

Washington State Department of Ecology  
Toxics Cleanup Program

April 2001  
Publication No. 01-09-046

## How To Get More Information About Sediment Cleanup Issues

This report focuses on various measures about sediment cleanup sites in Washington State. If the reader desires more information about Washington State sediment quality issues, additional information is available from the Department of Ecology.

A broad range of information on sediment management is available on the Department of Ecology's website at <http://www.ecy.wa.gov/programs/tcp/smu/sediment.html>

- A copy of the regulation for managing sediment contamination, Sediment Management Standards, Chapter 173-204 WAC, is available for viewing on our website or a copy can be ordered by contacting our publication department at [ecypub@ecy.wa.gov](mailto:ecypub@ecy.wa.gov) or (360) 407-7472.
- A bibliography of sediment related technical reports from the Sediment Management Unit is available on our website or by contacting Brett Betts at [bbet461@ecy.wa.gov](mailto:bbet461@ecy.wa.gov) or (360) 407-6914.
- A copy of this report is available on our webpage at <http://www.ecy.wa.gov/programs/tcp/smu/sitestatus2001.html>
- If you have questions about this report or would like additional copies, please contact Roger Dovel at [rdov461@ecy.wa.gov](mailto:rdov461@ecy.wa.gov) or (360) 407-6776.

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**Cover image:** The cover image was created using the Department of Ecology's Sediment Quality Information System, SEDQUAL. The image shows a photograph of Bellingham Bay overlaid with color shaded sediment quality stations. The red and yellow areas exceed standards for sediment quality. Green areas meet sediment standards.



WASHINGTON STATE  
DEPARTMENT OF  
E C O L O G Y

# Sediment Cleanup Status Report

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*printed on recycled paper*



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# Introduction

This report focuses on what is known by the Department of Ecology (Ecology) about the status of cleanup at contaminated sediment sites. Discharges and accidental releases of harmful contaminants to the aquatic environment have caused sediment contamination in Washington State. As Washington State's environmental protection agency, Ecology's mission includes regulation of efforts to provide remedies for previous contamination. As the lead state agency for cleanup activities, Ecology has a crucial role to play in the restoration of the state's sediment quality.

## Sediment Management Standards

In 1991, Ecology adopted the Sediment Management Standards (Chapter 173-204 WAC). To date, Washington remains the only state with adopted standards for sediment quality. The Sediment Management Standards address three major points:

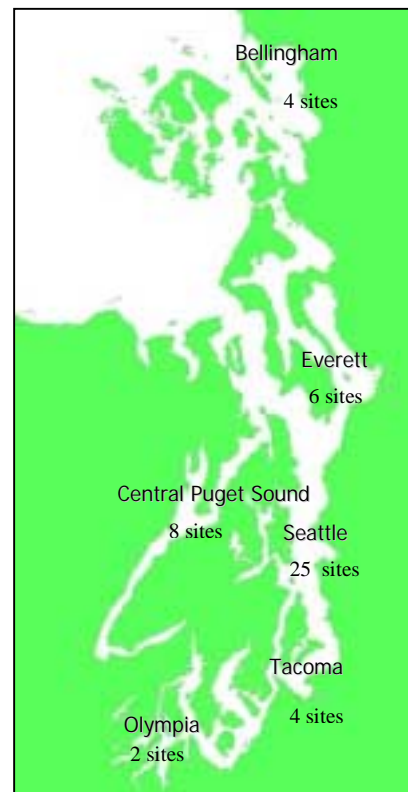
- Procedures for cleanup of historic sediment contamination,
- Procedures for preventing future sediment contamination from discharges, and
- Standards for defining sediment contamination.

The Sediment Management Standards include a long-term goal of no adverse effects to aquatic organisms and no significant health risks to humans, as well as higher regulatory levels used defining the maximum allowable levels for use in source control and cleanup programs.

## Sediment Cleanup Sites and Relationship to this Report

Prior to the Sediment Management Standards, sediment contamination in Puget Sound urban bays had been investigated, but there was no coherent statewide approach for addressing sediment contamination. With the adoption of the Sediment Management Standards, the development of an extensive database of sediment quality sampling stations, and the screening of sediment stations for contaminant levels, Ecology developed a list of contaminated sediment sites. In 1996, the *Contaminated Sediment Site List* identified and ranked 49 contaminated sediment sites in Puget Sound. Figure 1 shows the number of sites in each of a number of Puget Sound urban bays as identified by the 1996 site list. Since 1996, new information has been collected to identify additional sediment cleanup sites or areas of concern.

**Figure 1:** Puget Sound Sites from 1996 Contaminated Sediment Site List



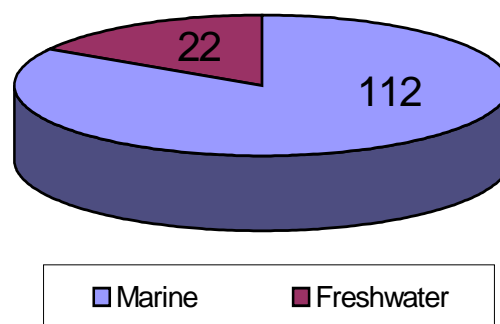


This report provides information about all the known or suspected Washington State sediment cleanup sites to date and various attributes of those sites that will provide a picture of sediment cleanup issues. The information gathered for this report was collected from Ecology sediment cleanup site managers in June of 2000 and reflects the most recent state of knowledge about sediment cleanup sites. As more is learned over time about sediment cleanup sites, some of the statistics and values reported here will undoubtedly change. The reporting of information about sediment sites is intended to inform policy and technical decision making. It is not intended to be a site list.

### Defining the “Universe” of Sediment Cleanup Sites

To date, there are 134 sediment cleanup sites or areas of concern identified by Ecology site managers with sufficient information to perform some degree of environmental analysis. The measures, indicators, or statistics developed for this report are based on those 134 sites or some subset of those sites. The majority of the sites are in marine sediment in Puget Sound (112 sites), while a much smaller number are found in freshwater sediment (22 sites). The various statistics derived elsewhere in this report are based on the current count of marine and freshwater sites. The high number of marine sites is reflective of the history of sediment management in Washington State, which has focused initial efforts on Puget Sound and its contaminated urban embayments. While the number of sites reflects what is known today, it is likely that other sites will continue to be identified, particularly in areas previously less studied.

Figure 2: 112 Sediment Cleanup Sites



### About Sediment Site Listing

The term “sites”, as used in this report, refers to areas of known or suspected sediment contamination. Some sites have been subject to a formal site listing process, including ranking. Other “sites” may be more appropriately termed “areas of concern” because of the lack of formal listing and confirmation as sites. In addition to the sites that were listed in the 1996 *Contaminated Sediment Site List*, some sites are listed on other site lists that include upland sites, such as the State’s *Hazardous Sites List*, the State’s *Confirmed & Suspected Contaminated Sites Report* (all sites reported to Ecology, excluding leaking underground storage tank sites), and the federal *National Priorities List* (Superfund sites). Additionally, some sites tracked here have been completed or have been investigated further and were determined not to require cleanup. The purpose of including these completed sites is to provide a picture of all sediment cleanup sites in Washington State.

The process for sediment site listing and ranking is described in the Sediment Management Standards (WAC 173-204-510).

