Table 2-1. Project Personnel Contact Information

Name	Role	Contact Information
USACE – Portland District Mark Dasso	**Project Manager**	333 SW First Avenue Portland, OR 97024-3495 Phone: (503) 808-4728 Fax: (503) 808-4905
USACE – Portland District Michael Gross	**Technical Lead and COR for URS Contract** Environmental Engineer	333 SW First Avenue Portland, OR 97024-3495 Phone: (503) 808-4913 Fax: (503) 808-4905
USACE – Portland District Kitia Howard	**Technical Support** Environmental Engineer	333 SW First Avenue Portland, OR 97024-3495 Phone: (503) 808-4953 Fax: (503) 808-4905
USACE – Portland District Amy Echols	**Public Affairs Office** Public Affairs Specialist	333 SW First Avenue Portland, OR 97024-3495 Phone: (503) 808-4510 Fax: (503) 808-4515
USACE – Seattle District John Wakeman	**Risk Assessment Lead** Biologist	4735 E. Marginal Way S Seattle, WA 98134 Phone: (206) 764-3430 Fax: (206) 764-3706
USACE – Portland District Barbara Creel	**Tribal Liaison**	1125 NW Couch Street Portland, Oregon, 97208-2870 Phone: (503) 808-3715 Cell: (503) 467-9181
USACE - ERDC Todd Bridges	**Independent Technical Review Team** Risk Assessor	ERDC 3909 Halls Ferry Road Vicksburg, MS 39180 Phone: (601) 634-3626 Fax: (601) 634-3120
USACE – Omaha Chuck Coyle Anita Meyer Sandy Frye Thomas Georgian Sam Bass	**Independent Technical Review Team** Environmental Engineer Risk Assessor Regulatory Specialist Chemist Geologist	12565 West Center Rd Omaha, NE 68144 Phone: (402) 697-2578 Fax: (402) 697-2595
USACE - Bonneville Dam Project Carlton Morris, Frank Salber	**Site Contacts**	Bonneville Lock and Dam Project Cascade Locks, OR 97014-0150 Phone: (541) 374-7986, 541-374-4571
EPA Ken Marcy	**Superfund Project Manager**	1200 Sixth Ave (ECL-112) Seattle, WA 98101 Phone: (206) 553-2782
US FWS Jeremy Buck	**Federal Trustee** Environmental Contaminant Specialist	2600 SE 98th Ave, Suite 100 Portland, Oregon 97266 Phone: (503) 231-6179 Fax: (503) 231-6195
NOAA Jeff Lockwood	**Federal Trustee** Fisheries Specialist	Phone: (503) 231-2349 Fax: (503) 231-6893

Name	Role	Contact Information
DEQ Bob Schwarz	**DEQ Project Manager**	400 East Scenic Drive, #307 The Dalles, OR 97058 Phone: (541) 298-7255 (ext.30)
ODFW Rose Owens	**State Trustee**	17330 SE Evelyn Street Clackamas, OR 97015 Phone: (503) 947-6085
Ecology Russ McMillan	**State Trustee** **Sediment Management Specialist**	Washington State Department of Ecology - Toxics Cleanup Program, SW Region, P.O. Box 47027, Olympia, WA 98504-7027 Phone: (360)407-6254
WDOH David McBride	**State Trustee** Toxicologist	877.485.7316 ext 3176
Yakama Tribe Rose Longoria	**Tribal Representative** Superfund Project Manager	PO Box 151, Fort Road Toppenish, WA 98948 Phone: (509) 865-5121 (ext 6365)
Umatilla Tribe Kathleen Feehan	**Tribal Representative** Water Quality Policy Specialist	PO Box 638 Pendleton, OR 97801 Phone: (541) 276-3165 Fax: (541) 276-3035
Warm Springs Tribe Brad Houslet	**Tribal Representative**	Fisheries Program Manager Confederated Tribes of the Warm Springs Reservation of Oregon Natural Resources Department P.O. Box C Warm Springs, OR 97761 541-553-2039 / fax 541-553-1994 bhouslet@wstribes.org
Columbia River Intertribal Fish Commission Patti Howard	**Tribal Representative**	729 NE Oregon St., Ste. 200 Portland, Oregon 97232 (503) 238-0667 fax (503) 235-4228
URS Jeffrey Wallace Chris Moody	**A/E Services Contractor** Project Manager and Point of Contact Assistant Project Manager	111 SW Columbia, Suite 1500 Portland, Oregon 97201 Phone: (503) 948-7242 Fax: (503) 222-4292

Table 3-1
Occurrence and Status of Threatened, Endangered, and Sensitive Species in the Bradford Island Vicinity, Oregon

Common and Scientific Name	Status					Probability of Occurrence
	Federal	State	ONHP List	TNC	ODFW	
Plants						
Golden indian-paintbrush *(Castilleja levisecta)*	LT	LE	1	G1, SH		Very unlikely, no suitable habitat, not seen in Oregon for 40 years, not observed.
Howellia (*Howellia aquatilus*)	LT		1	G2, SH		Very unlikely, no suitable habitat, not observed.
Howellis daisy *(Erigeron howellii)*	SoC	ODA Candi-date	1	G2, S2		Very unlikely, known from higher elevations in the Gorge, potentially suitable habitat on Bradford Island in forested areas, not project site, not observed.
Oregon daisy *(Erigeron oreganus)*	SoC	ODA Candi-date	1	G3, S3		Very unlikely, last seen in early 1900s in Bonneville Dam area, unlikely to occur, not observed.
Tall bugbane *(Cimicifuga elata)*	SoC	ODA Candi-date	1	G2, S2		Very unlikely, not observed, no suitable habitat.
Barrett's penstemon *(Penstemon barrettiae)*	SoC	ODA Candi-date	1	G2, S2		Very unlikely, not observed in potentially suitable habitat, and would be identifiable if it had been present.
Howell's bentgrass *(Agrostis howellii)*	SoC	ODA Candi-date	1	G2, S2		Very unlikely, not observed, should have been identifiable if present.
Cold-water corydalis *(Corydalis aquae-gelidae)*	SoC	ODA Candi-date	1	G3, S2		Very unlikely, not observed, no habitat present.
Liverwort *(Scapania gymnostomophila)*			2	G4, S1		Very unlikely, not observed, potentially suitable habitat present on side of island north of project area.
Strickland's tauschia *(Tauschia stricklandii)*			2	G4, S1		Very unlikely, no suitable habitat, not observed.
Long-bearded hawkweed *(Hieracium longiberbe)*			4	G4, S3		Very unlikely, not observed, potential cliff habitat not within project area.
Sicklepod rockcress *(Arabis sparsiflora* var. *atrorubens)*			2	G5T3, S2		Very unlikely, not observed, probably no suitable habitat present.

