

CHAPTER 6. WATER QUALITY

6.1 EXISTING WATER QUALITY DATA

The detailed listings of the Washington Department of Ecology's 1998 and 1994 *Washington State Water Quality Assessment; Section 305(b) Reports* were used to review beneficial uses and impairments of Vashon and Maury Island. The Washington Department of Ecology 1998 *303(d) List of Impaired and Threatened Waterbodies* is the current list for water quality impairment status. No waters on Vashon Island were listed in the 1998 303(d) list. A segment of Judd Creek was identified in Ecology GIS data, but there was an apparent mapping error as the attached information was for a watercourse in Mason County. The marine waters of Quartermaster Harbor and Puget Sound east of Vashon are 303(d) listed for dieldrin and dissolved oxygen (Quartermaster Harbor) and pH (Puget Sound, east of Vashon).

Data from 20 King County sampling stations were available for review of water quality on Vashon-Maury Island. The gauging stations and drainage basins are shown in Figure 6-1.

6.1.1 Water Quality Standards

Streams on Vashon Island drain directly to Puget Sound, which is classified as Class AA marine waters. As such, all streams on Vashon Island are classified AA by default (WAC 173-201A). Table 6-1 lists water quality standards that apply to Class AA waters. Beneficial Uses for Class AA streams include the following:

- Water supply
- Stock watering
- Fish and shellfish habitat, fishery, and migration
- Wildlife habitat
- Recreation
- Commerce and navigation

State water quality standards may change in the near future. The Department of Ecology issued a final rule on July 1, 2003, and the U.S. Environmental Protection Agency and other federal agencies must approve the rule before it becomes effective, which may take several months. It does not appear that the changes in standards would materially affect conclusions about water quality on Vashon-Maury Island. It may be desirable to update the water quality review after final adoption of the proposed new standards and the gathering of additional data.

TABLE 6-1.
CLASS AA CRITERIA FOR FRESHWATER STREAMS

Water Quality Parameter	Requirement
Fecal coliform	Shall not exceed a geometric mean value of 50 colonies/100 ml, and shall not have more than 10% of all samples obtained for calculating the geometric mean value exceeding 100 colonies/100 ml.
Dissolved Oxygen (DO)	Shall exceed 9.5 mg/L
Total Dissolved Gas	Shall not exceed 110 percent of saturation
Temperature	Shall not exceed 16.0°C due to human activities. When natural conditions exceed 16.0°C, no temperature increases will be allowed that increase water temperature by more than 0.3°C.
PH	6.5 to 8.5, with human-caused variation of less than 0.2 units
Turbidity	Shall not exceed 5 NTU (nephelometric turbidity units) over background when background is 50 NTU or less, or have more than a 10% increase in turbidity when the background turbidity is more than 50 NTU.
Toxic, Radioactive or Deleterious Materials	Specific criteria per WAC 173-201A-(040-050)
Aesthetic Values	Shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.