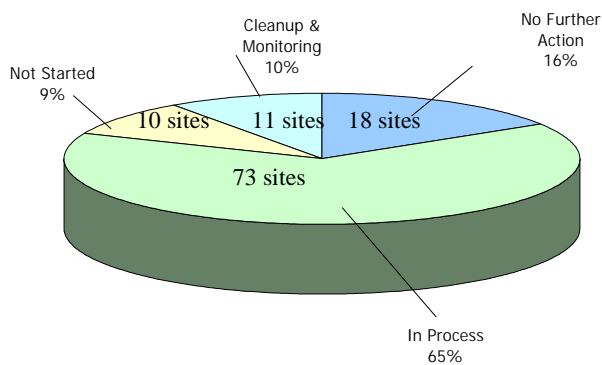


# Cleanup Progress

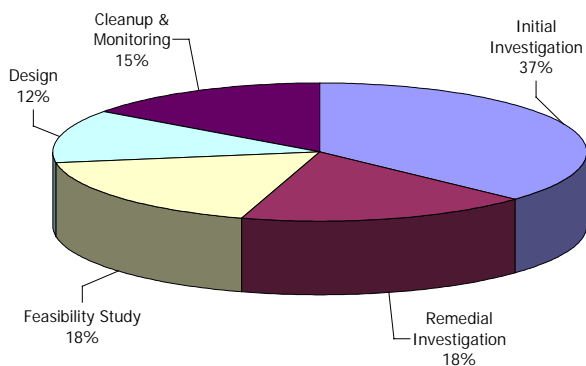
## Many Marine Sediment Sites in the Process of Cleanup

Of the 112 marine sediment sites, nearly two thirds (73 sites) are in the process of being cleaned up. This includes all ongoing sites with initial investigations, remedial investigations, feasibility studies, design phase, and cleanup and monitoring actions. In addition to the sites in the process of cleanup, other sites have been cleaned up or have been determined to be clean enough to not warrant cleanup (“no further actions” sites). At 10 sites, no cleanup process has started other than the identification that sediment contamination is suspected.

**Figure 3: Status of the 112 Marine Sediment Cleanup Sites**



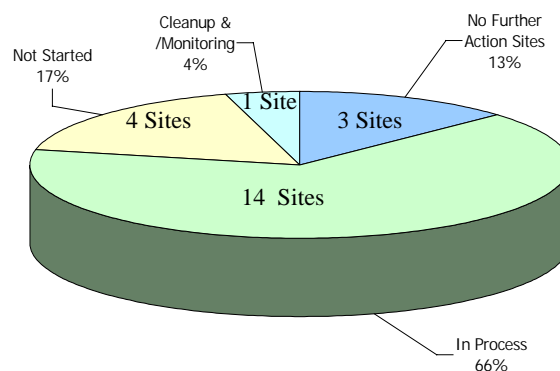
**Figure 4: Phase of Cleanup for 73 Marine Sediment Sites with Cleanup in Progress**



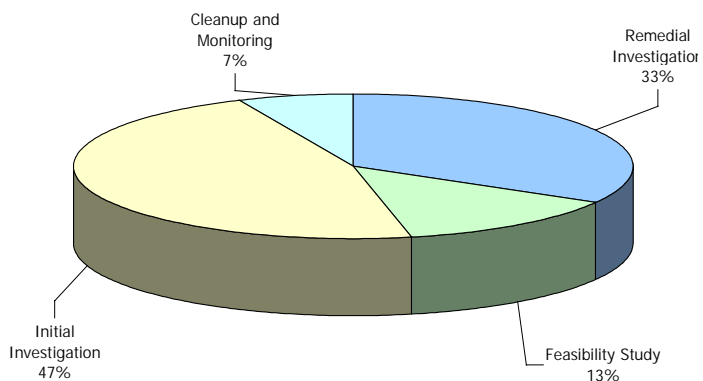
## Fewer Freshwater Sites, but Cleanup is Occurring

While there are few freshwater sediment cleanup sites (22 sites), roughly the same proportion of sites, nearly two-thirds, are in the process of cleanup (14 sites). As with the marine sites, approximately one-third of the sites that remain are fairly evenly divided between those completed and those not started. Freshwater sites are complicated by the lack of numeric chemical criteria similar to those adopted nine years ago for marine sediments. However, in spite of the lack of chemical criteria, it is still possible to identify sediments that cause impacts on a case-by-case basis.

**Figure 5: Status of 22 Freshwater Sediment Cleanup Sites**



**Figure 6: Phase of Cleanup for 14 Freshwater Sediment Sites with Cleanup in Progress**



# How Does Cleanup Get Done?

Depending on the sites, various cleanup authorities are used to accomplish cleanup at sediment sites. Primarily, cleanup is accomplished using either the state cleanup law – the Model Toxics Control Act – or the federal cleanup law – the Comprehensive Environmental Response Compensation Liability Act (Superfund).

A number of sediment cleanup actions are also accomplished voluntarily or in conjunction with development activities. Table 1 shows the cleanup authorities applied at marine sediment sites and the corresponding phase of cleanup at those sites. Table 2 shows similar information for freshwater sediment sites.

**Table 1:** Cleanup Authorities and Status of Marine Sediment Sites

Cleanup Authority	Number of Sites	Phase of Cleanup						
		Not Started	II	RI	FS	Design	Cleanup	NFA
MTCA	24	3	9	4	4	0	0	4
Superfund/MTCA	8	0	0	1	3	2	2	0
Superfund	22	0	0	4	3	6	3	6
Partial Superfund	4	0	1	1	0	1	1	0
Clean Water Act	9	2	3	0	0	0	2	2
Voluntary Cleanup	7	0	3	2	2	0	0	0
Other	7	1	2	1	1	0	2	0
Not Assigned	15	4	9	0	0	0	1	1
Not Identified	16	4	3	0	0	0	0	9
<b>TOTALS</b>	<b>112</b>	<b>14</b>	<b>30</b>	<b>13</b>	<b>13</b>	<b>9</b>	<b>11</b>	<b>22</b>

MTCA = Model Toxics Control Act  
 II = Initial investigation    RI = Remedial Investigation  
 FS = Feasibility Study    NFA = No Further Action  
 Sites may be in more than one phase (i.e. RI & FS)

**Table 2:** Cleanup Authorities and Status of Freshwater Sediment Sites

Cleanup Authority	Number of Sites	Phase of Cleanup						
		Not Started	II	RI	FS	Design	Cleanup	NFA
MTCA	9	0	4	4	0	0	0	1
CERCLA/MTCA	1	0	0	1	1	0	0	0
RCRA	2	0	0	0	1	0	0	0
Not Assigned	4	1	3	0	0	0	1	2
Not Identified	6	5	0	0	0	0	0	2
<b>TOTALS</b>	<b>22</b>	<b>6</b>	<b>7</b>	<b>5</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>5</b>

# How Much Sediment Is Contaminated?

The area of contaminated sediment in Puget Sound has been previously reported in other documents, such as *2000 Sediment Cleanup Status Report*, the *Puget Sound Confined Disposal Site Study Programmatic Environmental Impact Statement*, or the *Puget Sound's Health 1998*, published by the Puget Sound Water Quality Action Team. Information about the area of contamination outside of Puget Sound is not as detailed and is not presented in this section.

As shown in Table 3, acreage data exists for about two-thirds of Puget Sound marine sites which total 1,758 acres and average about 27 acres per site. If the same acreage per site is assumed for the remaining third of Puget Sound sites, the estimated area within the boundaries of Puget Sound sediment sites is 3,407 acres.

While having an understanding of the total area of sediment contamination can be an important measure of the health of the aquatic environment, it is important to define the basis for calculating areas of contamination. The area of the cleanup sites shown in Table 3 includes the most highly contaminated sediment in Puget Sound. Other areas of Puget Sound have some degree of impact, but not enough to warrant active cleanup.

Table 4 compares the estimated cleanup site acreage to other measures of Puget Sound. The total Puget Sound area exceeding the Sediment Quality Standards (SQS) is included in Table 4, and has been the most commonly reported measurement of sediment contamination reported by Ecology. The SQS is a level lower than the trigger for cleanup, and the area exceeding the SQS does not initially define the area that is subject to active cleanup, provided that reduction in contamination and associated

toxicity is predicted to occur. This may occur through natural capping by cleaner materials, biodegradation, or other forms of natural recovery. The 5,748 Puget Sound acres exceeding the SQS is approximately twice that included in cleanup sites. In Table 4, the 15,240 acres surveyed shows that about two-thirds of sediment stations reveal no contamination. This should not, however, be interpreted to mean that a third of Puget Sound is contaminated, because most sediment investigations focus on the urban bays and other areas of suspected contamination. The total area of Puget Sound, almost two million acres, dwarfs the other measures of area shown in Table 4.

