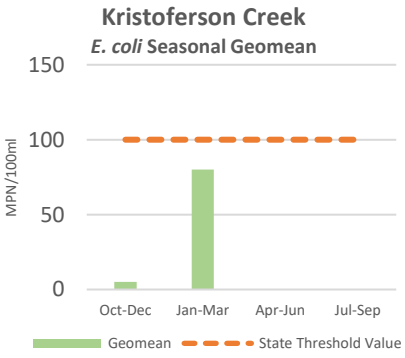
Six Year Trends	2018	2019	2020	2021	2022	2023	State Standard
Water Quality Status	Moderate	Good	Good	Good	Moderate	Good	
Pt 1: Max GM FC / *E. coli*	FC 171	FC 51	FC 54	28	304	80	<100
Pt 2: % Exceedances	5	4	0	0	0	0	<10

** WY2018-WY2021, WQI used to evaluate water quality status, WY2022-WY2023 only E. coli data used **



Key Takeaways:

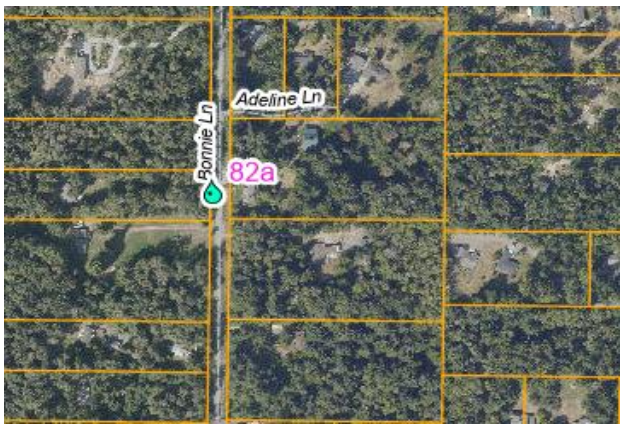
- Water quality was Good based on limited data collected in WY2023.
- The percentage of samples that exceeded the state limit 320 MPN/100 mL was 0% (0 of 3 samples)
- Majority of the year this stream was stagnant or low flowing
- E. coli levels comparable to previous year, met both parts of standard.
- Temperatures mainly at or below state threshold, maximum temperature recorded in 2023 well under standard: 7.10 ˚C
- Dissolved Oxygen annual geomeans met standard, 2023 minimum DO met standard: 11.49 mg/L
- This stream flowed 3 out of 12 months, December to February. Max discharge: 7.13 cfs, Min: Dry



Sampling Summary:

The annual geomean was 32 MPN/100 mL under the state limits and the seasonal geomeans met state standards of 100 MPN/100ml. Samples were able to be taken 3 out of 12 months due to the lack of flow caused by low precipitation and ponding of the water. SWQ team was able to collect water quality samples at the main site from December thru February. Stream stagnation led to bracketing of reconnaissance sites above and below the restoration area as well as nearby culverts. In previous years, ponding also led to surface water quality bracketing upstream to determine the possible causes of fecal pollution observed.

Stream Report Card: 82a- Bonnie Lane

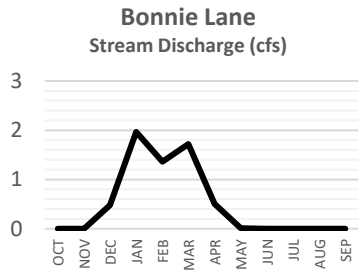


Site Description
Site is at the outlet of a channel draining through a forested wetland. After it hits Bonnie Lane, water is conveyed downstream in a road-side ditch. There is alder forest/shrub immediately around the site. Bonnie Lane is an outlet of a unmarked stream draining Lost Lake. Wetland improvement efforts are evident: clearing of non-native vegetation (blackberries) and marking of wetland areas.

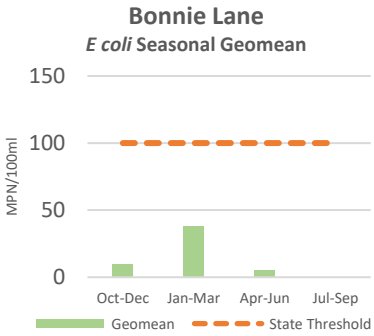
Bonnie Lane Summary Statistics *Cells filled with light green meet state standards

Six Year Trends	2018	2019	2020	2021	2022	2023	State Standard
Water Quality Status	NA	NA	NA	NA	NA	Good	
Pt 1: Max GM FC / *E. coli*	NA	NA	NA	NA	NA	38	<100
Pt 2: % Exceedances	NA	NA	NA	NA	NA	0	<10