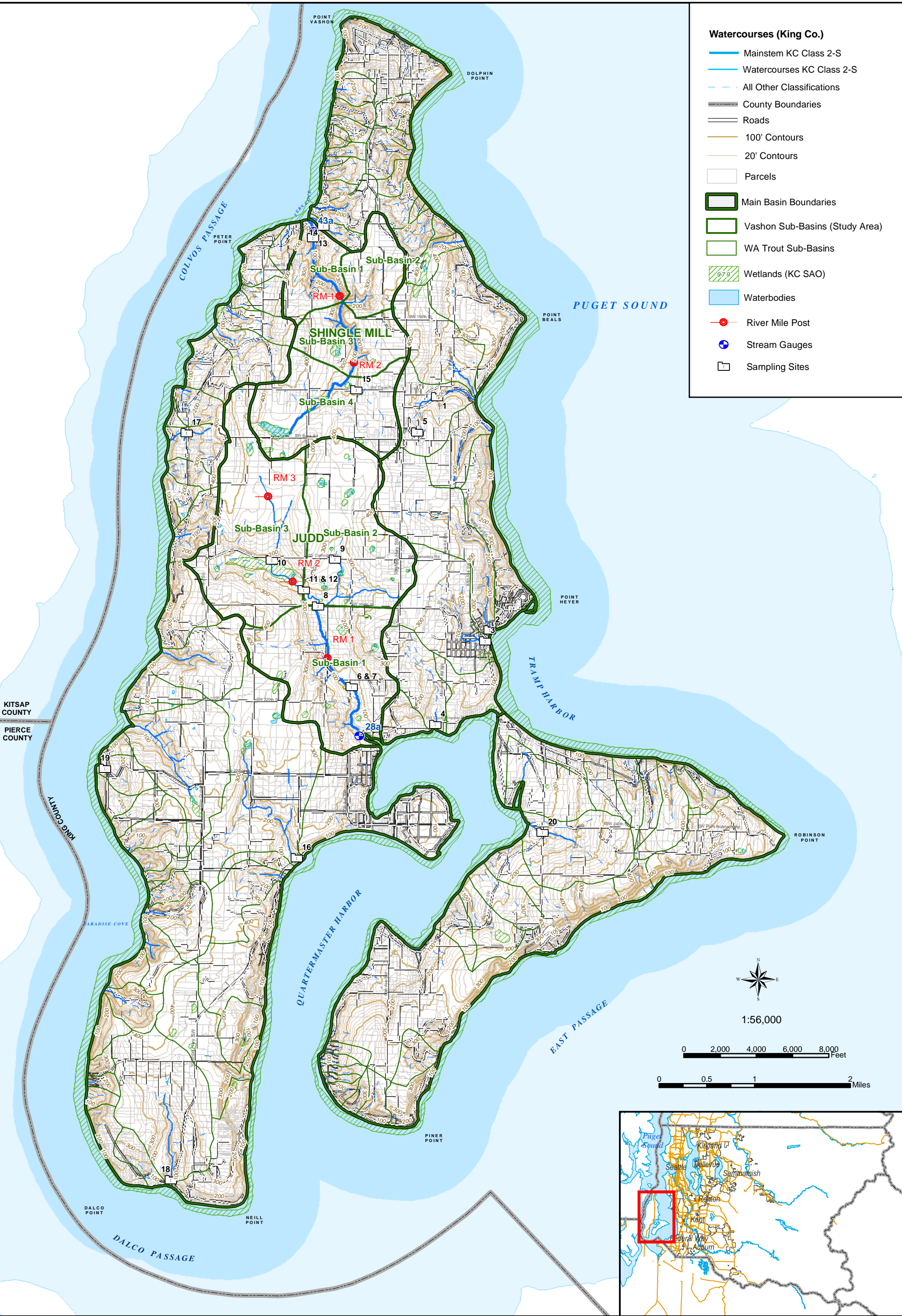
Source: Chapter 173-201A WAC

Under the proposed new rules, the streams on Vashon-Maury Island are designated for salmon spawning and rearing aquatic use, all primary contact uses, all water supply uses, and all other miscellaneous uses, as undesignated tributaries of the Puget Sound. The fresh water salmon spawning and rearing requirements are similar to the current AA classification, except that the bacteria standards would change. The current indicator organism is fecal coliform with a threshold of 50 colonies per 100 mL and the proposed indicator organism is E. coli coliform with a threshold of 100 colonies per 100 mL.

6.1.2 Water Quality Sampling Data

Figure 6-1 shows the 20 King County sampling stations from which water quality data were reviewed. There is no Ecology landside sampling station report for Vashon-Maury Island. There was one USGS station on Judd Creek, but no data were available. Tables 6-2 through 6-6 summarize the sampling data from the King County sampling stations. Sampling observation periods varied from one to four years.

Seven of the sampling stations encountered dry conditions occasionally. Results in Tables 6-2 through 6-6 provide flow-based results for comparison with total results. Parameters reported in these tables include pH, dissolved oxygen (DO), water temperature, and turbidity.



Watercourses (King Co.)