**Table 3:** Estimated Sediment Site Acreage for Puget Sound Sites

	No. of Sites	Acres
Puget Sound Marine Sites with Acreage Data	66	1758
Puget Sound Marine Sites without Acreage Data	62	1649
Estimated Area of Puget Sound Within Cleanup Site Boundaries	128	3407

\* Assume 26.6 acres per site

**Table 4:** Puget Sound Cleanup Acreage Compared with Other Puget Sound Measures

	Acres	Percent of Puget Sound
Area of All Puget Sound*	1,798,239	100.00
Area of Puget Sound Surveyed	15,240	0.85
Exceeding Sediment Quality Standards	5,748	0.32
Area of Puget Sound Cleanup Sites	3,407	0.20

\* Includes Straight of Juan de Fuca, Straight of Georgia and Hood Canal

## Cleanup Obstacles

While many sites have started the initial investigative phase of cleanup, there are often obstacles that prevent sites from moving further along in the cleanup process. Additionally, barriers exist which prevent some new sites from initiating the cleanup process. The major impediments to cleanup are listed below.

- **Policy for State Managed Aquatic Lands**  
Uncertainty regarding appropriate policy for use of state managed aquatic lands slows cleanup at some sites. When the state is involved, either as the principle owner/manager of the sediment site, or as the owner/manager of potential disposal areas, concerns about long-term liability can eclipse other concerns, such as the need to expedite cleanup and reduce risks to aquatic organisms and humans by limiting exposure to contaminants.
- **Need For Adequate Disposal Capacity**  
The recent *Puget Sound Confined Disposal Site Study Programmatic Environmental Impact Statement* identifies 30 sites where cleanup may be expedited by the construction of a regional facility for disposal of contaminated sediment. Disposal capacity and cost of disposal may be major factors for sites that are in the later phases of cleanup.
- **Reluctant Liable Party**  
At many cleanup sites, it is important to have a liable party that is willing to work towards cleanup. When the liable party is unwilling to work with Ecology and other liable parties, cleanup may become temporarily stalled at the initial investigation stage until appropriate actions can be taken.
- **Sources Not Yet Controlled**  
Concerns about recontamination by uncontrolled sources slows cleanup at some

sites. In many cases it does not make sense to perform costly cleanup only to have the sediments become recontaminated by ongoing sources.

- **Lack of Ecology Staff to Oversee Cleanup Activity**  
Funding for sediment cleanup staff is limited, and site managers are already committed to working on current sites.
- **High Cost of Cleanup**  
While not independent of some of the other obstacles described previously, Ecology site managers identified that the high cost of cleanup was an obstacle at some sites.
- **Regulatory Uncertainties**  
Some liable parties have balked at expediting cleanup due to concerns that additional cleanup requirements may be placed on sites due to non-cleanup laws, such as the recent salmon listings under the Endangered Species Act and the Clean Water Act's TMDL provisions. Some sites are also slowed by the need to develop cleanup levels on a case-by-case basis, particularly at freshwater sites.
- **Potential Superfund Listing**  
Ecology site managers identified a small number of sites where action was being deferred until it could be determined if the site would be listed as a federal Superfund site.
- **Area-wide contamination**  
Sites under investigation for contamination and/or cleanup may be but a small subset of a larger bay-wide or system-wide problem. Rather than approach cleanup on a site-by-site basis it often makes more economic and logistical sense to postpone major cleanup strategy until a coordinated system-wide approach can be developed. This is especially true for persistent bioaccumulative compounds.

# How Much Does Cleanup Cost?

## Cleanup Cost Ranges

This section focuses on the costs of cleanup as reported by Ecology site managers. Table 5 shows approximate cleanup costs at 72 sites as estimated by Ecology site managers and/or consultants. The accuracy of the cost estimates varies greatly depending on the stage of cleanup at the individual sites. For sites that are in the early stages of the cleanup process, the cost range estimates vary widely due to uncertainty, and are based on the acreage and volume estimates of contaminated sediments at the sites. Sites in the later stage use feasibility study data to determine costs and are more accurate. Costs also vary depending upon the potential remedy or combination of remedies as well as the disposal options selected for the site. Remedies may include but may not be limited to dredging, capping, *in situ* bioremediation, and active treatment, while disposal options can vary from nearshore placement and confined aquatic disposal to disposal at regulated landfills. Each option can significantly modify final cost estimates.

## Estimating Cost of Remaining Cleanup

The estimated costs for completing all unfinished sediment cleanup range between \$258 million and \$1.354 billion, with an intermediate cost estimate of \$803 million, as shown in Table 6. This is a rather broad range that will be narrowed as more sites progress to the latter phases of cleanup.

The cost ranges shown in Table 5 include sites that have been completed, as well as sites where costs are not yet known. In order to determine

the cost of all remaining uncompleted sediment cleanup, the completed sites must be removed from the calculation (20 sites) and costs must be estimated at unfinished sites where costs are unknown.

Table 5 shows that all but 11 sites with cost data fall between the range of \$0.5 million and \$10 million. This broad range is assumed for the unknown sites, thereby allowing for the estimates of total costs for cleanup of all the unfinished sites.

**Table 5:** Cleanup Cost Range Estimates for Sediment Sites

Cost Range (in Million \$)	Number of Sites	Total Cost Range (in Million \$)
0.5 - 5	33	17 - 170
1 - 5	6	6 - 30
1 - 25	1	1 - 25
5 - 10	21	105 - 210
5 - 25	3	15 - 75
10 - 50	7	70 - 350
25 - 70	1	25 - 70
Not Identified	62	-

**Table 6:** Estimated Cleanup Costs for All Sediment Sites Not Yet Completed

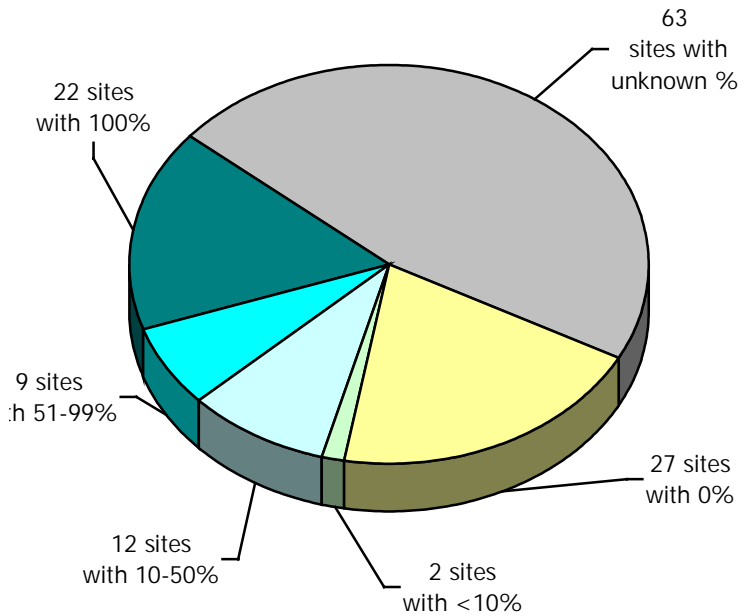
Status and Cost Info	Number of sites	Cost Estimate Low (millions)	Cost Estimate Mid (millions)	Cost Estimate High (millions)
Completed Sites	20	*	*	*
Unfinished sites w/ costs	65	\$ 227	\$ 545	\$ 864
Unfinished sites w/o costs	49	\$ 25	\$ 258	\$ 490
<b>Total for unfinished sites</b>	<b>134</b>	<b>\$ 252</b>	<b>\$ 803</b>	<b>\$ 1,354</b>

\* not included in the calculation

# State Managed Aquatic Land

One important aspect of sediment cleanup is that most of the aquatic bedlands and tidelands in Washington State are owned by the public, either through ownership by the public ports or by the state. Much of the nearshore harbor areas are managed by the Washington Department of Natural Resources (DNR). For many sites that include state managed aquatic land, addressing liability concerns and determining appropriate policy choices for land held in the public trust has proved difficult. Figure 7 shows the percent of state managed aquatic land at all 124 sediment sites. Table 7 shows estimates of sediment cleanup costs on state owned lands. The estimates are for cleanup costs on those lands, not state share of cleanup costs. The assumptions used to calculate total values are shown in the table.