Table 3-1 (continued)
Occurrence and Status of Threatened, Endangered, and Sensitive Species in the Bradford Island Vicinity, Oregon

Common and Scientific Name	Status					Probability of Occurrence
	Federal	State	ONHP List	TNC	ODFW	
Columbia lewisia *(Lewisia columbiana* var. *columbiana)*			2	G4T4, S2		Very unlikely, not observed, rocky slope habitat present outside of project area.
Oregon bolandra *(Bolandra oregana)*		Critical	4	G3, S3		Very unlikely, not observed, no wet cliff/talus habitat present on Bradford Island.
Invertebrates						
Pristine springsnail *(Pristinicola hempilli)*			3			Very unlikely, no suitable habitat (springs) present in project area.
Fish						
Sockeye salmon *(Oncorhynchus nerka)* Salmon River tributary to Snake River, Idaho ESU	LE		1	G5, S4		Any surviving fish of this extremely rare species would pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migration. No spawning or rearing.
Chum salmon *(Oncorhynchus keta)* Lower Columbia River ESU	LT	Critical	2	G5, S2		Unlikely, current range restricted to below Bonneville Dam. No spawning or rearing.
Steelhead *(Oncorhynchus mykiss)* Lower Columbia ESU	LT	Critical	1	G5T3Q, S3		Adults and smolt pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Steelhead *(Oncorhynchus mykiss)* Snake River Basin ESU	LT	Vulnerable	1	G5T3Q, S3		Adults and smolt pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Steelhead *(Oncorhynchus mykiss)* Middle Columbia ESU	LT	Vulnerable	3	G5T3Q, S3		Adults and smolt pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Chinook salmon *(Oncorhynchus tsawytscha)* Snake River ESU	LT	LT	1	G5T3Q, S3		Adults and smolt pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Chinook salmon *(Oncorhynchus tsawytscha)* Lower Columbia ESU	LT					Adults and smolt pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Coastal cutthroat trout *(Oncorhynchus clarki clarki)*	C	Critical	3	G4TQ, S4		Adults and juveniles pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.

Table 3-1 (continued)
Occurrence and Status of Threatened, Endangered, and Sensitive Species in the Bradford Island Vicinity, Oregon

Common and Scientific Name	Status					Probability of Occurrence
	Federal	State	ONHP List	TNC	ODFW	
Coho salmon *(Oncorhynchus kisutch)* Lower Columbia ESU	C	Critical	1	G4T3Q, S3		Adults and juveniles pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Pacific lamprey *(Lampropelta tridentata)*	SoC	Vulnerable	3	G5, S3		Adults and juveniles pass through Bonneville Dam and may move past Bradford Island on upstream and downstream migrations. No spawning or rearing.
Amphibians						
Larch mountain salamander *(Plethodon larselli)*	SoC	Vulnerable	2	G2, S2		Very unlikely, suitable small-sized talus slope habitat not present.
Oregon spotted frog *(Rana pretiosa)*	C	Critical	1	G2G3, S2		Very unlikely, no suitable warm, shallow marsh habitat present.
Reptiles						
Western painted turtle *(Chrysemys picta)*		Critical	2	G5, S2		Very unlikely, observed in ponds near Cascade Locks, no suitable habitat in project area.
Birds						
Northern spotted owl *(Strix occidentalis caurina)*	LT	LT	1	G3T3, S3		Very unlikely to occur, only as transients passing through, area too small and disturbed to provide habitat.
Bald eagle *(Haliaeetus leucocephalus)*	LT (soon to be delisted)	LT	1	G4,S3B, S4N		Summer breeding and wintering resident of the vicinity.
Mammals						
Columbia white-tailed deer *(Odocoileus virginianus lecurus)*	LE	Vulnerable	1	G5T2Q, S2		Very unlikely, no suitable habitat, current range below RM 50.
Northern (Stellar) Sea Lion *(Eumetopias jubatus)*	LT	Vulnerable	2	G3, S2		Sea lions have been observed foraging in the Bonneville pool, but they are not known to occur in the Bonneville forebay (above the dam).

State and Federal Status Definitions

LE – Listed Endangered. Taxa listed by the U.S. Fish and Wildlife Service or National Marine Fisheries Service as Endangered under the Endangered Species Act, or by the Oregon Departments of Agriculture (ODA) and Fish and Wildlife (ODFW) under the Oregon Endangered Species Act of 1987. Endangered taxa are those that are in danger of becoming extinct within the foreseeable future throughout all or a significant portion of their range.

LT – Listed Threatened. Taxa listed by the above agencies as Threatened; defined as those taxa likely to become endangered within the foreseeable future.

PE – Proposed Endangered. Taxa proposed by the above agencies to be listed as endangered.

Table 3-1 (continued)
Occurrence and Status of Threatened, Endangered, and Sensitive Species in the Bradford Island Vicinity, Oregon

PT – Proposed Threatened. Taxa proposed by the above agencies to be listed as threatened.

C – Candidate. Candidate taxa for which National Marine Fisheries Service or U.S. Fish and Wildlife Service have sufficient information to support a proposal to list under the Endangered Species Act, or which is a candidate for listing by the ODA under the Oregon Endangered Species Act.

SoC – Species of Concern. Former Category 2 candidates for which additional information is needed to propose as threatened or endangered under the Endangered Species Act; these species are under review for consideration as Candidates for listing under the Endangered Species Act.

Oregon Natural Heritage Program (ONHP) Definitions

List 1 - taxa that are threatened with extinction or presumed to be extinct throughout their entire range.

List 2 – taxa threatened with extirpation or presumed extirpated from Oregon; often peripheral or disjunct species that are of concern considering species diversity within Oregon; can be very significant in protecting the genetic diversity of the taxon; ONHP regards extreme rarity as a significant threat and has included species that are very rare in Oregon on this list.

List 3 – taxa for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range.

List 4 – taxa that are of conservation concern but not currently threatened or endangered, including taxa that are very rare but considered secure as well as those declining in numbers or habitat but still too common to be proposed as threatened or endangered; these taxa require continued monitoring.

The Nature Conservancy's (TNC) Natural Heritage Network Ranks

The Natural Heritage Network ranks are part of a national system of ranking species throughout the world and is used throughout the U.S., Canada, and 13 Latin American countries. Both global and state ranks are provided in ONHP (1998), abbreviated as "G" and "S."

1 – Critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation, typically with 5 or fewer occurrences.

2 – Imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction (extirpation), typically with 6-20 occurrences.

3 – Rare, uncommon, or threatened, but not immediately imperiled, typically with 21-100 occurrences.

4 – Not rare and apparently secure, but wth cause for long-term concern, usually with more than 100 occurrences.

5 – Demonstrably widespread, abundant, and secure.

H – Historical occurrence, formerly part of native biota with the implied expectation that it may be rediscovered.

X – Presumed extirpated or extinct.