- Mainstem KC Class 2-S
- Watercourses KC Class 2-S
- - - All Other Classifications
- County Boundaries
- Roads
- 100' Contours
- 20' Contours
- Parcels
- Main Basin Boundaries
- Vashon Sub-Basins (Study Area)
- WA Trout Sub-Basins
- Wetlands (KC SAO)
- Waterbodies
- River Mile Post
- Stream Gauges
- Sampling Sites


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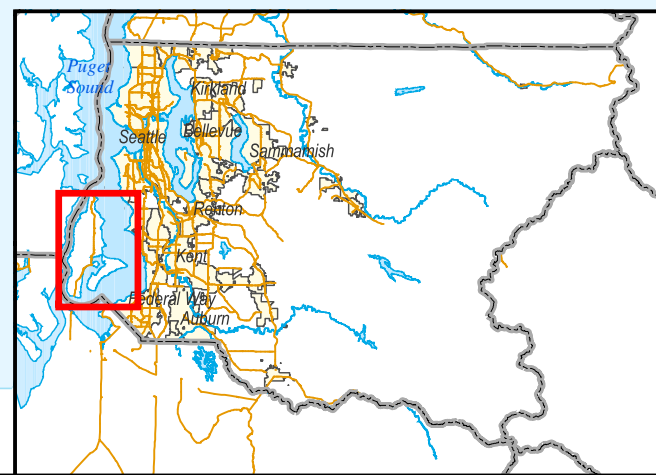
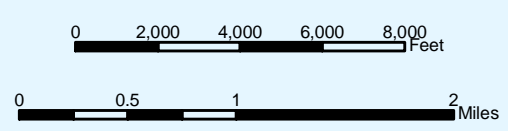


TABLE 6-2.
EAST VASHON BASIN SAMPLING SITES

	DO (mg/L) (>9.5 mg/l ^a)	pH (6.5-8.5 ^a)	Temperature (°C, <=16° ^a)	Turbidity (NTU, <=5 NTU over existing ^a)
E1217(SS* 1) (3/99 -12/99)				
Mean	10.4	7.2	9.1	7.2
Maximum	15.3	8.1	12.8	213.0
Minimum ^f	-1.0	-1.0	-1.0	-1.0
E1217(wet)				
Mean	10.9	7.5	9.5	7.5
Maximum	15.3	8.1	12.8	213.0
Minimum	3.1	6.4	6.0	0.0
E1221 (SS 2) (3/99-12/01)				
Mean	9.7	7.3	10.3	3.4
Maximum	12.7	8.4	13.8	42.0
Minimum ^f	-1.0	-1.0	-1.0	-1.0
E1221(wet)				
Mean	10.0	7.5	10.5	3.5
Maximum	12.7	8.4	13.8	42.0
Minimum	6.7	6.9	5.0	0.0
E1223 (SS 3) (3/99-12/01)				
Mean	10.2	7.4	10.5	3.1
Maximum	13.0	8.0	14.6	45.0
Minimum	7.8	6.0	7.0	0.0
E2722 (SS 4) (3/99-12/01)				
Mean	8.2	7.3	11.6	2.8
Maximum	11.0	7.9	18.4	30.0
Minimum	1.6	6.6	5.5	0.0
P592 (SS 5) (1/00-12/01)				
Mean	5.1	3.4	4.1	16.7
Maximum	18.0	8.1	16.3	420.0
Minimum ^b	-1.0	-1.0	-1.0	-1.0
P592(wet)				
Mean	10.9	7.5	8.9	33.3
Maximum	18.0	8.1	16.3	420.0
Minimum	7.5	6.4	5.1	0.0

* SS = Sampling Station as indicated on Figure 6.1

- a. Class AA and Salmon Spawning (new) Standard. Variance allowed for human causes: ph: 0.2, temperature: 0.3° over natural temperature if natural temperature is over 16°.
- b. -1.0 minimum measurement indicates a dry condition.