**Figure 7:** Percent State Managed Aquatic Lands at Sediment Cleanup Sites



**Table 7:** Estimates of Sediment Cleanup Costs on State Managed Aquatic Lands

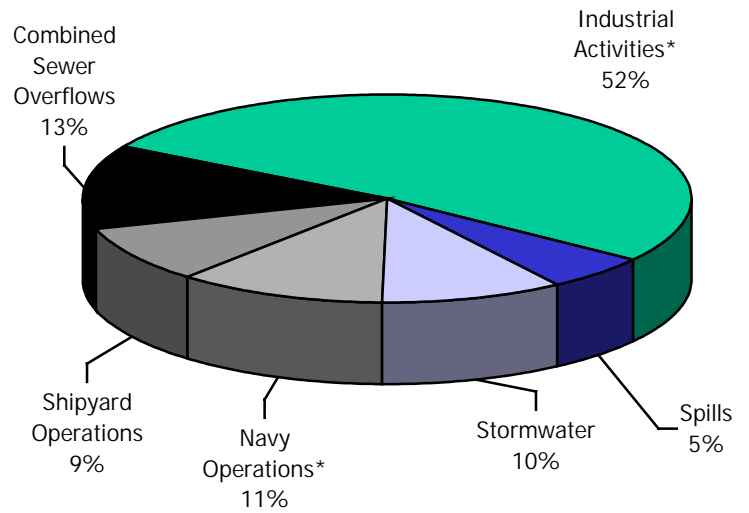
	No. of sites	State Cost Estimate Low (millions)	State Cost Estimate Mid (millions)	State Cost Estimate High (millions)
Completed Sites	20	-	-	-
No SOAL sites	23	-	-	-
Sites with cleanup cost data with percent SOAL data	34	\$ 116.06	\$ 264.32	\$ 412.58
Sites without cleanup cost data with percent SOAL data (assume costs of \$ 0.5, 5.25, 10 million)	6	\$ 2.38	\$ 24.94	\$ 47.50
Sites with cleanup cost data without percent SOAL data (assume 50% SOAL)	11	\$ 13.75	\$ 33.39	\$ 53.03
Sites without cleanup cost data without percent SOAL data (use assumptions above)	18	\$ 4.50	\$ 47.25	\$ 90.00
<b>Totals</b>	<b>112</b>	<b>\$ 137</b>	<b>\$ 370</b>	<b>\$ 603</b>

# Sources of Contamination

Much of the current sediment contamination has resulted from historic activities that have now ceased or been improved. However, many of the activities that caused the historic contamination continue in some form, indicating the need for continued scrutiny of such sources. Figure 8 illustrates the major factors that have contributed to sediment contamination at sediment cleanup sites. Industrial activity is overwhelmingly the most significant category; however, this designation is very general and describes a wide range of activities, including pulp and paper, wood treatment, metal refining, chemical production, manufacturing and petroleum refining, transport, and storage.

Current municipal and industrial discharges are regulated to prevent the release of significant quantities of the contaminants that have caused the cleanup sites discussed in this report. Methods and procedures for assessing potential sources of sediment contamination are included in the source control section of the Sediment Management Standards (WAC 173-204-400 through 420). Requirements necessary to prevent future sediment contamination are included in water quality discharge permits issued by Ecology.

**Figure 8:** Predominant Sources of Contamination at Sediment Cleanup Sites





# Waterbody Focus

Most sediment cleanup sites are located in a relatively small number of bays, lakes, and rivers. Table 8 shows the number of sites within particular waterbodies. For the purposes of this report, the eastern Kitsap Peninsula inlets near Bremerton with sediment sites – Sinclair Inlet, Eagle Harbor, and Liberty Bay – are combined.

The subsequent sections of the report focus on the most significant of the individual waterbodies where all but 31 of the sediment cleanup sites are located.

As mentioned earlier, the listing of sites in the subsequent section focusing on waterbodies is not the same as the formal site listing and ranking process described in the Sediment Management Standards (WAC 173-204-540).

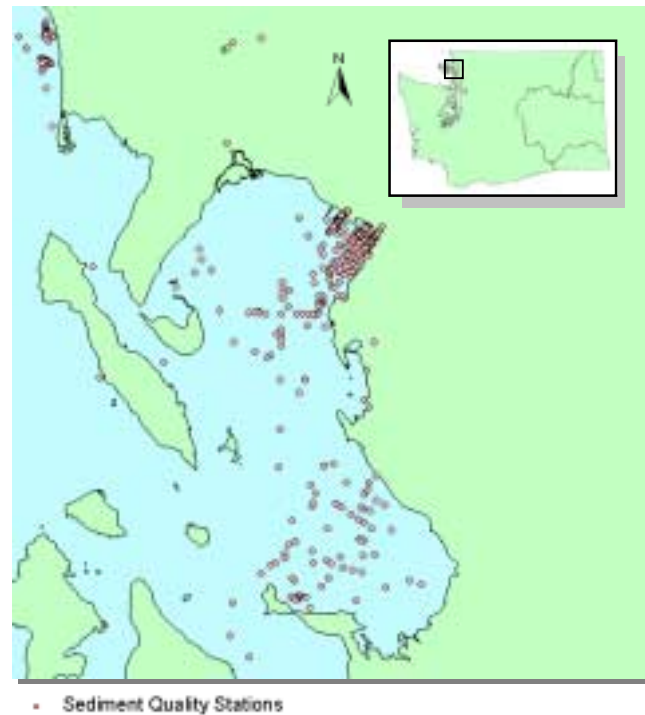
**Table 8:** Sediment Cleanup Site Locations

Waterbody	No. of Sites
Bellingham Bay	9
Bremerton/Kitsap Inlets	11
Columbia River	5
Commencement Bay	12
Duwamish River	8
Elliott Bay	19
Everett/Port Gardner	9
Fidalgo Bay	6
Lake Union	7
Lake Washington	7
Waterbodies with 3 or less sites	41
<b>Total</b>	<b>134</b>

## Bellingham Bay

Bellingham Bay has nine sites, as listed (Table 9) below. Much of the cleanup in Bellingham Bay is in the early stages, as indicated by the large number of sites in the initial investigation phase. Bellingham Bay is the subject of a pilot project involving local, state, and federal agencies, as well as tribes and business to address bay-wide cleanup of sediment sites. A draft Environmental Impact Statement (EIS) for the Bellingham Bay Comprehensive Strategy was issued in July 1999. The cost estimates (Figure 19) are significantly influenced by the large estimate for cleanup of the Whatcom and I&J waterways. It is possible that the costs will be reduced considerably as a result of the Remedial Investigation and Feasibility Study and the Bellingham Bay Comprehensive Strategy.