** WY2018-WY2021, WQI used to evaluate water quality status, WY2022-WY2023 only E. coli data used **

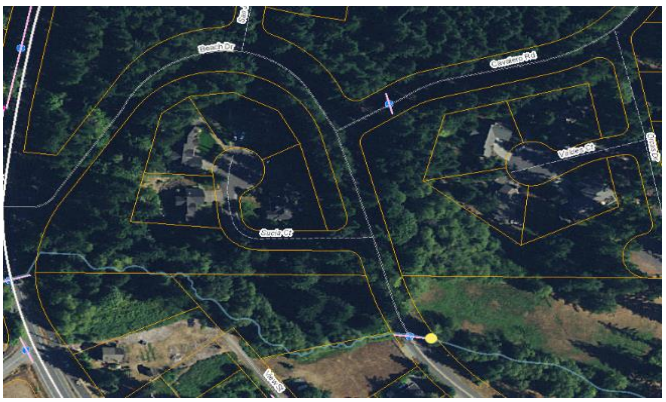


Key Takeaways:
- Water quality was Good based on data collected in WY2023.
- The percentage of samples that exceeded the state limit 320 MPN/100 mL was 0% (0 out of 6 samples)
- E. coli levels lower than threshold, annual geomean was 15 MPN/100ml.
- Temperatures mainly below state threshold, however, maximum temperature recorded in 2023 above the state standard: 19.51 ˚C
- Dissolved Oxygen annual geomeans met standard, 2023 minimum DO met standard: 6.88 mg/L
- This stream flowed 4 out of 12 months, Max discharge: 1.9656 cfs, Min: Dry



Sampling Summary:
Annual and seasonal geomeans were below state standards of 100 MPN/100ml. Samples were able to be taken 5 out of 12 months with the site being dry from October to November and from June to September. Data for this location may not have been representative of ambient water quality due to the inability to collect samples year-round. In previous years water quality was unable to be measured consistently due to dry conditions.

Stream Report Card: 74a- Cavalero Creek

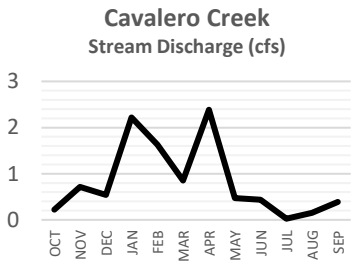


Site Description
This perennial stream begins as a series of ponds then drops into a forested ravine between dense developments with two road crossings before discharging into Port Susan. The area immediately upstream from the sampling site is zoned for rural residential and designated to be an urban area.

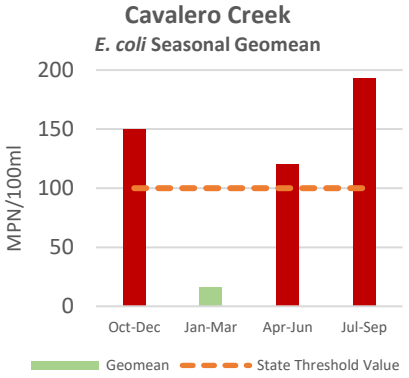
Cavalero Creek Summary Statistics *Cells filled with light green meet state standards

Six Year Trends	2018	2019	2020	2021	2022	2023	State Standard
Water Quality Status	Moderate	Moderate	Moderate	Good	Moderate	Poor	
Pt 1: Max GM FC / *E. coli*	116	289	143	64	120	193	<100
Pt 2: % Exceedances	0	14	7	0	0	18	<10

** WY2018-WY2021, WQI used to determine water quality status, WY2022-WY2023 only E. coli data used **



Key Takeaways:
- Water quality was Poor based on data collected in the WY2023
- The percentage of samples that exceeded the state limit of 320 MPN/100 mL was 19% (5 out of 27 samples)
- E. coli levels higher than previous year, high hits during Quarters 1, 3 and 4. Failed Parts 1 and 2 of standard.
- Temperatures mainly at or below state threshold, however maximum temperature recorded in 2023 over standard: 22.25˚C
- Dissolved Oxygen annual geomeans met standard, 2023 minimum DO just met standard: 8.20 mg/L
- Stream flowed all year, Max discharge: 2.39 cfs, Min: 0.03 cfs



Sampling Summary:
Water quality has decreased since WY2022. The annual geomean was slightly under the state threshold of 100 MPN/ml, but seasonal geomeans exceeded the state threshold during the fall, spring and summer months. Cavalero Creek is a fish bearing stream and is one of the newer box culverts installed in the summer of 2021. This stream flowed throughout the year and was consistently sampled. Multiple high hits lead to Source ID bracketing above to the culvert on Beach Road which came back with high results in August and September and site was referred to AMAT. Bracketing upstream to Lawson Road showed a higher hit as well but results were not conclusive due to dry conditions. The sample site showed high geomeans for each quarter except Jan – Mar with the highest occurring in the fourth quarter of the water year (Jul – Sep). Further bracketing will be conducted to determine the source.

DISCUSSION

Data Collection and EIM Submission

The primary objectives of Island County's Surface Water Quality Monitoring Program (SWQMP) are to collect reliable surface water quality data, identify areas where water quality standards are being exceeded and identify the sources of those exceedances, and to collaborate with other departments and outside agencies to address the source of exceedances with the Adaptive Management Action Team (AMAT).

Collaboration includes working with the Department of Ecology (ECY) and submitting our data to the Environmental Information Management (EIM) database. This involves extensive review and research to eliminate gaps in the data, include weather and tidal conditions, as well as conduct data correction and alignment with EIM standards of submittal. The EIM data uploads also include monthly updates to the newly revamped SQL database. The EIM upload was created in coordination with the Island County IT department to format requests for downloading reports from the SQL database. Standard Operating Procedures (SOPs) for data submission were developed for more effective EIM data transfer. ECY is developing protocols for the transfer to the national water quality EPA database, WQX. "The Water Quality Exchange (WQX) is the mechanism for data partners to submit water monitoring data to EPA. The Water Quality Portal (WQP) is the mechanism for anyone, including the public, to retrieve water monitoring data from EPA (EPA 2023).