TABLE 6-3.
JUDD CREEK BASIN SAMPLING SITES

	DO (mg/L) (>9.5 mg/l ^a)	pH (6.5-8.5 ^a)	Temperature (°C, <=16° ^a)	Turbidity (NTU, <=5 NTU over existing ^a)
E1230 (SS 6) (3/99-7/02)				
Mean	11.4	7.6	10.0	4.4
Maximum	17.1	8.0	15.4	40.6
Minimum	8.2	6.9	3.8	0.0
E1231 (SS 7) (3/99-10/02)				
Mean	10.8	7.4	10.3	4.1
Maximum	15.3	7.9	15.9	30.9
Minimum	7.9	6.8	3.7	0.0
E1232 (SS 8) (1/01-10/02)				
Mean	10.8	7.4	10.3	4.2
Maximum	15.3	7.9	15.9	30.9
Minimum	7.9	6.8	3.7	0.0
E2756 (SS 9) (5/00-12/01)				
Mean	9.7	6.7	9.4	4.5
Maximum	18.4	7.9	14.5	43.1
Minimum ^f	-1.0	-1.0	-1.0	-1.0
E2756 (wet)				
Mean	10.6	7.4	10.3	4.9
Maximum	18.4	7.9	14.5	43.1
Minimum	7.5	6.4	3.2	0.0
E2758 (SS 10) (5/00-12/01)				
Mean	11.0	7.5	9.9	8.2
Maximum	17.4	8.2	13.8	77.3
Minimum	7.9	6.6	3.7	0.0
E2761 (SS 11) (4/99-10/02)				
Mean	0.6	0.2	0.5	0.6
Maximum	12.7	7.6	12.5	28.3
Minimum ^f	-1.0	-1.0	-1.0	-1.0
E2761 (wet)				
Mean	10.5	7.2	10.0	10.1
Maximum	12.7	7.6	12.5	28.3
Minimum	9.0	6.4	5.6	0.0
E2762 (SS 12) (4/99-10/02)				
Mean	10.5	7.4	10.3	7.5
Maximum	15.0	8.0	16.0	43.3
Minimum	7.3	6.4	3.4	0.0

* SS = Sampling Station as indicated on Figure 6.1

- a. Class AA and Salmon Spawning (new) Standard. Variance allowed for human causes: pH: 0.2, temperature: 0.3° over natural temperature if natural temperature is over 16°.
- b. -1.0 minimum measurement indicates a dry condition.

	DO (mg/L) (>9.5 mg/l ^a)	pH (6.5-8.5 ^a)	Temperature (°C, <=16° ^a)	Turbidity (NTU, <=5 NTU over existing ^a)
E1236 (SS 13) (3/99-10/02)				
Mean	11.4	7.7	9.2	3.5
Maximum	14.7	8.0	13.2	27.0
Minimum	8.3	7.1	4.1	0.0
E2753 (SS 14) (1/02-10/02)				
Mean	12.2	7.9	9.3	12.6
Maximum	14.8	8.1	11.3	97.7
Minimum	11.4	7.3	5.8	2.5
E2746 (SS 15) (3/99-10/02)				
Mean	5.9	3.8	4.1	4.5
Maximum	18.0	8.1	14.1	48.0
Minimum ^f	-1.0	-1.0	-1.0	-1.0
E2746 (wet)				
Mean	11.0	7.4	7.9	8.6
Maximum	18.0	8.1	14.1	48.0
Minimum	7.1	6.4	2.8	0.0
* SS = Sampling Station as indicated on Figure 6.1				
a. Class AA and Salmon Spawning (new) Standard. Variance allowed for human causes: pH: 0.2, temperature: 0.3° over natural temperature if natural temperature is over 16°.				
b. -1.0 minimum measurement indicates a dry condition.				

Data on specific conductance was available but is not reported, since some of the measurements were inconsistent, and there are no criteria for specific conductance in WAC 173-201A. Generally, high specific conductance indicates presence of salts or other materials from natural or manmade sources, or tidal influence. No information was available from the source reviewed on aesthetics or toxic, radioactive, or deleterious materials.

East Vashon Basin

East Vashon had five sampling stations. Mean DO levels were above the 9.5 mg/L standard for AA waters. However, minimum DO levels at all locations were below the standard. The pH during wet conditions was within limits for two locations (Stations E1221 and E2722). Three locations had minimum pH levels below the lower limit for pH (Stations E1217, E1223, and P592, with respective minimum levels of 6.4, 6.0 and 6.4). However, a variability of 0.2 is allowed for manmade causes, which would allow the measurements at Stations E1217 and P592 to be considered within the lower limit.

With two exceptions, temperatures were below the 16°C limit for average and maximum temperatures. Station E2722 had a maximum temperature of 18.4°C during a sunny day, on 8/10/99, and Station P592 had a maximum of 16.3°C on a cloudy day on 9/19/00.