**Figure 9:** Bellingham Bay Vicinity Map and Sediment Quality Stations



**Table 9:** Bellingham Bay Sediment Cleanup Site Information

Site	Area (acres)	Cost Estimate Low (millions)	Cost Estimate High (millions)	State Owned Land (%)	Site Cleanup Status	Causes of Contamination
Cornwall Ave. Landfill	14	\$1	\$25	100%	R1/FS	Historic municipal landfill
Georgia-Pacific Outfall	4	---	\$1	100%	Initial Investigation	Industrial
Harris Avenue Shipyard (MCI Bellingham)	4	\$1	\$5	100%	R1/FS	Industrial
BB4	---	---	\$1	0%	Initial Investigation	Industrial
Olivine - Hilton Ave.	1	\$1	\$5	0%	Initial Investigation	Industrial
Squalicum Shipyard	---	---	\$1	---	Initial Investigation	Industrial
BB7	---	---	\$1	100%	Initial Investigation	Industrial
BB8	---	---	\$1	0%	Initial Investigation	Industrial
Whatcom and I&J Waterways	190	\$25	\$70	95%	R1/FS	Industrial
<b>Totals</b>	<b>213 acres</b>	<b>\$28* million</b>	<b>110* million</b>			
<b>Based on data available for</b>	<b>4 of 9 sites</b>	<b>3 of 9 sites</b>	<b>9 of 9 sites</b>			

R1 = Remedial Investigation; FS = Feasibility Study; "—" = not applicable or data unavailable

\* Remedies and costs for the Bellingham Bay Pilot Project are currently under negotiation

## Bremerton and Eastern Kitsap Peninsula Inlets

Sinclair Inlet, Eagle Harbor, Liberty Bay, and Dyes Inlet, on the eastern Kitsap Peninsula near Bremerton, are considered here together. The area and cost information in Table 10 is reasonably complete for the 11 sites in these bays. Much of the contamination in Sinclair Inlet and Liberty Bay is attributed to Naval operations. In Eagle Harbor much of the contamination is related to industrial activity (a former wood treatment facility). Table 10 shows that most of the Bremerton/Kitsap sites are in the latter phases of cleanup. Two sites are completed and five sites are in the final phases of cleanup (design, cleanup, or monitoring).

**Figure 10:** Bremerton and Eastern Kitsap Peninsula Vicinity Map and Sediment Quality Stations



**Table 10:** Bremerton and Eastern Kitsap Peninsula Sediment Cleanup Site Information

Site	Location	Area (acres)	Cost Estimate Low (millions)	Cost Estimate High (millions)	State Owned Land (%)	Site Cleanup Status	Causes of Contamination
Eagle Harbor - West OU	Eagle Harbor	5.7	\$0.5	\$5	100%	Cleanup & Monitoring	Industrial
Eagle Harbor - East OU 1	Eagle Harbor	34	\$5	\$10	100%	Design	Industrial/Spill
Eagle Harbor - East OU 2	Eagle Harbor	34	\$5	\$10	100%	Design	Industrial/Spill
Bremerton Evergreen Park	Sinclair Inlet	2.3	---	---	---	Initial Investigation	Industrial
USN PSNS - Sinclair East	Sinclair Inlet	133	\$5	\$10	25%	FS	Navy operations
USN PSNS - Sinclair West	Sinclair Inlet	266	\$5	\$10	50%	FS	Navy operations
USN Keyport - Liberty2	Liberty Bay	12	\$0.5	\$5	---	Done	Navy operations
USN Keyport - Liberty1	Liberty Bay	24	\$0.5	\$5	---	Done	Navy operations
USN Keyport - Tide Flats	Liberty Bay	0.2	\$0.5	\$5	0%	Design	Navy operations
USN Jackson Park	Dyes Inlet	169	\$0.5	\$5	100%	FS	Navy operations
USACE Manchester Annex	Clam Bay	6.9	\$0.5	\$5	100%	Design	Navy operations, Landfill
<b>Totals</b>		<b>687 acres</b>	<b>\$23 million</b>	<b>\$70 million</b>			
<b>Based on data available for</b>		<b>11 of 11 sites</b>	<b>10 of 11 sites</b>	<b>10 of 11 sites</b>			

RI = Remedial Investigation PS = Feasibility Study "—" = not applicable or data unavailable

## Columbia River

The five Columbia River sites listed in Table 11 are likely not the only sites in the Washington portion of the waterbody. Investigation of sediment contamination issues in the Columbia River is a relatively recent activity in comparison to the work done in Puget Sound. However, regional work in the river progresses, including Oregon's cleanup of Portland Harbor. With the exception of the Port of Vancouver copper ore spill, the Columbia River sites listed below are in the initial stages of cleanup.

**Figure 11:** Columbia River Vicinity Map and Sediment Quality Stations



• Sediment Quality Stations

**Table 11:** Columbia River Sediment Cleanup Site Information

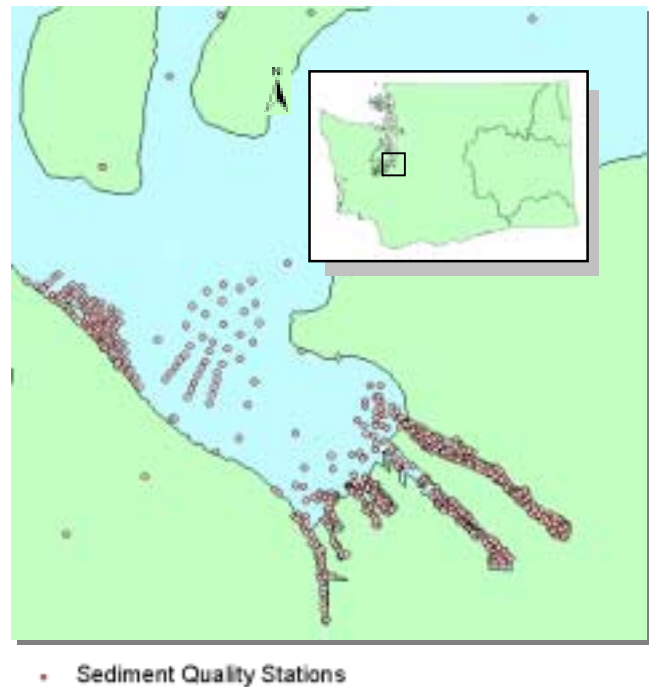
Site	Area (acres)	Cost Estimate Low (millions)	Cost Estimate High (millions)	State Owned Land (%)	Site Cleanup Status	Causes of Contamination
Port of Vancouver, Copper Ore	---	---	---	---	Done	Industrial
ALCOA, Aluminum PCB, Vancouver	---	---	---	100%	Initial Investigation	Industrial
Gibbons Creek	---	---	---	0%	Initial Investigation	Industrial, Wood Treating
Columbia River	---	---	---	---	Not started	---
CR5	---	---	---	---	Initial Investigation	Industrial

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## Commencement Bay

Commencement Bay, near Tacoma, was one of the first locations in the state where sediment cleanups were initiated. Commencement Bay work has significantly contributed to the historic foundation of sediment management in Washington State. There are 12 Commencement Bay sites listed in Table 12. The sites are associated with the industrial history of Tacoma, including the former Asarco smelter. All 12 sites are in the latter stages of cleanup. Most of the Commencement Bay sites are addressed through Superfund cleanups. Recently, Ecology announced significant reductions in the amount of toxic metals discharged to the bay. Challenges include ensuring that industrial and municipal discharges will not cause recontamination.