U – Unknown rank.

ODFW Ranks

SC – **State Critical**. Species for which listing as threatened or endangered is pending; or those for which listing as threatened or endangered may be appropriate if immediate conservation activities are not taken. Also considered critical are some peripheral species that are at risk throughout their range, and some disjunct populations.

SV – State Vulnerable. Species for which listing as threatened or endangered is not believed to be imminent and can be avoided through continued or expanded use of adequate protective measures and monitoring. In some cases the population is sustainable and protective measures are being implemented; in others, the population may be declining and improved protective measures are needed to maintain sustainable populations over time.

Table 3-1 (continued)
Occurrence and Status of Threatened, Endangered, and Sensitive Species in the Bradford Island Vicinity, Oregon

SP – Peripheral or Naturally Rare. Peripheral species refer to those whose Oregon populations are on the edge of their range. Naturally rare species are those that had low population numbers historically in Oregon because of natural limiting factors. Maintaining the status quo for the habitats and populations of these species is a minimum requirement. Disjunct populations of several species that occur in Oregon should not be confused with peripheral.

SU – Undetermined Status. Animals in this category are species whose status is unclear. They may be susceptible to population decline of sufficient magnitude that they could qualify for endangered, threatened, critical, or vulnerable status, but scientific study will be required before a judgment can be made.

Table 3-2
Designated Beneficial Uses – Mainstem Columbia River

Beneficial Uses	Columbia River Mouth to RM 86	Columbia River RM 86 to 309
Public Domestic Water Supply[1]	X	X
Private Domestic Water Supply[1]	X	X
Industrial Water Supply	X	X
Irrigation	X	X
Livestock Watering	X	X
Fish & Aquatic Life[2]	X	X
Wildlife & Hunting	X	X
Fishing	X	X
Boating	X	X
Water Contact Recreation	X	X
Aesthetic Quality	X	X
Hydro Power		X
Commercial Navigation & Transportation	X	X

Source: OAR 340-41-0101, November 2003

[1] With adequate pretreatment and natural quality that meets drinking water standards.
[2] See also Table 3-3 for fish use designations for this river.

Table 3-3
Beneficial Use Designations – Fish Uses, Mainstem Columbia River

Geographic Extent of Use	**Salmon and Steelhead Migration Corridors (20°C)**	**Salmon and Steelhead Spawning through Fry Emergence**	**Shad and Sturgeon Spawning and Rearing**
Mainstem Columbia River			
Beacon Rock to Upstream of Ives Island (RM 141.5 to RM 143.5)		October 15 March 31	
Columbia River, mouth to Washington border (RM309)	X		
Columbia River (RM 147 to RM 203)			X

Source: OAR 340-41-0101, November 2003
RM = River mile

Table 5-1. List of COIs in Soil from Landfill: Upland In-Place, Bradford Island

Analyte (1)	Summary Statistics				Selection of COIs		
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/kg)	Max Detected Conc. (mg/kg)	WDOE Clark County Background Conc. (mg/kg) (2)	Max Conc. Exceeds Background?	Retain as COI?
INORGANICS							
Aluminum	21	100%	2380	23100	52300	No	No
Antimony	31	65%	0.309	8.19	NA	na	**Yes**
Arsenic	32	100%	1.5	16.6	6	Yes	**Yes**
Barium	32	100%	34	243	NA	na	**Yes**
Beryllium	32	66%	0.186	0.576	2	No	No
Cadmium	32	81%	0.343	3.54	1	Yes	**Yes**
Chromium	32	100%	11	2300	27	Yes	**Yes**
Cobalt	21	100%	3.99	42.3	NA	na	**Yes**
Copper	32	100%	17.9	378	34	Yes	**Yes**
Lead	38	100%	5.34	1660	17	Yes	**Yes**
Manganese	32	100%	146	1713	1500	Yes	**Yes**
Mercury	32	84%	0.015	5.5	0.04	Yes	**Yes**
Nickel	32	100%	7.85	1760	21	Yes	**Yes**
Selenium	32	41%	0.106	0.848	NA	na	**Yes**
Silver	32	69%	0.101	1.52	NA	na	**Yes**
Thallium	32	69%	0.0361	0.254	NA	na	**Yes**
Vanadium	21	100%	15.9	93.4	NA	na	**Yes**
Zinc	32	100%	41.6	1140	96	Yes	**Yes**
BUTYLTINS							
Dibutyltin	16	6%	0.0202	0.0202	NA	na	**Yes**
Monobutyltin	16	6%	0.00908	0.00908	NA	na	**Yes**
Tributyltin	16	13%	0.00841	0.00901	NA	na	**Yes**
HERBICIDES							
2,4,5-T	25	8%	0.063	0.093	NA	na	**Yes**
Dichlorprop	25	8%	0.17	0.18	NA	na	**Yes**
MCPP	25	8%	5.03	14	NA	na	**Yes**
PESTICIDES							
Chlordane (technical)	14	43%	0.0494	1.56	NA	na	**Yes**
Heptachlor	25	8%	0.0018125	0.00283	NA	na	**Yes**
alpha-Chlordane	11	9%	0.00303	0.00303	NA	na	**Yes**
p,p'-Dichlorodiphenyl dichloroethylene	25	8%	0.0005	0.017	NA	na	**Yes**
PCBs							
Aroclor 1254	36	36%	0.0267	1.1	NA	na	**Yes**
Aroclor 1260	36	58%	0.00205	0.66	NA	na	**Yes**
VOCs							
Tetrachloroethylene	21	62%	0.000605	0.0330	NA	na	**Yes**
Toluene	21	33%	0.000225	0.00318	NA	na	**Yes**
o-Xylene	21	10%	0.000368	0.000735	NA	na	**Yes**
SVOCs							
2,6-Dinitrotoluene	25	16%	0.0095	0.0104	NA	na	**Yes**
2-Methylnaphthalene	25	32%	0.000057	0.0434	NA	na	**Yes**
3- & 4-Methylphenol	14	21%	0.0034	0.064	NA	na	**Yes**
Acenaphthene	25	60%	0.000042	2.53	NA	na	**Yes**
Acenaphthylene	25	36%	0.000022	0.111	NA	na	**Yes**
Anthracene	25	72%	0.000012	8.44	NA	na	**Yes**