TABLE 6-5.
WEST VASHON BASIN SAMPLING SITES

	DO (mg/L) (>9.5 mg/l ^b)	pH (6.5-8.5 ^a)	Temperature (°C, ≤16 ^{o a})	Turbidity (NTU, ≤5 NTU over existing ^a)
E1227 (SS 16) (3/99-12/01)				
Mean	10.7	7.5	10.4	10.7
Maximum	14.1	8.2	14.7	280.0
Minimum	8.0	6.5	5.6	0.0
E2803 (SS 17) (3/99-12/01)				
Mean	10.6	7.5	10.2	6.0
Maximum	13.6	8.2	14.7	32.0
Minimum	8.0	6.9	5.6	0.0
E2887 (SS 18) (3/99-12/01)				
Mean	10.6	7.5	10.6	11.3
Maximum	13.9	8.2	14.3	205.0
Minimum	7.8	6.4	5.8	0.0
P587 (SS 19) (1/00-12/01)				
Mean	8.6	6.8	9.5	13.6
Maximum	13.7	7.9	17.5	110.0
Minimum ^f	-1.0	-1.0	-1.0	-1.0
P587 (wet)				
Mean	9.2	7.3	10.2	14.6
Maximum	13.7	7.9	17.5	110.0
Minimum	1.5	6.1	4.1	0.0
* SS = Sampling Station as indicated on Figure 6.1				
a. Class AA and Salmon Spawning (new) Standard. Variance allowed for human causes: pH: 0.2, temperature: 0.3° over natural temperature if natural temperature is over 16°.				
b. -1.0 minimum measurement indicates a dry condition.				

TABLE 6-6.
MAURY ISLAND SAMPLING SITES

	DO (mg/L) (>9.5 mg/l ^a)	pH (6.5-8.5 ^a)	Temperature (°C, <=16° ^a)	Turbidity (NTU, <=5 NTU over existing ^a)
E1226 (SS 1226) (3/99-12/01)				
Mean	8.8	7.4	10.1	4.3
Maximum	14.0	8.3	14.3	138.0
Minimum	2.0	6.4	5.7	0.0
* SS = Sampling Station as indicated on Figure 6.1				
a. Class AA and Salmon Spawning (new) Standard. Variance allowed for human causes: pH: 0.2, temperature: 0.3° over natural temperature if natural temperature is over 16°.				
b. -1.0 minimum measurement indicates a dry condition.				

Average turbidity was relatively high at two locations (Stations E1217 and P592). Maximum turbidity levels were extremely high at Station E1217 (213 NTU) and P592 (420 NTU), and were associated with rains on 11/9/99 and 11/14/01. High levels were reported for the maximum readings at the other locations (Stations E1221, E1223, and E2722, with 42 NTU, 45 NTU, and 30 NTU, respectively, on 11/14/01, 9/17/01, 11/14/01), and were associated with cloudy or rainy conditions.

Judd Creek Basin

The Judd Creek Basin had seven sampling stations. Two stations experienced dry bed conditions on occasion (Stations E2756 and E2761). Average DO levels during wet conditions were above the 9.0 mg/L standard; however, minimum DO levels were all below the standard, within a range of 7.3 to 9.0 mg/L.

During wet conditions, four stations (Stations E1230, E1231, E1232 and E2758) had pH readings that were within the lower and upper limits of 6.5 to 8.5. Three stations had minimum pH readings just below the 6.5 lower limit, at 6.4 (Stations E2756, E2761, and E2762).

Average and maximum temperatures were at or below the standard of 16.0°C. Stations E1230, E1231, and E2762 had maximum temperatures that were just below or at the standard (15.4°C, 15.9°C, and 16.0°C, respectively).

Average turbidity was relatively high at three locations (Stations E2758, E2761, and E2762, with average NTU counts of 8.2, 7.5, and 10.1, respectively, during wet conditions. All locations showed high maximum turbidity, some significantly so. Station E2758 had a maximum turbidity of 77.3 NTU, and Stations E1230, E2756, and E2762 had maximum turbidities that were over 40 NTU.

Shinglemill Creek Basin

The Shinglemill Basin had three sampling stations. All sampling stations had average DO levels above the 9.5 mg/L minimum standard during wet conditions. Minimum DO levels at Stations E1236 and E2746, however, were lower than the 9.5 mg/L standard. The pH measurements for two stations were within

limits (Stations E1236 and E2743); however, Station E2746 had one instance of pH (6.4) that was below the lower limit of 6.5.