**Figure 12:** Commencement Bay Vicinity Map and Sediment Quality Stations



**Table 12:** Commencement Bay Sediment Cleanup Site Information

Site	Area (acres)	Cost Estimate Low (millions)	Cost Estimate High (millions)	State Owned Land (%)	Site Cleanup Status	Causes of Contamination
CB1 - Asarco	205	\$5	\$10	100%	RI/FS	Industrial, Spill, Stormwater
CB2 - Thea Foss	103	\$5	\$10	90%	Design	Industrial, Stormwater
CB3 - Hylebos	192	\$5	\$10	0%	Design	Industrial, Stormwater
CB3 - Hylebos wood debris	---	---	---	0%	RI/FS	Industrial
CB4 - Middle Waterway	13	\$5	\$10	90%	RI/FS	Industrial, Stormwater
Dickman Mill	---	---	---	---	RI/FS	---
Oline Autofluff	---	---	\$0.5	0%	Done	Industrial
Olympic View Resource Area	---	---	---	100%	RI/FS	Industrial
Pier 23, US Army Reserve	---	---	---	25%	RI/FS	Industrial, Shipyard
Silver Cloud Inn, Ruston	---	---	---	---	RI/FS	Leaking UST
Sitcum Waterway	---	---	---	---	Done	---
St. Paul Waterway	---	---	---	---	Done	---
<b>Totals</b>	<b>513 acres</b>	<b>\$20 million</b>	<b>\$41 million</b>			
<b>Based on data available for</b>	<b>4 of 12 sites</b>	<b>4 of 12 sites</b>	<b>5 of 12 sites</b>			

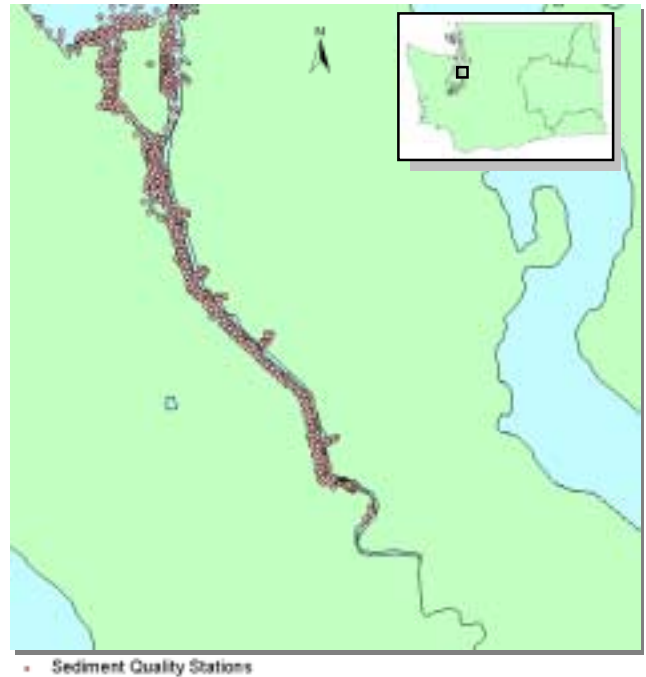
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## Duwamish River

The largest concentration of sites in Washington waters is near Seattle in Elliott Bay and the Duwamish River. While the waterbodies are connected, they are treated separately here, with the south end of Harbor Island as the boundary between the river and the bay. There are eight sites in the Duwamish River as listed in Table 13 below. The heavy concentration of industrial activity along the river is the primary cause of contamination. The sediment sites in the Duwamish are classified as marine, due to the saltwater wedge that extends upriver on the bottom with the more buoyant freshwater at the surface. Most of the sites in the Duwamish River are in the early stages of cleanup. An Administrative Order on Consent (AOC) between public and private parties was recently signed for lower Duwamish River cleanup investigations and evaluation, and may expedite cleanup.

**Figure 13:** Duwamish River Vicinity Map and Sediment Quality Stations



**Table 13:** Duwamish River Sediment Cleanup Site Information

Site	Area (acres)	Cost Estimate Low (millions)	Cost Estimate High (millions)	State Owned Land (%)	Site Cleanup Status	Causes of Contamination
Boeing Plant 2	23	\$10	\$50	0%	RI/FS	Industrial/Spills
DR29 - South Harbor Island	28	\$5	\$10	0%	Initial Investigation	Industrial/CSO
DR30 - Duwamish River main channel	115	\$10	\$50	0-10%	Initial Investigation	Unknown
DR31 - Duwamish/Diagonal CSO	2.5	\$0.50	\$5	0%	Initial Investigation	CSO/Stormwater
DR32 - Brandon St. CSO	1.5	\$0.50	\$5	0%	Initial Investigation	CSO
DR34 - Slip 3, MP&E	7.3	\$0.50	\$5	50% ?	Initial Investigation	Shipyard Discharges
DR36 - Duwamish Shipyard	2.1	\$0.50	\$5	Unknown	Initial Investigation	Shipyard Discharges
Norfolk CSO	---	---	---	0%	Cleanup & Monitoring	---
<b>Totals</b>	<b>180 acres</b>	<b>\$27 million</b>	<b>\$130 million</b>			
<b>Based on data available for</b>	<b>7 of 8 sites</b>	<b>7 of 8 sites</b>	<b>7 of 8 sites</b>			

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## Elliott Bay

There are 19 sediment sites in Elliott Bay, as shown in Table 14. As mentioned previously, Elliott Bay and the Duwamish River are discussed separately here, with the south end of Harbor Island as the boundary between the river and the bay. When considered with the Duwamish River sites, Seattle has 27 marine sites. The contamination in Elliott Bay results from maritime and industrial activity that has, in part, made Seattle the state's largest city. There are clusters of sites surrounding Harbor Island, with a few isolated sites along the western shore of Elliott Bay on the Seattle downtown waterfront. Much of the cleanup in Elliott Bay is underway and in the remedial investigation and feasibility study phase.

**Figure 14:** Elliott Bay Vicinity Map and Sediment Quality Stations



**Table 14:** Elliott Bay Sediment Cleanup Site Information

Site	Area (acres)	Cost Estimate Low (millions)	Cost Estimate High (millions)	State Owned Land (%)	Site Cleanup Status	Causes of Contamination
EB1 - Harbor Island West Waterway	12	\$0.50	\$5	0%	RI/FS	Stormwater, Ship traffic
EB10 - Todd/Lockheed	18	\$5	\$10	100%	RI/FS	Refueling Spills
EB11 - Harbor Island West Waterway	6.6	\$0.50	\$5	0%	RI/FS	Shipyard wastes
EB12 - Harbor Island West Waterway	27	\$5	\$10	0%	RI/FS	Stormwater, Ship traffic
EB13 - Harbor Island West Waterway	6.1	\$0.50	\$5	0%	RI/FS	Stormwater, CSO
EB17 - East Waterway	19	\$5	\$10	30-50%	RI/FS	Unknown
EB18 - Piers 46-52	16	\$5	\$10	80-90%	Initial Investigation	Industrial, CSO, Stormwater
EB2 - Harbor Island West Waterway	9.1	\$0.50	\$5	0%	RI/FS	Shipyard wastes
EB23 - Seacrest Park	14	\$5	\$10	100%	Done	Unknown
EB25 - Central Seattle Waterfront	36	\$10	\$50	---	Not started	Industrial, CSO, Spills
EB26 - Denny Way CSO	2.4	\$0.50	\$5	---	Cleanup & Monitoring	CSO
EB27 - Piers 46-48	1.6	\$0.50	\$5	0-5%	Not started	CSO
EB28 - Colman Dock, Pier 58	13	\$5	\$10	30-50%	RI/FS	Industrial, CSO, Spills
EB3 - Todd/Lockheed	77	\$5	\$25	100%	RI/FS	Shipyard discharges
EB5 - Todd/Lockheed	20	\$5	\$25	80%	RI/FS	Shipyard Discharges
EB6 - Pacific Sound Resources	11	\$0.50	\$5	100%	RI/FS	Industrial
EB7 - East Waterway	12	\$5	\$10	0%	RI/FS	CSO, Tank Farm Seeps
EB8 - Harbor Island (partial T18)	38	\$5	\$25	0%	Initial Investigation	Industrial, CSO, Port Operations
EB9 - East Waterway	2.6	\$0.50	\$5	0%	RI/FS	Unknown
<b>Totals</b>	<b>341 acres</b>	<b>\$64 million</b>	<b>\$235 million</b>			
<b>Based on data available for</b>	<b>19 of 19 sites</b>	<b>19 of 19 sites</b>	<b>19 of 19 sites</b>			