Table 5-1. List of COIs in Soil from Landfill: Upland In-Place, Bradford Island

Analyte (1)	Summary Statistics				Selection of COIs		
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/kg)	Max Detected Conc. (mg/kg)	WDOE Clark County Background Conc. (mg/kg) (2)	Max Conc. Exceeds Background?	Retain as COI?
Benzidine	24	8%	0.015	0.0383	NA	na	**Yes**
Benzo(a)anthracene	25	88%	0.000029	31.2	NA	na	**Yes**
Benzo(a)pyrene	25	88%	0.000028	34	NA	na	**Yes**
Benzo(b)fluoranthene	15	80%	0.000034	0.087	NA	na	**Yes**
Benzo(g,h,i)perylene	25	88%	0.00002	17	NA	na	**Yes**
Benzo(k)fluoranthene	15	73%	0.00004	0.065	NA	na	**Yes**
Benzofluoranthenes	10	100%	0.197	31.3	NA	na	**Yes**
Benzoic acid	25	32%	0.00002	0.553	NA	na	**Yes**
Bis(2-ethylhexyl)phthalate	25	80%	0.00015	3.96	NA	na	**Yes**
Butyl benzyl phthalate	25	16%	0.000022	0.152	NA	na	**Yes**
Carbazole	25	52%	0.000027	2.84	NA	na	**Yes**
Chrysene	25	88%	0.000062	35.3	NA	na	**Yes**
Dibenz(a,h)anthracene	25	60%	0.000018	1.94	NA	na	**Yes**
Dibenzofuran	25	48%	0.00002	0.419	NA	na	**Yes**
Diethyl phthalate	25	24%	0.00005	0.0734	NA	na	**Yes**
Fluoranthene	25	88%	0.000042	48.3	NA	na	**Yes**
Fluorene	25	60%	0.000047	1.61	NA	na	**Yes**
Indeno(1,2,3-cd)pyrene	25	84%	0.000018	20	NA	na	**Yes**
Naphthalene	25	40%	0.0000545	0.176	NA	na	**Yes**
PCP	25	8%	0.000072	0.201	NA	na	**Yes**
Phenanthrene	25	84%	0.000013	21.9	NA	na	**Yes**
Pyrene	25	88%	0.000043	67.1	NA	na	**Yes**
TPHs							
Diesel Fuel No. 2	17	82%	22.9	9735	NA	na	**Yes**
Diesel Range Hydrocarbons	15	67%	17.0	1000	NA	na	**Yes**
Gasoline Range Hydrocarbons	20	15%	2.10	3.28	NA	na	**Yes**
Residual Range Organics	32	81%	31.1	41900	NA	na	**Yes**

Notes:

All bolded chemicals were retained as COIs, which are defined as those analytes with a 5% detection frequency or greater and, for inorganics only, with a maximum detected concentration above WDOE background concentrations, or inorganics without a background value.

Represents soil samples collected from 0 to 10 feet bgs.

COI = Chemical of Interest

NA = not available

na = not applicable

(1) Only chemicals with detection frequency equal to or greater than 5% are shown in the table. The following essential nutrients were excluded as COIs in soil: calcium, iron, magnesium, potassium, and sodium.

(2) Natural Background Soil Metals Concentrations in Washington State, October 1994 (Regional 90th percentile values for Clark County selected).

Table 5-2. List of COIs in Soil from Sandblast Area: Upland In-Place, Bradford Island

Analyte (1)	Summary Statistics				Selection of COIs		
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/kg)	Max Detected Conc. (mg/kg)	WDOE Clark County Background Conc. (mg/kg) (2)	Max Conc. Exceeds Background?	Retain as COI?
INORGANICS							
Aluminum	50	100%	1530	23100	52300	No	No
Antimony	50	84%	0.0895	13.7	NA	na	**Yes**
Arsenic	50	98%	0.613	80.9	6	Yes	**Yes**
Barium	50	100%	10.7	123	NA	na	**Yes**
Beryllium	50	50%	0.0587	0.598	2	No	No
Cadmium	50	78%	0.0561	2.61	1	Yes	**Yes**
Chromium	53	100%	5.27	2650	27	Yes	**Yes**
Cobalt	50	100%	2.52	25.0	NA	na	**Yes**
Copper	50	100%	15.8	319	34	Yes	**Yes**
Lead	53	100%	5.24	3260	17	Yes	**Yes**
Manganese	50	100%	167	818	1500	No	No
Mercury	50	67%	0.0114	0.153	0.04	Yes	**Yes**
Nickel	50	100%	5.35	1060	21	Yes	**Yes**
Selenium	50	56%	0.127	1.17	NA	na	**Yes**
Silver	50	94%	0.0571	0.268	NA	na	**Yes**
Thallium	50	75%	0.0288	0.255	NA	na	**Yes**
Vanadium	50	100%	6.89	89.1	NA	na	**Yes**
Zinc	50	100%	31.1	1160	96	Yes	**Yes**
BUTYLTINS							
Dibutyltin	45	19%	0.00353	0.21	NA	na	**Yes**
Monobutyltin	45	24%	0.00328	0.108	NA	na	**Yes**
Tributyltin	45	23%	0.00165	1.86	NA	na	**Yes**
PESTICIDES							
4,4'-DDE	8	38%	0.000835	0.0017	NA	na	**Yes**
4,4'-DDT	8	50%	0.00339	0.0191	NA	na	**Yes**
Aldrin	8	13%	0.00098	0.00098	NA	na	**Yes**
Dieldrin	8	13%	0.00941	0.00941	NA	na	**Yes**
Endosulfan II	8	25%	0.00199	0.0108	NA	na	**Yes**
Endosulfan sulfate	8	13%	0.00161	0.00161	NA	na	**Yes**
Endrin	8	13%	0.00845	0.00845	NA	na	**Yes**
Heptachlor epoxide	8	13%	0.000634	0.000634	NA	na	**Yes**
beta-BHC	8	25%	0.000952	0.0125	NA	na	**Yes**
delta-BHC	8	13%	0.00303	0.00303	NA	na	**Yes**
gamma-BHC (Lindane)	8	13%	0.00968	0.00968	NA	na	**Yes**
gamma-Chlordane	8	13%	0.00337	0.00337	NA	na	**Yes**
PCBs							
Aroclor 1260	45	87%	0.00264	0.282	NA	na	**Yes**
VOCs							
1,1,1-Trichloroethane	14	7%	0.0000969	0.0000969	NA	na	**Yes**
1,2,4-Trimethylbenzene	14	39%	0.000215	14.3	NA	na	**Yes**
1,3,5-Trimethylbenzene	14	43%	0.0000435	6.5	NA	na	**Yes**
4-Isopropyltoluene	14	61%	0.0000622	0.161	NA	na	**Yes**
4-Methyl-2-pentanone	14	7%	0.00214	0.00214	NA	na	**Yes**
Benzene	14	43%	0.000372	0.0006	NA	na	**Yes**
Carbon disulfide	14	7%	0.000549	0.000549	NA	na	**Yes**
Dichlorodifluoromethane	14	7%	0.000085	0.000085	NA	na	**Yes**
Ethylbenzene	14	7%	0.0374	0.0374	NA	na	**Yes**
Isopropylbenzene	14	7%	0.0473	0.0473	NA	na	**Yes**
Tetrachloroethene	14	46%	0.000118	420	NA	na	**Yes**
Toluene	14	29%	0.000786	39	NA	na	**Yes**
Trichloroethene	14	71%	0.000045	6.08	NA	na	**Yes**
cis-1,2-Dichloroethene	14	21%	0.00495	0.12	NA	na	**Yes**