Temperatures were all below the standard of 16°C. Turbidity was relatively high for Stations E2753 and E2746 (means of 12.6 NTU and 8.6 NTU, respectively), with elevated maximums (97.7 NTU and 48.0 NTU, respectively).

West Vashon Basin

West Vashon had four sampling stations. Average DO exceeded the 9.5 mg/L standard, with the exception of Station P587, which had a mean of 9.2 mg/L during wet conditions. All minimum DO levels were below the 9.5 mg/L standard. Minimum pH levels at Stations E2887 and P587 were below the lower limit of 6.5, ranging from 6.1 to 6.9. All maximum pH levels were below the upper limit of 8.5. Average temperatures were below the 16°C limit, but Station P587 had a maximum of 17.5°C on a hot, sunny day. Average turbidity measurements were somewhat high, and maximum turbidity measurements were high to extremely high (280 NTU, 205 NTU, and 110 NTU for Stations E1227, E2887, and P587, respectively).

Maury Island

Maury Island had one sampling station, Station E1226 on Mileta Creek, which had a mean DO of 8.8 mg/L, below the 9.6 mg/L standard for AA waters. Temperatures were within range. The minimum pH at 6.4 was below the 6.5 standard; however, a 0.2 variation is allowed for manmade causes. Average turbidity was 4.3 NTU, but the maximum turbidity was extremely high: a measurement of 138 NTU associated with heavy rain.

6.1.3 Biotic Integrity

Additional evaluation was conducted on biotic integrity as part of the habitat review in Section 7. Evaluations were made for the East Vashon, Judd Creek, Shinglemill Creek, and West Vashon basins. Indices of biotic integrity use biological data to numerically depict a stream's relative health. The benthic index of biotic integrity (B-IBI) used by King County (King County 2002) accomplishes this by comparing the existing abundance of invertebrate taxa to what would be expected under pristine conditions. King County's B-IBI evaluations ranged from fair to poor in most cases, and very poor in one case (Station E1236 in the Shinglemill Basin).

6.2 POTENTIAL POLLUTANT SOURCES

Materials reviewed to identify potential pollutant sources included King County aerial photographs, zoning, land use and cover data, sensitive areas map data, King County water quality data, and Ecology water quality data. Nearby conditions that could affect surface water quality are listed in Table 6-7. Other possible causes of turbidity and pollutants include first flush runoff and erosion hazard areas. Other nearby land use sources include farmlands, residences, and roads.

An area-wide problem for Vashon-Maury Island has been lead and arsenic contamination of surface soils by emissions from historical smelter activity in the Tacoma area. The King County Health Department is conducting a study and planning effort to address the contamination. The level of stormwater runoff contamination has not been quantitatively assessed through current monitoring data, and it could be

considered for inclusion in future monitoring in order to evaluate the potential effects of lead and arsenic contamination. .

Vashon Island has been the subject of several recent studies by King County. Washington Trout, with funding from King County, King County Vashon Audubon, and other sources, conducted a stream inventory that included, among other data, sediment sources and other potential sources of pollution. These potential sources are shown on Figure 6-2.

Finally, the Vashon Town Center area is the subject of a recent study by King County for storm drainage and stormwater quality, titled, *Vashon Town Center Stormwater Study*, (October 2002). The study provides a detailed evaluation of the Vashon Town Center stormwater drainage system and reviews options for water quality improvement. The draft study concludes that the stormwater impacts from the town on the Shinglemill Creek Basin, which has high resource value, is relatively small. Shinglemill is noted as having a much larger basin system and is more intact than Gorsuch, with proportionately much more forest and much less urban development. The stormwater impact from the town on Gorsuch Creek, which has lower resource value, is significant. No low-cost stormwater improvements that would provide any significant reduction in the runoff for the town have been identified. The study recommends waiting until the Island-wide assessment has been completed before making any large capital expenditures.