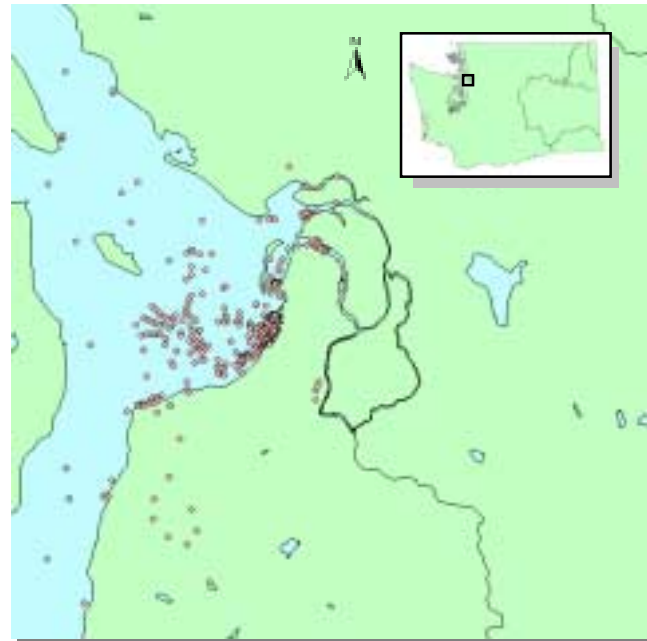
RI = Remedial Investigation FS = Feasibility Study "—" = not applicable or data unavailable



## Everett and Port Gardner

The nine sediment cleanup sites near Everett are listed in Table 15 below. The sediment cleanup sites near Everett are a study in contrasts, with all of the sites either completed or not yet started. For the sites not yet started, lack of available staff has been identified as the primary impediment to progress. Most of the completed sites were associated with the former Weyerhaeuser Everett facility. Sale of the facility by Weyerhaeuser may have contributed to the expedited cleanup of the associated sites.

**Figure 15:** Everett Vicinity Map and Sediment Quality Stations



• Sediment Quality Stations

**Table 15:** Everett Sediment Cleanup Site Information

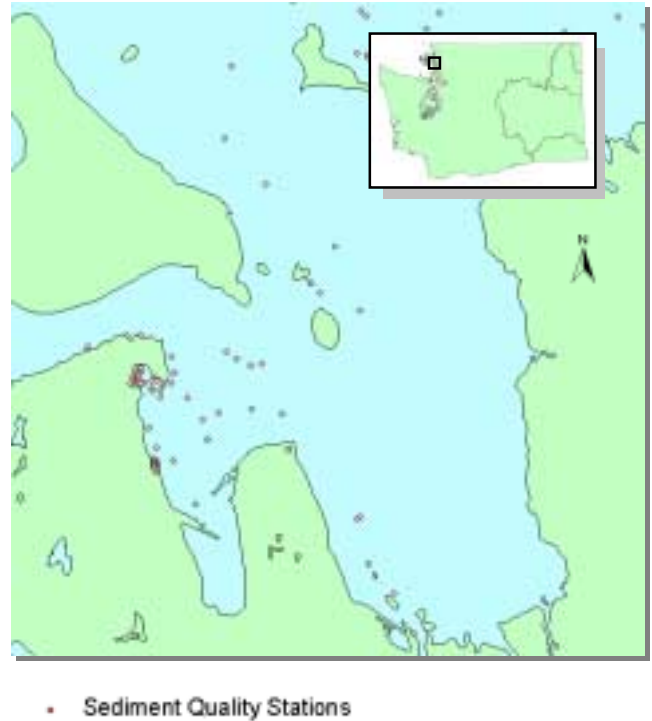
Site	Area (acres)	Cost Estimate Low (millions)	Cost Estimate High (millions)	State Owned Land (%)	Site Cleanup Status	Causes of Contamination
Mill E/Koppers	46	\$0	\$0	0%	Done	Industrial
Piers 1&3	11	\$0.5	\$5	10-20%	Done	Industrial, CSO
South East Waterway	7.3	\$0.5	\$5	---	Not Started	Industrial, Spills
North East Waterway	13	\$5	\$10	---	Not Started	Industrial
South Terminal	27	\$5	\$10	20% ?	Not Started	Industrial
Mukilteo DFSP	25	\$5	\$10	---	Not Started	Industrial, Military, Groundwater
Everett Simpson	---	---	---	---	Done	---
Weyerhaeuser - Everett	---	---	---	---	Done	---
Smith Island Slough	---	---	---	---	Done	---
<b>Totals</b>	<b>130 acres</b>	<b>\$16 million</b>	<b>\$40 million</b>			
<b>Based on data available for</b>	<b>6 of 9 sites</b>	<b>6 of 9 sites</b>	<b>6 of 9 sites</b>			

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## Fidalgo Bay

There are five sediment sites identified in Fidalgo Bay near Anacortes, listed in Table 16 below. Most of the sites are in the early stages of cleanup. Much of the information about area and cost of cleanup has not yet been determined. It should be noted that while two refineries are located in Fidalgo Bay, the sites listed here do not appear to be associated with the refinery operations. Instead, the sites are associated with maritime and industrial activities near Anacortes.

**Figure 16:** Fidalgo Bay Vicinity Map and Sediment Quality Stations



**Table 16:** Fidalgo Bay Sediment Cleanup Site Information

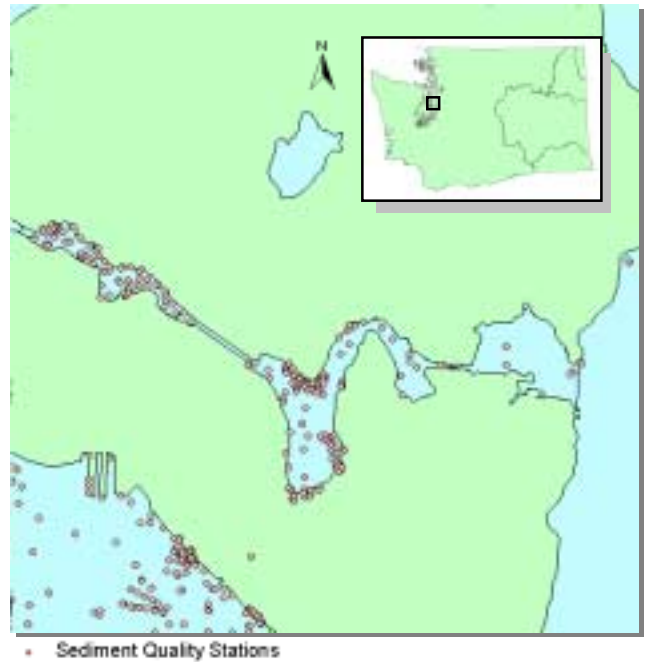
Site	Area (acres)	Cost Estimate Low (millions)	Cost Estimate High (millions)	State Owned Land (%)	Site Cleanup Status	Causes of Contamination
Custom Plywood	3.7	\$0.5	\$5.0	0	Initial Investigation	Industrial
Dakota Creek Shipyard	---	---	---	---	Not Started	---
MOB Properties	---	\$0.5	\$5.0	Unknown	Not Started	Industrial
FB4	---	---	---	Unknown	Initial Investigation	Industrial
Shannon Point Seafoods	---	---	---	---	Done	---
FB6	---	---	---	---	Not Started	Industrial
<b>Totals</b>	<b>4 acres</b>	<b>\$1 million</b>	<b>\$10 million</b>			
<b>Based on data available for</b>	<b>1 of 6 sites</b>	<b>2 of 6 sites</b>	<b>2 of 6 sites</b>			

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## Lake Union

Lake Union and the Ship Canal are located in Seattle and have five sediment sites as shown in Table 17 below. Maritime industry is the predominant activity in the vicinity and with the exception of the Gas Works Park site, the Lake Union sites are related to maritime activity. The Lake Union sites are in the early stage of cleanup. While there can be some marine water influence entering through the locks at the Ship canal, the sediments in Lake Union are freshwater in nature. Ecology site managers identified lack of staff to oversee cleanup and control of sources as the primary impediments to progress in Lake Union.