In addition to data collection for core and rotational monitoring, the SWQMP staff performs reconnaissance, source identification, and effectiveness water quality monitoring, and coordinates public outreach activities. The following activities were carried out during WY2023.

Reconnaissance Monitoring

Reconnaissance monitoring was intended to explore water quality outside of the regular core watershed sample sites, identify areas with water quality impairments that may need further investigation, and check for watersheds that may have experienced a land use change. Reconnaissance monitoring occurred at sampling locations selected based on the presence of priority resources and estimation of current pollution risk, identified in the Adamus & Eilers (2006) report. Water quality staff used results to determine whether a site merited the addition to core or rotational sample sites or required a source identification investigation.

- Reconnaissance monitoring was conducted in Livingston Bay, the south region of Camano Island, Strawberry Point, Penn Cove, South Holmes Harbor, and Maxwelton Valley on Whidbey Island. In these areas, residential and commercial shellfish harvest operations were closed or under threat of being closed due to marine water quality impairment identified by the Washington State Department of Health (WADOH). Private and commercial shellfisheries have been identified as a priority resource for Island County.
- Monitoring revealed impairments that were shared with and addressed by the Island County Onsite Septic (OSS) team.
- Investigated complaints of onsite septic failures on both Camano and Whidbey Islands in support of Island County's OSS Program and working with AMAT.
- Reconnaissance monitoring in the Race Lagoon area in anticipation of salmon recovery efforts and restoration projects.
- Monitoring will continue in the future in concurrence with the Pollution Identification and Correction (PIC) program, with grant funding from the State awarded until the year 2027. The goals of the PIC program are outlined in more detail in the Adaptive Management section of this report.

Source Identification

Source Identification (Source ID) water quality monitoring was initiated when monitoring trends indicated areas with repeated exceedances of water quality standards that rose above the Statistical Threshold Value (STV) for *E. coli* (Figure 6). Source ID narrowed down possible sources of pollution through:

- Monitoring intensification, which involves increasing the number and locations of monitoring points upstream and downstream from the original sample point (a process known as "bracketing"), until geographic pinpointing of the pollution source(s) is/are achieved;

- Increasing the frequency and/or timing of monitoring at the original sample point to pinpoint the activity in that location that may be influencing sample results

Once the bracketing process has narrowed down the likely area to a section of a waterbody, the AMAT works to determine if the cause is natural, such as driven by wildlife, or if it is likely human caused, such as a failing septic system. Nearby parcels are investigated for current septic inspection compliance, and if needed, a courtesy letter is sent out to those parcels to remind the landowner to bring septic systems up to date. In WY2023, letters were sent out to communities near Maxwelton Creek, Cultus Creek, and surrounding the Maple Grove boat launch in response to sustained high levels of fecal bacteria. While there were other areas that were identified as having increased *E. coli* levels and were undergoing source identification, the actual cause was unable to be determined before the levels dropped.

Beginning in WY2024, the SWQ team will begin using a new method to detect *E. coli* in source identification investigations quicker than in previous years. This method uses R-Cards, a product designed to detect *E. coli* colonies within 24 hours rather than waiting multiple weeks for official lab results. Using this method, the SWQ team will be able to bracket multiple locations in one day, and from those results better gauge where the most pollution is located. Once that is determined, and official lab sample is also collected for a more accurate colony count and subsequent follow up actions as necessary.

Source Identification Success

While doing reconnaissance sampling out near Strawberry Point in Oak Harbor, high levels of *E. coli* were detected. The SWQ team resampled and bracketed in three separate directions from where the waters converged. It was determined that one of the three branches was the only one with elevated bacteria levels, so the SWQ team walked the stream path to see if there was anything easily identifiable and discovered a dead deer in the waterway. It appeared that the recent rains had washed over the dead animal and caused the contamination and would be easily removed. Subsequent sampling in that location yielded once again low levels of *E. coli*. Another example of the benefit of a Source ID process can be seen at the Maple Grove boat launch area, outlined in more detail below.