TABLE 6-7.
POTENTIAL POLLUTANT SOURCES

Site	Nearby Conditions/Potential Sources
East Vashon Basin Sampling Sites	
E1217	Near wastewater treatment plant. Downstream of Vashon Town. Some nearby agriculture/residences.
E1221	Downstream of agriculture/residential uses.
E1223	Downstream of agriculture/residential uses.
E2722	Mixed urban/low density residential/agriculture uses.
P592	Vashon Town area. Mixed urban/residential uses.
Judd Creek Basin Sampling Sites	
E1230	Near some agriculture/rural residential uses. Downstream of agriculture/rural residential uses. In or near erosion hazard area.
E1231	Mixed agriculture/rural residential uses.
E1232	Mixed agriculture/rural residential uses. In or near erosion hazard area.
E2756	Mixed agriculture/rural residential uses.
E2758	Mixed agriculture/rural residential uses. In or near erosion hazard area.
E2761	Mixed agriculture/rural residential uses. In or near erosion hazard area.
E2762	Mixed agriculture/rural residential uses. In or near erosion hazard area.
Shinglemill Creek Basin Sampling Sites	
E1236	Large landslide, erosion.
E2753	In erosion hazard area.
E2746	In or near erosion hazard area. Some agriculture/rural development.
West Vashon Basin Sampling Sites	
E1227	Downstream of agriculture/residential uses. Near or in erosion hazard area. Some low density development.
E2803	Some low density development. Near erosion hazard area.
E2887	Some low density development. Near or in erosion hazard area.
P587	Some rural residential. In or near erosion hazard area.
Maury Island Sampling Site	
E1226	Some low density development, road. Near or in erosion hazard area.