Table 5-2. List of COIs in Soil from Sandblast Area: Upland In-Place, Bradford Island

Analyte (1)	Summary Statistics				Selection of COIs		
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/kg)	Max Detected Conc. (mg/kg)	WDOE Clark County Background Conc. (mg/kg) (2)	Max Conc. Exceeds Background?	Retain as COI?
m,p-Xylene	14	14%	0.04	7.4	NA	na	**Yes**
n-Propylbenzene	14	14%	0.000409	0.122	NA	na	**Yes**
o-Xylene	14	21%	0.000197	3.2	NA	na	**Yes**
sec-Butylbenzene	14	14%	0.000435	0.0902	NA	na	**Yes**
trans-1,2-dichloroethene	14	7%	0.00228	0.00228	NA	na	**Yes**
SVOCs							
2-Methylnaphthalene	15	37%	0.00129	0.124	NA	na	**Yes**
3- & 4-Methylphenol	14	7%	0.00246	0.00246	NA	na	**Yes**
4-Chloroaniline	14	7%	0.411	0.411	NA	na	**Yes**
Acenaphthene	15	67%	0.00541	3.2	NA	na	**Yes**
Acenaphthylene	15	50%	0.00139	0.295	NA	na	**Yes**
Anthracene	15	63%	0.00503	2.04	NA	na	**Yes**
Benzo(a)anthracene	15	67%	0.0265	12.3	NA	na	**Yes**
Benzo(a)pyrene	15	67%	0.0289	11.7	NA	na	**Yes**
Benzo(g,h,i)perylene	15	73%	0.00433	3.83	NA	na	**Yes**
Benzofluoranthenes	15	73%	0.0077	16.3	NA	na	**Yes**
Benzoic acid	14	29%	0.0273	0.377	NA	na	**Yes**
Benzyl alcohol	14	7%	0.00781	0.00781	NA	na	**Yes**
Benzyl butyl phthalate	14	11%	0.0205	0.0317	NA	na	**Yes**
Bis(2-ethylhexyl)phthalate	15	87%	0.00667	43.5	NA	na	**Yes**
Carbazole	14	46%	0.00456	0.524	NA	na	**Yes**
Chrysene	15	67%	0.0327	12	NA	na	**Yes**
Di-n-butylphthalate	14	29%	0.0239	0.251	NA	na	**Yes**
Di-n-octylphthalate	14	39%	0.0161	0.425	NA	na	**Yes**
Dibenz(a,h)anthracene	15	57%	0.00123	1.43	NA	na	**Yes**
Dibenzofuran	15	50%	0.000996	0.485	NA	na	**Yes**
Fluoranthene	15	73%	0.00629	28.6	NA	na	**Yes**
Fluorene	15	53%	0.00713	0.779	NA	na	**Yes**
Indeno(1,2,3-cd)pyrene	15	73%	0.00352	4.17	NA	na	**Yes**
Naphthalene	15	37%	0.00204	0.256	NA	na	**Yes**
Phenanthrene	15	80%	0.00247	6.55	NA	na	**Yes**
Pyrene	15	73%	0.00914	32	NA	na	**Yes**
TPHs							
Diesel Range Hydrocarbons	48	81%	6.44	1440	NA	na	**Yes**
Gasoline Range Hydrocarbons	12	17%	132	3960	NA	na	**Yes**
Motor Oil Range Hydrocarbons	48	83%	29.8	1980	NA	na	**Yes**

Notes:

All bolded chemicals were retained as COIs, which are defined as those analytes with a 5% detection frequency or greater and, for inorganics only, with a maximum detected concentration above WDOE background concentrations, or inorganics without a background value.

Represents soil samples collected from 0 to 10 feet bgs.

COI = Chemical of Interest

NA = not available

na = not applicable

(1) Only chemicals with detection frequency equal to or greater than 5% are shown in the table. The following essential nutrients were excluded as COIs in soil: calcium, iron, magnesium, potassium, and sodium.

(2) Natural Background Soil Metals Concentrations in Washington State, October 1994 (Regional 90th percentile values for Clark County selected).

Table 5-3. List of COIs in Soil from Pistol Range: Upland In-Place, Bradford Island

Analyte (1)	Summary Statistics				Selection of COIs		
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/kg)	Max Detected Conc. (mg/kg)	WDOE Clark County Background Conc. (mg/kg) (2)	Max Conc. Exceeds Background?	Retain as COI?
INORGANICS							
Copper	10	100%	37.6	53.1	34	Yes	**Yes**
Lead	71	100%	7	1110	17	Yes	**Yes**
Nickel	10	100%	19	27	21	Yes	**Yes**
Zinc	10	100%	74	199	96	Yes	**Yes**

Notes:

All bolded chemicals were retained as COIs, which are defined as those analytes with a 5% detection frequency or greater and, for inorganics only, with a maximum detected concentration above WDOE background concentrations.

Represents soil samples collected from 0 to 10 feet bgs.

COI = Chemical of Interest

NA = not available

na = not applicable

(1) Only chemicals with detection frequency equal to or greater than 5% are shown in the table.

(2) Natural Background Soil Metals Concentrations in Washington State, October 1994 (Regional 90th percentile values for Clark County selected).

Table 5-4. List of COIs in Soil from Bulb Slope: Upland In-Place, Bradford Island

Analyte (1)	Summary Statistics				Selection of COIs		
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/kg)	Max Detected Conc. (mg/kg)	WDOE Clark County Background Conc. (mg/kg) (2)	Max Conc. Exceeds Background?	Retain as COI?
INORGANICS							
Lead	9	100%	25	444	17	Yes	**Yes**
Mercury	9	100%	0.05	0.74	0.04	Yes	**Yes**
PCBs							
Aroclor 1260	9	67%	0.027	0.16	NA	na	**Yes**
TPHs							
Diesel Range Hydrocarbons	9	100%	8.3	170	NA	na	**Yes**
Motor Oil Range Hydrocarbons	9	100%	44	410	NA	na	**Yes**

Notes:

All bolded chemicals were retained as COIs, which are defined as those analytes with a 5% detection frequency or greater and, for inorganics, with a maximum detected concentration above WDOE background concentrations.

Represents soil samples collected from 0 to 10 feet bgs.

COI = Chemical of Interest

NA = not available

na = not applicable

(1) Only chemicals with detection frequency equal to or greater than 5% are shown in the table.

(2) Natural Background Soil Metals Concentrations in Washington State, October 1994 (Regional 90th percentile values for Clark County selected).