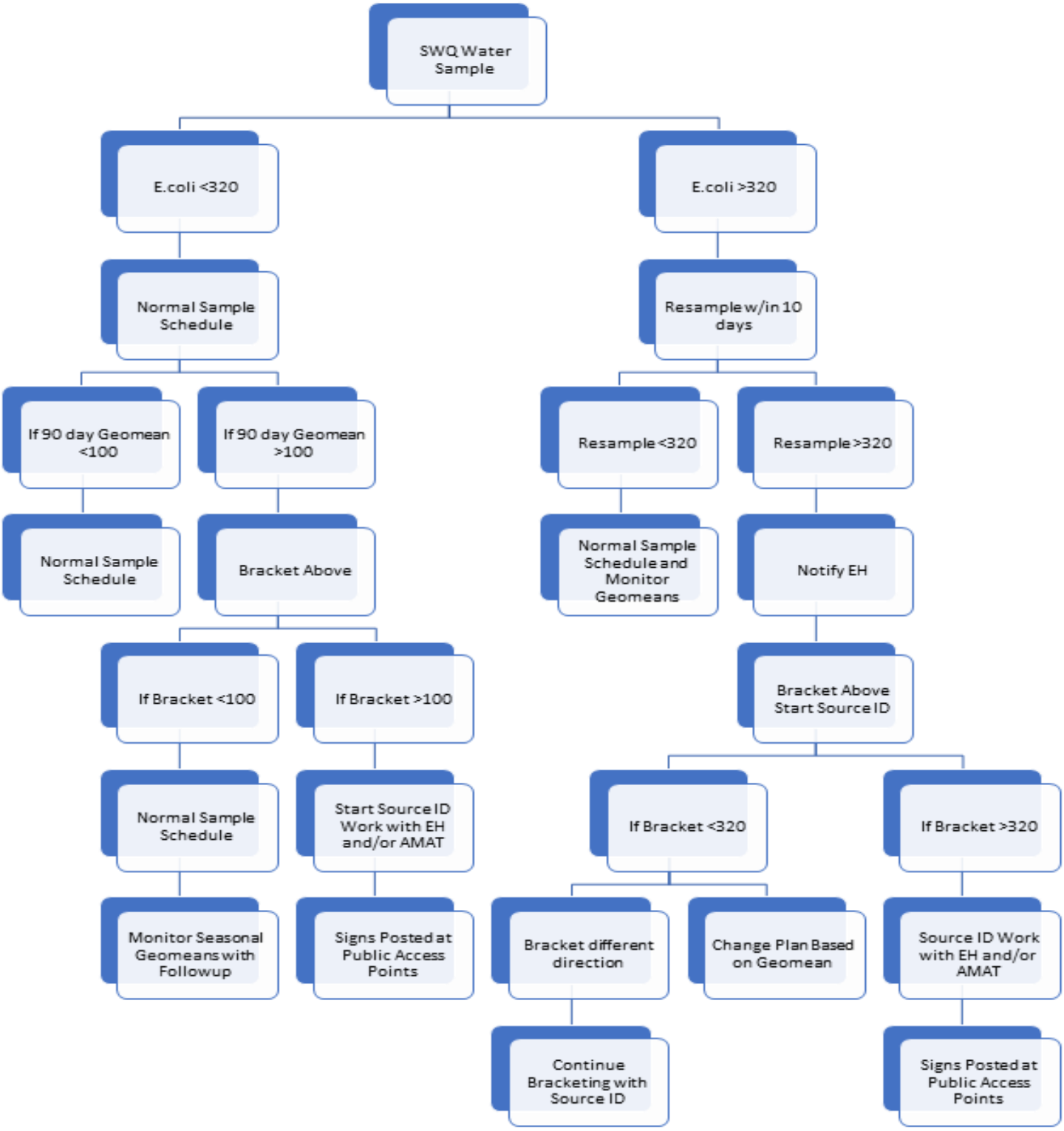


Figure 6. Island County source ID bracketing decision tree

Adaptive Management

The Adaptive Management Action Team (AMAT) is a vital piece of the SWQMP, composed of several other county departments, that meets regularly to discuss water quality impairment data to inform and direct prioritization of areas of overlapping concerns and potential Island County code violations. Education and outreach are a vital piece of the AMAT and provides community members with resources which help them address Federal, State, and Local Critical Areas Ordinance (CAO) violations. The Island County AMAT includes Island County Surface Water Quality (SWQ) staff, Island County Environmental Health Onsite Septic (OSS) team, Whidbey Island Conservation District staff, Island County Public Works staff, and Island County Planning & Community Development Department staff.

During Water Year 2023, a number of continued exceedances of water quality standards were recorded, so a Source ID bracketing process was initiated for each of these sites. In addition to Source ID, reporting and sharing of information related to each specific site was implemented with a plan for determining next steps and corrections by an interdepartmental coordination and communication process. These steps can include sending letters out to residents around sites with repeated exceedances to have their septic systems inspected, educational materials sent out to provide information on septic providers and Island County Code, and investigating alternative sources of pollution that may not be related to homeowner septic violations. Occasionally they can find outside funding sources to assist the community in achieving full septic compliance.

The SWQ team has collaborated with the OSS team to investigate complaints of onsite septic failures on both Camano and Whidbey Islands. Bracketing as part of Source ID investigations resulted in notification letters sent to neighboring property owners from the OSS team for septic compliance. Resources were shared monthly amongst team members to come up with a plan to provide additional resources and education to community members.

Maple Grove

Recent monitoring conducted at Maple Grove is an example of the importance of AMAT and the adaptive management process. The Maple Grove boat launch on Camano Island is surrounded by residential homes, many of which are many decades old. Some of these homes have old and/or failing septic systems which can allow fecal pollution to reach the nearby marine waters. Water quality samples taken at Maple Grove boat launch showed exceedances of *E. coli* levels nearly all year. In following standard procedures, the SWQ team bracketed up the waterway at several other sample sites in the vicinity but were unable to pinpoint the exact source of pollution. The Public Health department posted an advisory at the boat launch to be cautious with water contact due to this pollution, while simultaneously sending letters out to residents to bring septic inspections up to date as they may be contributing to the problem. Additionally, the County held a town hall to talk with residents and answer questions related to the water quality and septic health. In response, many residents called the County and discussed options and received helpful information on how to address their systems, and many are now connecting to an alternative system. With recent funding procured for reinstatement of the Island County PIC program, there will be better tools and resources to be able to pinpoint the source of pollution in this area, should the exceedances occur again.