**Figure 17:** Lake Union Vicinity Map and Sediment Quality Stations



**Table 17:** Lake Union Sediment Cleanup Site Information

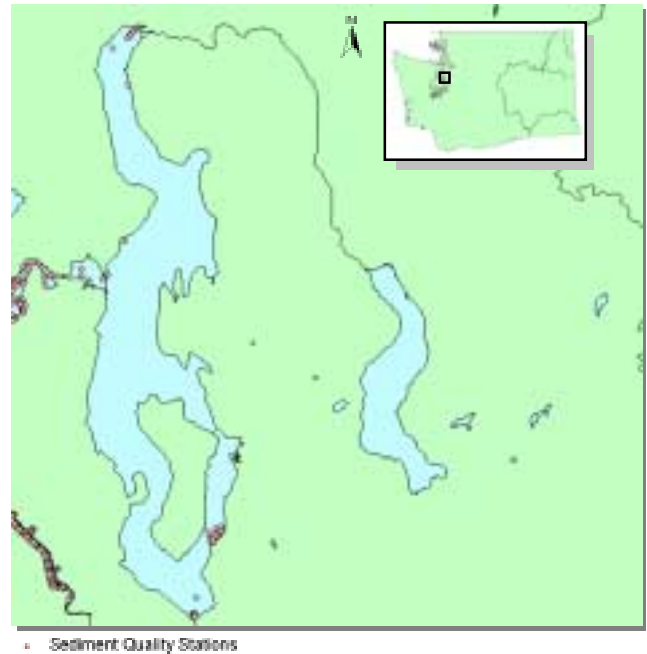
Site	Area (acres)	Cost Estimate Low (millions)	Cost Estimate High (millions)	State Owned Land (%)	Site Cleanup Status	Causes of Contamination
Lake Union Drydock	11	\$0.50	\$5	10-30%	Initial Investigation	Stormwater, Refueling
LU2	11	\$0.50	\$5	---	Initial Investigation	Shipyard
Northlake Shipyard	32	\$0.50	\$5	80%	Initial Investigation	Shipyard
Gas Works Park	52	\$5	\$10	---	Initial Investigation	Industrial
Lake Union/Ship Canal	---	\$10	\$50	90%	Initial Investigation	Industrial, CSO, Stormwater, Vessels
<b>Totals</b>	<b>107 acres</b>	<b>\$17 million</b>	<b>\$75 million</b>			
<b>Based on data available for</b>	<b>4 of 5 sites</b>	<b>5 of 5 sites</b>	<b>5 of 5 sites</b>			

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## Lake Washington

The six known sites in Lake Washington are shown in Table 18. Contaminants from wood treatment and other industry in the southern part of the lake are the predominant concern. As shown in Figure 18, the available sediment quality data from sampling stations are clustered around a few distinct sites and not much is known about sediment quality in the majority of the lake. However, much of the lake lacks the influences that cause sediment contamination and is not likely to have sediments causing adverse impacts or risks to human health.

**Figure 18:** Lake Washington Vicinity Map and Sediment Quality Stations



**Table 18:** Lake Washington Sediment Cleanup Site Information

Site	Area (acres)	Cost Estimate Low (millions)	Cost Estimate High (millions)	State Owned Land (%)	Site Cleanup Status	Causes of Contamination
LW1	1.1	\$0.50	\$5	0% ?	Not Started	Industrial
Port Quendall	13	\$5	\$10	30-40%	RI/FS	Industrial
Barbee Mill	---	---	---	---	Not Started	Industrial
Barter	---	---	---	---	RI/FS	Industrial
NOAA Sandpoint	---	---	---	---	Cleanup & Monitoring	---
Boeing Renton	---	---	---	---	RI/FS	Industrial
<b>Totals</b>	<b>15 acres</b>	<b>\$6 million</b>	<b>\$15 million</b>			
<b>Based on data available for</b>	<b>2 of 6 sites</b>	<b>2 of 6 sites</b>	<b>2 of 6 sites</b>			

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## Other Waterbodies with Sites

Of the 31 sites located in waterbodies other than those shown in the previous pages, 22 are listed in Table 19 below. Data on the additional 9 sites is currently being evaluated for accuracy and completeness and is therefore not presented here. The 22 sites in Table 19 include both

freshwater and marine sites. The list contains a few high priority sites such as Intalco in the

Strait of Georgia north of Bellingham and Cascade Pole in Budd Inlet in Olympia. If sediment cleanup is approached on a bay-by-bay basis, some accommodation will need to be made for sites in waterbodies with fewer identified sites.

**Table 19:** Other Waterbodies with Sediment Cleanup Sites

Site	Location	Fresh or Marine Waters (F,M)	Area (acres)	Cost Estimate Low (millions)	Cost Estimate High (millions)	State Owned Land (%)	Site Cleanup Status	Causes of Contamination
Cascade Pole	Budd Inlet	M	8.7	\$0.50	\$5	0%	FS	Industrial
Midwest	Budd Inlet	M	16	\$5	\$10	100%	Cleanup	Industrial and Municipal Sewer
Heritage Park, Capitol Lake	Capitol Lake	F	---	---	---	100%	Done	Industrial
Gray's Harbor Paper Co.	Gray's Harbor	M	---	---	---	---	Initial Investigation	---
Gray's Harbor Shipyard Berg Marine	Gray's Harbor	M	---	---	---	50%	Initial Investigation	Industrial
Pakonen Boatyard	Gray's Harbor	M	---	---	\$1	---	Cleanup	Industrial
USN Subbase Bangor	Hood Canal	M	9.2	\$0.50	\$5	---	Done	Navy operations
Pope and Talbot	Hood Canal, Fort Gamble	M	---	---	---	---	Initial Investigation	Industrial
USN Port Hadlock	Indian Island	M	9.2	\$0.50	\$5	---	Done	Navy operations
Goose Lake	Mason Co.	F	---	---	\$1	90%	RI	Industrial
Oakland Bay, Shelton	Mason Co., Oakland Bay	M	---	---	---	100%	Initial Investigation	Industrial
Mill Creek, Western Processing	Mill Creek, King Co.	F	---	---	---	0%	Done	Industrial
Whitmarsh Landfill - Padilla Bay	Padilla Bay	M	---	---	---	---	Initial Investigation	Landfill
Port Angeles Harbor	Port Angeles	M	---	---	---	---	Initial Investigation	---
Port Ludlow	Port Ludlow	M	---	---	---	100%	Initial Investigation	Industrial
Point Wells Chevron	So. Edmonds	M	14	\$0.50	\$5	60%	Initial Investigation	Industrial
McNeil Island Penitentiary	South Puget Sound	M	---	---	---	100%	Done	Industrial, Shipyard
Norwegian Seafoods	South Puget Sound	M	---	---	---	---	RI	---
Spokane River	Spokane River	F	---	---	---	---	Initial Investigation	Mining Operations
Intalco	Strait of Georgia	M	48	\$10	\$50	100%	FS	Industrial
USN Lake Hancock	Whidbey Island	M	6.9	\$0.50	\$5	25%	Done	Navy - Bombing practice
Pacific Wholesale, Raymond	Willapa River	M	---	---	---	0%	---	Leaking LUST
<b>Totals</b>			<b>112 acres</b>	<b>\$18 million</b>	<b>\$86 million</b>			
<b>Based on data available for</b>			<b>7 of 22 sites</b>	<b>7 of 22 sites</b>	<b>9 of 22 sites</b>			

RI = Remedial Investigation FS = Feasibility Study "----" = not applicable or data unavailable