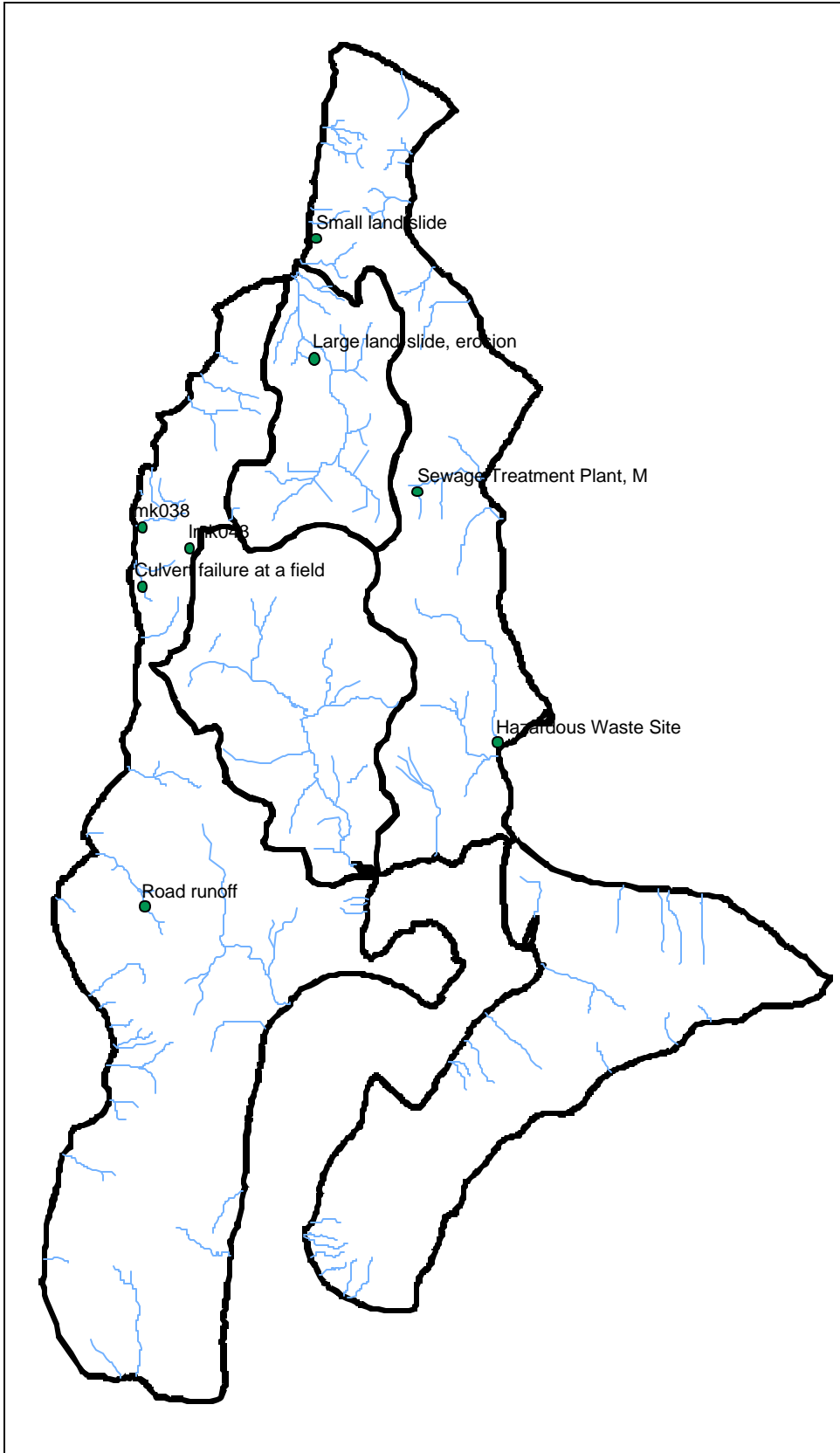


Figure 6-2. Sediment Sources Identified by Washington Trout

6.3 CONCLUSIONS AND RECOMMENDATIONS

The following are conclusions and recommendations based on the review in this section of Vashon water quality.

Vashon streams are designated for salmon spawning and rearing aquatic use, all primary contact uses, all water supply uses, and all other miscellaneous uses, as undesignated tributaries of the Puget Sound. Although no stream has been placed on the 303(d) list of impaired water bodies, excursions occur with dissolved oxygen, pH and turbidity, and to a minor extent, temperature. Sampling stations with higher occurrences of turbidity tend to occur with occurrences of low dissolved oxygen. Very high turbidity measurements (>50 NTU) were recorded in East Vashon (E1217, P592), West Vashon (E1227, E2887, P587), and Maury Island (E1226). This could be occurring with erosion and transport of sediments from erosion hazard areas, landslides, and areas of human activities such as development and logging. Some documentation of potential sources has occurred and more would be helpful to an understanding of the sources of the problem and methods to mitigate them. Possible controls that could be implemented include replanting programs for areas that have natural erosion (landslides, steep areas), more monitoring and enforcement of construction activity for erosion and sediment controls, and in the long term, controls on development in erosion potential areas, that are specific to Vashon and Maury Island.

The specific problem areas identified by Washington Trout could be further reviewed as a basis for a specific list of drainage and stream improvements to benefit water quality as well as habitat conditions. Some problem areas have already been noted by other sections of this report, and have formed the basis for drainage improvement projects, that have water quality and habitat improvement value.

The occurrences of low dissolved oxygen could be due to several potential causes, including by erosion and sediment transport, higher temperature, and biological or chemical oxygen demand (BOD or COD). Turbidity has been discussed above, and more monitoring and controls are suggested. Temperature excursions were noted (in East Vashon, at E2722 and P592, and in West Vashon, at P587), but in relatively few areas compared to low DO occurrences. While turbidity appears to be associated with low DO on Vashon and Maury Island, other possible sources, such as BOD or COD may be contributing to the problem. King County currently does not have monitoring data on BOD or COD, or related parameters.

Information is lacking on other parameters which could provide a more complete understanding of water quality on Vashon. This would include agriculture-related parameters such as fecal coliform, ammonia-nitrogen, conductance, and in heavily farmed areas, pesticides. In the Vashon Town Center and other areas that have more human activity, consideration should be given to sampling for metals and toxins (for example, lead and arsenic), in coordination with the Health Department study.

In a broader approach to monitoring, National Pollutant Discharge Elimination System (NPDES) industrial discharge permits for activities in the basin could also be examined for compliance with water quality requirements. This would include NPDES permits for construction stormwater, industrial stormwater, and industrial wastewater discharge. While such permits are under the jurisdiction of the Department of Ecology, King County has a natural interest in monitoring the potential pollution sources that may affect surface water quality.

In a broader approach to mitigation and control of water quality impacts, King County could also consider drainage requirements that work with the natural and rural conditions still found on much of Vashon and

Maury Island. This could include review of low impact and other innovative practices for rural implementation, as part of the planned Surface Water Design Manual update. Erosion control requirements in the Surface Water Design Manual should also be reviewed for ways to improve mitigation of construction and long-term drainage impacts on stream water quality.