Source Identification Monitoring and Pollution Identification and Correction (PIC) Support

The Pollution Identification and Correction (PIC) program is a program identified in the Puget Sound Action Agenda as an essential component in restoring and protecting the many shellfish beds in the region. Implemented by many local governments, the program aims to focus pollution identification efforts in targeted areas that have significant impacts on shellfish beds. Island County was without a PIC program in WY2023, however, funding was secured for WY2024 and will be used to focus on the shellfish growing areas of Maple Grove on Camano Island, the Freeland Park region of Holmes Harbor, and the Dave Mackie Memorial Park area of the Maxwelton watershed.

The goals of the PIC program are to use water quality data to identify areas of fecal pollution and then collaborate with other departments to facilitate corrective action(s) to be taken. These include education, outreach, and any other corrective actions deemed necessary based on partnering departmental procedures. The program is used in tandem with guidance from Washington Department of Health and Washington Department of Ecology to find practical and tangible solutions to pollution problems in our county.

Shellfish

The Growth Management Act of Washington, RCW 36.70A outlines the goals of the Monitoring Plan to ensure that critical areas are protected from impacts and to protect Island County ground water resources and surface water resources. Swim beaches and shellfish harvesting areas are important to Island County's recreation opportunities and economy.

WADOH is interested in water quality in Island County for the following Growing Areas on Whidbey Island: Southwest Whidbey, Possession Sound, Holmes Harbor, and Penn Cove. According to WADOH this review will document any changes in pollution sources, new freshwater quality data, and recent onsite sewage system evaluations that may impact safe shellfish harvest.

Success Stories: Penn Cove / Freeland areas reopened

According to the Island County Shellfish Harvesting Coordinator, "For shellfish, Penn Cove from Long Point to Strawberry Point was opened to the harvest of butter and varnish clams after the long biotoxin closure. Additionally, there were the parcels in Holmes Harbor that were opened back up after ongoing bacterial pollution closures."

Onsite Septic Systems

Island County SWQ team works carefully with the OSS team and regularly meet to share information on surface water quality locations that are receiving higher counts of *E. coli* in surface water to compare if they are near septic systems in need of maintenance. Both teams work cooperatively and share information in both directions, receiving lists of code violation cases in septic failures as well as communicating higher hits in sampling information. This relationship is critical and helps the OSS team make decisions on prioritizing septic repair permits in areas that are impacting habitat. The prioritization of repair permits has not only helped affect changes in water quality but also becomes important for when the State Department of Health requests our data in relationship to shellfish growing areas.

Salmon Recovery

Island County provides critical shoreline rearing and resting areas that juvenile salmon headed to the ocean first use when coming from the Skagit, Snohomish, and Stillaguamish Rivers. Using the habitat are three species listed as threatened per the Endangered Species Act (Chinook, bull trout, and Hood Canal summer chum), as well as other salmon species and the prey they eat in the Island County watershed. Water Resource Inventory Area (WRIA) 6, which encompasses all of Island County, contains 213 miles of shoreline and 30.3 miles of fish bearing streams.

The following information is taken from the Multi Species Salmon Recovery Plan Update of 2019 (Pucci 2019):

"It is well known that during the lifetime of salmon, the highest mortality often occurs when they are juveniles. Of major concern is that stage when they are transitioning from their home rivers and estuaries to feed and grow in the ocean (Quinn 2005). The watersheds of WRIA 6 in Island County are comprised of streams that are too small to support much salmon spawning. This means that the marine nearshore habitats, pocket estuaries, and the small streams themselves provide vital transition habitat for out-migrating juveniles from the large rivers draining to the Whidbey Basin (Zackey et al., 2015).

"Because changes in the nearshore marine environment are implicated in the status of imperiled fish populations, the WRIA 6 salmon recovery strategies are focused on protecting the diverse marine nearshore and estuarine habitats near three major rivers - the Skagit, Stillaguamish and Snohomish. The central location of WRIA 6 in the Salish Sea, at the junction of Puget Sound, the Strait of Juan de Fuca and Georgia Strait, places it on the migration corridors used by most Puget Sound juvenile and adult salmon and trout populations.

"As these fish move to and from their respective natal streams and rivers, nearshore and coastal estuaries in WRIA 6 provide critical feeding areas and/or shelter from wave energy and predators. Many spawning beaches and eelgrass

beds are used by forage fish – surf smelt, sand lance and herring – which salmonids feed on or rely on as a buffer prey for predators. Eelgrass beds provide refuge to juvenile salmonids from both predators and high-energy marine environments. Sheltered beaches, bays, and lagoons also provide resting areas for adult salmonids. In addition to marine habitats, freshwater and tidally influenced streams in WRIA 6 provide valuable stream habitat for juvenile fish to rest in during their early marine out-migrations. Anadromous fish need these areas to adapt to salt water after rearing in freshwater in these coastal streams (Beamer et al. 2013; Zackey et al., 2015)."