Table 5-5. List of COIs in Soil from Landfill: Upland Transport, Bradford Island

Analyte (1)	Summary Statistics							Soil Background Comparison		Upland to River Transport Pathway Evaluation							
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/kg)	Max Detected Conc. (mg/kg)	Statistical Distribution	90% UCL (mg/kg) (2)	Notes	Lowest Background Conc. (mg/kg) (4)	Max Conc. Exceeds Background?	Selected Sediment Screening Level (mg/kg) (5)	Is Max Detected Greater than Selected Sediment Screening Level?	Is Chemical Detected at Upland Shoreline - Distance from Shoreline (feet)?				Is Chemical Detected in Forebay Sediment?	Is Further Investigation of Overland Runoff Necessary? (6)
												0 to 50	50 to 100	100 to 150	150 to 200		
INORGANICS																	
Aluminum	21	100%	2380	23100	Gamma	10576		17233	Yes	NA	No SLV	Yes	Yes	Yes	No	Yes	**Yes**
Antimony	31	65%	0.309	8.19	Lognormal	2.23		<0.5	Yes	3	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Arsenic	32	100%	1.5	16.6	Lognormal	4.84		2.98	Yes	6	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Barium	32	100%	34	243	Gamma	108		103.83	Yes	NA	No SLV	Yes	Yes	Yes	Yes	Yes	**Yes**
Beryllium	32	66%	0.186	0.576	Normal	0.313		1.18	No	Below Soil Background							No
Cadmium	32	81%	0.343	3.54	Non-parametric	2.11		0.58	Yes	0.6	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Chromium	32	100%	11	2300	Non-parametric	919		17.47	Yes	37	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Cobalt	21	100%	3.99	42.3	Gamma	19.6		15.9	Yes	NA	No SLV	Yes	Yes	Yes	No	Yes	**Yes**
Copper	32	100%	17.9	378	Non-parametric	127		34	Yes	36	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Lead	38	100%	5.34	1660	Gamma	495		13.86	Yes	35	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Manganese	32	100%	146	1713	Non-parametric	543		479.33	Yes	1100	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Mercury	32	84%	0.015	5.5	Non-parametric	1.521		0.04	Yes	0.2	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Nickel	32	100%	7.85	1760	Non-parametric	637		19.9	Yes	18	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Selenium	32	41%	0.106	0.848	Gamma	0.272		<0.5	Yes	NA	No SLV	Yes	Yes	Yes	No	No	**Yes - Qual**
Silver	32	69%	0.101	1.52	Non-parametric	0.581		<0.5	Yes	4.5	No	Yes	Yes	Yes	No	No	No
Thallium	32	69%	0.0361	0.254	Normal	0.134		<0.5	No	Below Soil Background							No
Vanadium	21	100%	15.9	93.4	Normal	55.967		59	Yes	NA	No SLV	Yes	Yes	Yes	No	Yes	**Yes**
Zinc	32	100%	41.6	1140	Non-parametric	298		56.63	Yes	123	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
BUTYLTINS																	
Dibutyltin	16	6%	0.0202	0.0202	Non-parametric	0.0123		NA	na	NA	No SLV	Yes	No	No	No	No	**Yes - Qual**
Monobutyltin	16	6%	0.00908	0.00908	Non-parametric	0.00722		NA	na	NA	No SLV	Yes	No	No	No	No	**Yes - Qual**
Tributyltin	16	13%	0.00841	0.00901	Non-parametric	0.00773		NA	na	0.0017	Yes	Yes	No	No	No	No	No
HERBICIDES																	
2,4,5-T	25	8%	0.063	0.093	Non-parametric	0.0231		NA	na	NA	No SLV	No	No	No	Yes	No	No
Dichlorprop	25	8%	0.17	0.18	Non-parametric	0.144		NA	na	NA	No SLV	No	Yes	No	Yes	No	**Yes - Qual**
MCPP	25	8%	5.03	14	Non-parametric	6.10		NA	na	NA	No SLV	No	No	Yes	Yes	No	No
PESTICIDES																	
Chlordane (technical)	14	43%	0.0494	1.56	Gamma	0.434		NA	na	0.000046	Yes	Yes	Yes	No	No	No	**Yes**
Heptachlor	25	8%	0.0018125	0.00283	Non-parametric	0.000949		NA	na	0.01	No	Yes	No	No	No	No	No
alpha-Chlordane	11	9%	0.00303	0.00303	Gamma	0.00303	(3)	NA	na	0.000046	Yes	No	No	Yes	No	No	**Yes**
p,p'-Dichlorodiphenyl dichloroethylene	25	8%	0.0005	0.017	Non-parametric	0.00397		NA	na	NA	No SLV	No	Yes	No	No	No	**Yes - Qual**
PCBs																	
Aroclor 1254	36	36%	0.0267	1.1	Lognormal	0.297		NA	na	0.000046	Yes	Yes	No	No	No	Yes	**Yes**
Aroclor 1260	36	58%	0.00205	0.66	Lognormal	0.148		NA	na	0.000046	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
VOCs (7)																	
Tetrachloroethene	21	62%	0.000605	0.0330	Lognormal	0.00882		NA	na	0.5	No	Yes	Yes	Yes	Yes	not analyzed	**Yes**
SVOCs																	
2,6-Dinitrotoluene	25	16%	0.0095	0.0104	Non-parametric	0.0104	(3)	NA	na	NA	No SLV	No	No	No	No	No	No
2-Methylnaphthalene	25	32%	0.000057	0.0434	Lognormal	0.0434	(3)	NA	na	NA	No SLV	Yes	Yes	No	No	No	**Yes - Qual**
3- & 4-Methylphenol	14	21%	0.0034	0.064	Gamma	0.0237		NA	na	NA	No SLV	Yes	No	No	No	No	**Yes - Qual**
Acenaphthene	25	60%	0.000042	2.53	Non-parametric	0.910		NA	na	0.29	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Acenaphthylene	25	36%	0.000022	0.111	Non-parametric	0.0283		NA	na	0.16	No	Yes	Yes	No	No	No	No
Anthracene	25	72%	0.000012	8.44	Non-parametric	1.52		NA	na	0.057	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Benzidine	24	8%	0.015	0.0383	Non-parametric	0.0383	(3)	NA	na	NA	No SLV	Yes	Yes	Yes	Yes	No	**Yes - Qual**
Benzo(a)anthracene	25	88%	0.000029	31.2	Non-parametric	7.36		NA	na	0.032	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Benzo(a)pyrene	25	88%	0.000028	34	Non-parametric	7.36		NA	na	0.032	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Benzo(b)fluoranthene	15	80%	0.000034	0.087	Gamma	0.0304		NA	na	NA	No SLV	No	Yes	Yes	Yes	Yes	**Yes**
Benzo(g,h,i)perylene	25	88%	0.00002	17	Non-parametric	3.75		NA	na	0.3	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Benzo(k)fluoranthene	15	73%	0.00004	0.065	Lognormal	0.0126		NA	na	0.027	Yes	No	Yes	Yes	Yes	Yes	**Yes**