Island County Salmon Recovery Plan strategies will continue to be centered on prioritizing the protection of functional lower stream mouths and their pocket estuaries that are critical to resting, feeding, and refuge for migrating salmon. These areas and other important shorelines provide spawning and rearing areas for juvenile forage fish (Pacific herring, surf smelt, and Pacific sand lance), which serve as an important prey source for salmon as they migrate through Island waters on their way to the ocean.

Outreach and Education

The Surface Water Quality Monitoring Program (SWQMP) prioritizes education and outreach as a vital part of our program to protect and improve water quality in Island County. Outreach and education events were again provided in WY2023. The SWQ team alongside our EH team participated in many local events including informational tables at the Penn Cove Water Festival, Island County Fair, Whidbey 101 and Camano 101 to highlight water quality and pollution prevention methods. The teams introduced themselves to property owners and invited residents to feel free to stop and ask questions if they see Island County staff conducting water sampling in their neighborhoods.

In addition to showcasing our work at local events, SWQ staff also participated in outreach and education for younger community members. SWQ team has attended Children's Day in the past in the South Whidbey area to educate the younger population about surface water runoff in an engaging manner, and this past year also saw continued outreach initiative implemented for local school districts, and several teachers invited the SWQ team to their classrooms to present watershed and wetlands models and hands-on activities related to watershed health. Future classroom visits and field trips to sample sites will bring a working knowledge of the Surface Water Quality Program and research opportunities to local students.

CONCLUSION

There are many benefits of clean water and watershed health, including human health, livestock and wildlife health, and overall community health. These benefits are achieved through the guidance of plans such as the Puget Sound Salmon Recovery Plan, local shoreline master plans, and critical areas ordinances. Water Resource Inventory Area (WRIA) 6 is composed of Whidbey, Camano, and other smaller islands like Smith, Minor, Deception, Strawberry, Ben Ure, and Baby Island that hold unique ecosystems that require just as unique approaches to management to maintain the health benefits we all enjoy. WRIA 6 is unusual in that it lies solely within the boundaries of one county and contains no large river systems, and has a hard boundary line limiting growth, unlike many of our neighboring WRIAs. This has led to a lack of understanding on the importance of seasonal streams such as the ones discussed in this report that may not contain flowing water all year round. This has resulted in confusion or misinterpretation on the documented existence of streams, especially their channels and outlets, as well as how fish and other species utilize these systems. Because of the nature and importance of our seasonal streams and associated watersheds, there must be a constant reference to existing documentation and an emphasis on both current and historical monitoring of all aspects of water quality, especially stream flow trends.

Water Year 2023 marked a decrease in water quality status for several streams that have historically seen good water quality. This decrease can be attributed to several reasons, including increased development, lower flows caused by decreased rainfall and higher summer temperatures, and old or malfunctioning septic systems. Although the SWQ team was unable to do a detailed analysis of land uses compared to stream quality, studies have been conducted on the effects of land uses and how they impact overall stream health. A 2023 study by Lee et. al. highlights how important it is to consider a watershed scale approach to planning in order to minimize impacts to water quality. This same study points out that both water quality and biological diversity decreased in response to increased urban areas and agricultural uses. Urban development increases impervious surfaces, thereby increasing runoff from streets and driveways into waterways. This runoff can hold pollutants such as oils and chemicals from cars and equipment. In most areas of Island County, septic systems are utilized, but not always inspected or maintained. Faulty septic systems and inadequate drain field protections can allow untreated wastewater potentially carrying pathogens such as *E. coli*, household cleaning products, or other harmful chemicals to be released directly into the groundwater and or surface water (EPA). Agricultural practices have the potential to emit excess nitrogen and phosphorus concentrations, sediments from runoff, and animal waste, some of which can be mitigated by riparian buffers and best management practices designed to limit impacts to bordering streams.

Year to year Island County will continue to see fluctuations in surface water quality, precipitation amounts, and low flow conditions due to changes in climate. These fluctuations could have positive or negative impacts on our community, so it is vitally important to look at the long-range scope of water quality improvements and understand that increasing pressures through climate change and population density will create new challenges that will require collaboration between Island County departments and outside agencies. No matter if watersheds improve, remain the same, or decrease in water quality, the Island County Surface Water Quality Team is committed to utilizing the best available science to monitor streams and incorporate the adaptive management process outlined in this report into Water Year 2024 and beyond to provide continuous improvement of water quality in all our streams.

The water quality goals of the Island County Surface Water Quality Monitoring Plan remain the same: to continue to be focused on preventative and remedial actions to ensure that public health and critical areas are protected from negative impacts, and to protect Island County's ground water and surface water resources. By preserving and improving ecosystem conditions in streams, local swim beaches, estuarine salmon habitat, and shellfish harvesting areas, benefits will be felt by all of Island County through ecotourism and recreational opportunities, the enjoyment of green spaces and clean beaches, the recharge of our groundwater aquifers, and the natural beauty that draws us here.