Table 5-5. List of COIs in Soil from Landfill: Upland Transport, Bradford Island

Analyte (1)	Summary Statistics							Soil Background Comparison		Upland to River Transport Pathway Evaluation							
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/kg)	Max Detected Conc. (mg/kg)	Statistical Distribution	90% UCL (mg/kg) (2)	Notes	Lowest Background Conc. (mg/kg) (4)	Max Conc. Exceeds Background?	Selected Sediment Screening Level (mg/kg) (5)	Is Max Detected Greater than Selected Sediment Screening Level?	Is Chemical Detected at Upland Shoreline - Distance from Shoreline (feet)?				Is Chemical Detected in Forebay Sediment?	Is Further Investigation of Overland Runoff Necessary? (6)
												0 to 50	50 to 100	100 to 150	150 to 200		
Benzofluoranthenes	10	100%	0.197	31.3	Normal	14.4		NA	na	NA	No SLV	Yes	Yes	No	No	No	**Yes - Qual**
Benzoic acid	25	32%	0.00002	0.553	Non-parametric	0.0990		NA	na	NA	No SLV	Yes	Yes	Yes	No	No	**Yes - Qual**
Bis(2-ethylhexyl)phthalate	25	80%	0.00015	3.96	Non-parametric	0.990		NA	na	0.75	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Butyl benzyl phthalate	25	16%	0.000022	0.152	Lognormal	0.113		NA	na	NA	No SLV	Yes	Yes	No	No	No	**Yes - Qual**
Carbazole	25	52%	0.000027	2.84	Non-parametric	0.626		NA	na	0.14	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Chrysene	25	88%	0.000062	35.3	Non-parametric	7.40		NA	na	0.057	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Dibenz(a,h)anthracene	25	60%	0.000018	1.94	Non-parametric	0.683		NA	na	0.033	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Dibenzofuran	25	48%	0.00002	0.419	Non-parametric	0.0903		NA	na	5.1	No	Yes	Yes	Yes	No	No	No
Diethyl phthalate	25	24%	0.00005	0.0734	Non-parametric	0.0144		NA	na	NA	No SLV	Yes	Yes	Yes	No	No	**Yes - Qual**
Fluoranthene	25	88%	0.000042	48.3	Non-parametric	11.3		NA	na	0.01	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Fluorene	25	60%	0.000047	1.61	Non-parametric	0.311		NA	na	0.077	Yes	Yes	Yes	Yes	Yes	No	**Yes**
Indeno(1,2,3-cd)pyrene	25	84%	0.000018	20	Non-parametric	4.26		NA	na	0.017	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Naphthalene	25	40%	0.0000545	0.176	Non-parametric	0.0396		NA	na	0.176	No	Yes	Yes	Yes	No	No	No
PCP	25	8%	0.000072	0.201	Non-parametric	0.0956		NA	na	NA	No SLV	Yes	Yes	No	No	No	**Yes - Qual**
Phenanthrene	25	84%	0.000013	21.9	Non-parametric	8.52		NA	na	0.042	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Pyrene	25	88%	0.000043	67.1	Non-parametric	15.6		NA	na	0.01	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
TPHs																	
Diesel Fuel No. 2	17	82%	22.9	9735	Lognormal	9019		NA	na	NA	No SLV	Yes	Yes	Yes	No	No	**Yes - Qual**
Diesel Range Hydrocarbons	15	67%	17.0	1000	Non-parametric	674		NA	na	NA	No SLV	No	Yes	Yes	Yes	Yes	**Yes**
Gasoline Range Hydrocarbons	20	15%	2.10	3.28	Normal	3.03		NA	na	NA	No SLV	Yes	Yes	No	No	No	**Yes - Qual**
Residual Range Organics	32	81%	31.1	41900	Lognormal	17575		NA	na	NA	No SLV	Yes	Yes	Yes	Yes	No	**Yes - Qual**

Notes:

COIs identified for in-place upland soils based on samples collected from 0 to 10 feet bgs were investigated for their potential to be transported to the river. For the "Upland to River Transport Pathway Evaluation," only soils from 0 to 1 foot bgs were evaluated, as soils below this depth are not likely to erode.
COI = Chemical of Interest
NA = Not Available
na = not applicable
SLV = Screening Level Value
UCL = upper confidence level on the mean
(1) Only chemicals with detection frequency equal to or greater than 5% are shown in the table. The following essential nutrients were excluded as COIs in soil: calcium, iron, magnesium, potassium, and sodium.
(2) For non-detect samples, the 90% UCL was calculated using values determined by the robust method.
(3) The calculated 90% UCL is above the max detected, hence the max detected value is shown.
(4) Lowest of the three available background concentrations in soil (see "Subtask 2.2.2(a) - Preliminary List of COIs in Soil from Landfill: Upland In-Place List A" table).
(5) Lowest of Freshwater Sediment SLVs (ODEQ, 2001) and Bioaccumulation SLVs for Individual Bird, Individual Mammal, Freshwater Fish, and Subsistence Humans (ODEQ, 2007) are selected as final Sediment Screening Levels (Table entitled "Subtask 2.2.1(a,b) - Preliminary List of COIs in Sediment" provides all SLVs considered during selection process).
(6) Analytes for which two or more of the following criteria were met were retained as COIs: 1) detection frequency equal to or greater than 5%, 2) max conc. above soil background conc. (inorganics only), 3) max conc. above the selected sediment screening level, 4) no sediment SLV available, 5) detected in upland shoreline soil (within 100 feet of the river), 6) detected in forebay sediment. All COIs that may require further investigation are shown in bold font. COIs for which no SLVs are available but were detected at the shoreline OR in forebay sediment will be retained for a qualitative analysis in the uncertainties section.

(7) Although other VOCs were detected in soils from the Landfill, only those for which sediment SLVs were presented in the Portland Harbor - Joint Source Control Strategy report (December 2005) were included in this river transport evaluation. No DEQ Level II SLVs protective of a freshwater benthic community are available for the detected VOCs, and the actual potential for these chemicals to erode into the river is expected to be low given their low persistence in surface soil, sediment, and surface water. The sediment SLV for tetrachloroethene is a USEPA Sediment Quality Advisory Level (MacDonald 1999).