GLOSSARY

Acronyms

AMAT Adaptive Management Action Team

BMP's Best Management Practices

CAO Critical Areas Ordinance

CEC's Contaminants of Emerging Concern

CFU Coliform Forming Units

DNR Department of Natural Resources

E. coli Escherichia coli

ECY Washington State Department of Ecology

EIM Environmental Informational Management System

EPA Environmental Protection Agency

GM Geometric Mean

GMV Geometric Mean Value

IC Island County

MPN Most Probable Number

OSS Onsite Septic

PIC Pollution Identification and Correction

SOP Standard Operating Procedure

Source ID Source Identification

STV Standard Threshold Value

SQL Database Structured query language relational database

SWQ Surface Water Quality

SWQMP Surface Water Quality Monitoring Plan

TMDL Total Maximum Daily Load

USGS U.S Geological Survey

WAC Washington Administrative Code

WADOH Washington State Department of Health

WQI Water Quality Index

WQP The Water Quality Portal (WQP)

WQX Water Quality Exchange (WQX)

WY Water Year

Definitions

Ambient Background or away from point sources of contamination. Surrounding environmental condition.

Anadromous Migrating up rivers from the sea to breed in fresh water.

Aquifers An aquifer is a body of porous rock or sediment saturated with groundwater. Groundwater enters an aquifer as precipitation seeps through the soil. It can move through the aquifer and resurface through springs and wells.

Best Management Practices Policies, practices, procedures, or structures implemented to mitigate the adverse environmental effects on surface water quality resulting from development. BMPs are categorized as structural or non-structural.

Contaminants of Emerging Concern Contaminants of Emerging Concern (CECs) are chemicals and toxics that have been found in waterbodies that may cause ecological or human health impacts and are not currently regulated

Coliform bacteria A group of bacteria predominantly inhabiting the intestines of humans or other warm-blooded animals, but also occasionally found elsewhere. Used as an indicator of human fecal contamination.

Conditionally approved shellfish Area When it meets Approved criteria some of the time but does not during predictable periods. During these periods the area is closed.

Conductivity A measure of the ability of water to pass an electrical current. This parameter indicates the quantity of dissolved substances (salts) present in the water.

Conservation Easement An easement restricting a landowner to land uses that are compatible with long-term conservation and environmental values.

Discharge The volume of water in a stream passing a given point at a given moment in time and is determined by measuring the stream channel cross-sectional area and the water's mean velocity at the selected site

Dissolved oxygen The concentration of dissolved oxygen (mg/L) in a water sample.

Dye Testing Using dye to Identify if a septic system is working properly.

E. coli A bacterium in the family Enterobacteriaceae named Escherichia coli and is a common inhabitant of the intestinal tract of warm-blooded animals, and its presence in water samples is an indication of fecal pollution and the possible presence of enteric pathogens.

Enterococci A subgroup of the fecal streptococci that includes S. faecalis, S. faecium, S. gallinarum, and S. avium. The enterococci are differentiated from other streptococci by their ability to grow in 6.5% sodium chloride, at pH 9.6, and at 10 degrees C and 45 degrees C.

Fecal Coliform That portion of the coliform group of bacteria which is present in intestinal tracts and feces of warm-blooded animals as detected by the product of acid or gas from lactose in a suitable culture medium within 24 hours at 44.5 plus or minus 0.2 degrees Celsius. Fecal coliform bacteria are “indicator” organisms that suggest the possible presence of disease-causing organisms. Concentrations are measured in colony forming units per 100 milliliters of water (cfu/100 mL).

Geometric Mean A mathematical expression of the central tendency (an average) of multiple sample values.

Harmful Algae Blooms When colonies of algae grow out of control and produce toxic or harmful effects on people, fish, shellfish, marine mammals and birds.

Non-point source pollution Pollution that enters any waters of the state from any dispersed land-based or water-based activities, including but not limited to atmospheric deposition, surface-water runoff from agricultural lands, urban areas, or forest lands, subsurface or underground sources, or discharges from boats or marine vessels not otherwise regulated under the NPDES program. Generally, any unconfined and diffuse source of contamination. Legally, any source of water pollution that does not meet the legal definition of “point source” in section 502(14) of the Clean Water Act.

Noxious Weeds Noxious weeds are invasive, non-native plants that threaten agricultural crops, local ecosystems, or fish & wildlife habitats.

Perennial Stream Flowing throughout the year.

pH A measure of the acidity or alkalinity of water. A low pH value (0 to 7) indicates that an acidic condition is present, while a high pH (7 to 14) indicates a basic or alkaline condition. A pH of 7 is neutral. Since the pH scale is logarithmic, a water sample with a pH of 8 is ten times more basic than one with a pH of 7.

Pocket estuaries Protected estuaries and lagoons within which there is too little wave action to form beaches.

Pollution Contamination or other alteration of the physical, chemical, or biological properties of any waters of the state. This includes change in temperature, taste, color, turbidity, or odor of the waters. It also includes discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state. This definition assumes that these changes will, or are likely to, create a nuisance or render such waters harmful, detrimental, or injurious to (1) public health, safety, or welfare, or (2) domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or (3) livestock, wild animals, birds, fish, or other aquatic life.

Pour Point The point on the surface at which water flows out of an area. It is the lowest point along the boundary of a watershed.

Restricted Shellfish Area Water quality does not meet standards for an Approved classification, but the sanitary survey indicates a limited degree of pollution from non-human sources. Shellfish harvested from Restricted growing areas cannot be marketed directly. They must be relayed (transplanted) to Approved growing areas for a specified amount of time, allowing shellfish to naturally cleanse themselves of contaminants before they are harvested for market.

Salinity The relative concentration of dissolved salts, usually sodium chloride, in each water.

Septic system Septic System is an on-site system designed to treat and dispose of sewage.

Shellfish beds Shallow and deep-water habitats with substrates consisting of mollusk shells. [EPA Habitat Categories/Habitat Protection at http://www.epa.gov/owow_keep/estuaries/pivot/habitat/habtype.htm]

Statistical Threshold Value STV is a measure of variability of your water quality distribution, derived as a model-based calculation approximating the 90th percentile using the lognormal distribution.

Surface Water All water naturally open to the atmosphere, such as rivers, lakes, reservoirs, ponds, streams, estuaries, and springs.

Turbidity A measure of water clarity. High levels of turbidity can have a negative impact on aquatic life.

Wetlands An area that is saturated by surface or ground water with vegetation adapted for life under those soil conditions, as swamps, bogs, fens, marshes, and estuaries.

REFERENCES

Adamus P., Eilers J. 2006. *Draft Water Quality Data Synthesis and Recommendations for a Surface Freshwater Monitoring Program.* Island County Department of Planning and Community Development, Coupeville, WA.

Assessment of State Waters 303d. Washington State Department of Ecology. Undated. https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-improvement/Assessment-of-state-waters-303d. Accessed November 2022.

Beamer, E., et al. 2013. *Juvenile Chinook salmon rearing in small non-natal streams draining into the Whidbey Basin.* Skagit River System Cooperative. La Conner, Washington.

EIM — Environmental Monitoring Data. Environmental Information Management database – Washington State Department of Ecology. (n.d.). https://ecology.wa.gov/Research-Data/Data-resources/Environmental-Information-Management-database

Encyclopedia of the Puget Sound. 2002, July 1. *Water Resource Inventory Areas in Puget Sound.* Puget Sound Institute, UW Tacoma Center for Urban Waters. https://www.eopugetsound.org/articles/water-resource-inventory-areas-puget-sound#:~:text=WRIA%206%3A%20Island%20County,de%20Fuca%20and%20Admiralty%20Inlet

Environmental Protection Agency. 2023, March 24. *Water Quality Data.* EPA. https://www.epa.gov/waterdata/water-quality-data

Environmental Protection Agency. 2013, October 30. *Streams*. EPA. https://archive.epa.gov/water/archive/web/html/streams.html

Fresh water designated uses and criteria. WAC 173-201A-200: (n.d.). Washington State Legislature.

Ground Water Protection Council. 2022. *Op Ed: Decentralized Wastewater Infrastructure – Challenges and Opportunities*. Memo by Mary Clark, MDB, Inc, and EPA Decentralized Wastewater MOU Partners. https://www.gwpc.org/op-ed-decentralized-wastewater-infrastructure-challenges-and-opportunities/

Growth Management-Planning by Selected Counties and Cities. Chapter 36.70a RCW: (n.d.). Washington State Legislature.

Hallock, D. 2002. *A Water Quality Index for Ecology's Stream Monitoring Program*. Washington State Department of Ecology. Publication No. 02-03-052.

Helsel, D.R., & Frans, L.M. 2006. *Regional Kendall test for trend.* Environmental Science & Technology, 40(13), 4066–4073. doi.org/10.1021/es051650b

Island County Noxious Weed List. Island County WA. 2022. https://www.islandcountywa.gov/344/Noxious-Weeds. Pamphlet.

Jian, X., et al. 2022. *Streamflow -- Water Year 2021: U.S. Geological Survey Fact Sheet 2022-3072.* U.S. Geological Survey, Reston, Virginia. doi.org/10.3133/fs20223072.

Lee, Jong-Won et. al. 2023. *Effect of Land Use on Stream Water Quality and Biological Conditions in Multi-Scale Watersheds*. Water, 15(24). https://doi.org/10.3390/w15244210

Onsite Sewage Septic Systems. Island County WA. https://www.islandcountywa.gov/190/Onsite-Sewage-Septic-Systems. Accessed November 2022.

Pucci, D. June 2019. *Multispecies Salmon Recovery Plan Update: WRIA 6 (Whidbey & Camano Islands).* Addendum to the WRIA 6 Multi-Species Salmon Recovery Plan (2005) adopted by Island County.

Quinn, T. P. 2005. *The Behavior and Ecology of Pacific Salmon & Trout.* American Fisheries Society. Bethesda, Maryland in association with the University of Washington Press, Seattle, Washington.

Salmon Recovery Plan (SRP) Technical Advisory Group: WRIA 6. 2005. *WRIA 6 (Whidbey & Camano Islands) Multi-Species Salmon Recovery Plan.* Adopted by the Island County Water Resources Advisory Committee and Board of Island County Commissioners.

Swimming Standard and Water Quality. Washington State Department of Ecology. Undated. ecology.wa.gov/Water-Shorelines/Water-quality/Saltwater/BEACH-program/Swimming-standard-and-water-quality

U.S. Census Bureau. 2020. *Quick facts: Island County, Washington*. https://www.census.gov/quickfacts/fact/table/islandcountywashington/PST040222

Zackey, T., et al. 2015. *Application of a Predictive Model to Identify Coastal Streams in the Whidbey Basin with Juvenile Chinook Presence.* Tulalip Tribes, Skagit River System Cooperative, Northwest Indian Fish Commission.