Table 5-6. List of COIs in Soil from Sandblast Area: Upland Transport, Bradford Island

Analyte (1)	Summary Statistics							Soil Background Comparison		Upland to River Transport Pathway Evaluation							
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/kg)	Max Detected Conc. (mg/kg)	Statistical Distribution	90% UCL (mg/kg) (2)	Notes	Lowest Background Conc. (mg/kg) (4)	Max Conc. Exceeds Background?	Selected Sediment Screening Level (mg/kg) (5)	Is Max Detected Greater than Selected Sediment Screening Level?	Is Chemical Detected Outside of Drainage System? - Distance to Shoreline (feet) (6)			Is Chemical Detected Inside of System (CB#1)? (6)	Is Chemical Detected in Forebay Sediment?	Is Further Investigation of Overland Runoff Necessary? (7)
												0 to 50	50 to 100	100 to 150			
INORGANICS																	
Aluminum	50	100%	1530	23100	Non-parametric	9015		17233	Yes	NA	No SLV	Yes	Yes	Yes	Yes	Yes	**Yes**
Antimony	50	84%	0.0895	13.7	Gamma	2.06		<0.5	Yes	3	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Arsenic	50	98%	0.613	80.9	Non-parametric	10.7		2.98	Yes	6	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Barium	50	100%	10.7	123	Gamma	70.8		103.83	Yes	NA	No SLV	Yes	Yes	Yes	Yes	Yes	**Yes**
Beryllium	50	50%	0.0587	0.598	Normal	0.313		1.18	No	Below Soil Background							No
Cadmium	50	78%	0.0561	2.61	Non-parametric	1.01		0.58	Yes	0.6	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Chromium	53	100%	5.27	2650	Non-parametric	788		17.47	Yes	37	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Cobalt	50	100%	2.52	25.0	Normal	14.0		15.9	Yes	NA	No SLV	Yes	Yes	Yes	Yes	Yes	**Yes**
Copper	50	100%	15.8	319	Gamma	62.7		34	Yes	36	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Lead	53	100%	5.24	3260	Gamma	450		13.86	Yes	35	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Manganese	50	100%	167	818	Normal	453		479.33	Yes	1100	No	Yes	Yes	Yes	Yes	Yes	**Yes**
Mercury	50	67%	0.0114	0.153	Lognormal	0.0435		0.04	Yes	0.2	No	No	Yes	Yes	Yes	Yes	**Yes**
Nickel	50	100%	5.35	1060	Non-parametric	345		19.9	Yes	18	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Selenium	50	56%	0.127	1.17	Gamma	0.523		<0.5	Yes	NA	No SLV	Yes	No	Yes	Yes	No	**Yes - Qual**
Silver	50	94%	0.0571	0.268	Gamma	0.139		<0.5	No	Below Soil Background							No
Thallium	50	75%	0.0288	0.255	Normal	0.115		<0.5	No	Below Soil Background							No
Vanadium	50	100%	6.89	89.1	Normal	44.2		59	Yes	NA	No SLV	Yes	Yes	Yes	Yes	Yes	**Yes**
Zinc	50	100%	31.1	1160	Non-parametric	224		56.63	Yes	123	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
BUTYLTINS																	
Dibutyltin	45	19%	0.00353	0.21	Lognormal	0.128		NA	na	NA	No SLV	No	Yes	No	Yes	No	**Yes - Qual**
Monobutyltin	45	24%	0.00328	0.108	Lognormal	0.0143		NA	na	NA	No SLV	No	No	No	Yes	No	**Yes - Qual**
Tributyltin	45	23%	0.00165	1.86	Non-parametric	0.435		NA	na	0.0017	Yes	No	No	No	Yes	No	**Yes**
PESTICIDES																	
4,4'-DDE	8	38%	0.000835	0.0017	Gamma	0.0017	(3)	NA	na	0.0015	Yes	No	No	No	Yes	No	**Yes**
4,4'-DDT	8	50%	0.00339	0.0191	Gamma	0.0125		NA	na	0.000035	Yes	Yes	Yes	No	Yes	No	**Yes**
Aldrin	8	13%	0.00098	0.00098	Non-parametric	0.000893		NA	na	0.04	No	No	No	No	Yes	No	No
Dieldrin	8	13%	0.00941	0.00941	Non-parametric	0.00853		NA	na	0.003	Yes	No	No	No	Yes	No	**Yes**
Endosulfan II	8	25%	0.00199	0.0108	Non-parametric	0.00994		NA	na	NA	No SLV	No	No	No	Yes	No	**Yes - Qual**
Endosulfan sulfate	8	13%	0.00161	0.00161	Non-parametric	0.000940		NA	na	NA	No SLV	No	No	No	Yes	No	**Yes - Qual**
Endrin	8	13%	0.00845	0.00845	Non-parametric	0.00766		NA	na	0.003	Yes	No	No	No	Yes	No	**Yes**
Heptachlor epoxide	8	13%	0.000634	0.000634	Non-parametric	0.000357		NA	na	0.0006	Yes	No	No	No	No	No	No
beta-BHC	8	25%	0.000952	0.0125	Non-parametric	0.0114		NA	na	NA	No SLV	Yes	No	No	Yes	No	**Yes - Qual**
delta-BHC	8	13%	0.00303	0.00303	Non-parametric	0.00275		NA	na	NA	No SLV	No	No	No	No	No	No
gamma-BHC (Lindane)	8	13%	0.00968	0.00968	Non-parametric	0.00877		NA	na	0.0009	Yes	No	No	No	No	No	No
gamma-Chlordane	8	13%	0.00337	0.00337	Non-parametric	0.00306		NA	na	0.000046	Yes	No	No	No	Yes	No	**Yes**
PCBs																	
Aroclor 1260	45	87%	0.00264	0.282	Lognormal	0.0795		NA	na	0.000046	Yes	Yes	Yes	No	Yes	Yes	**Yes**
VOCs (8)																	
Tetrachloroethene	14	46%	0.000118	420	Lognormal	420	(3)	NA	na	0.5	Yes	Yes	No	No	No	not analyzed	**Yes**
Trichloroethene	14	71%	0.000045	6.08	Lognormal	6.08	(3)	NA	na	2.1	Yes	Yes	Yes	No	No	not analyzed	**Yes**
SVOCs																	
2-Methylnaphthalene	15	37%	0.00129	0.124	Lognormal	0.0648		NA	na	NA	No SLV	Yes	Yes	No	No	No	**Yes - Qual**
3- & 4-Methylphenol	14	7%	0.00246	0.00246	Non-parametric	0.00246	(3)	NA	na	NA	No SLV	No	Yes	No	No	No	No
4-Chloroaniline	14	7%	0.411	0.411	Non-parametric	0.213		NA	na	NA	No SLV	No	No	No	Yes	No	**Yes - Qual**
Acenaphthene	15	67%	0.00541	3.2	Gamma	0.820		NA	na	0.29	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Acenaphthylene	15	50%	0.00139	0.295	Gamma	0.0861		NA	na	0.16	Yes	Yes	Yes	No	Yes	No	**Yes**
Anthracene	15	63%	0.00503	2.04	Gamma	0.778		NA	na	0.057	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Benzo(a)anthracene	15	67%	0.0265	12.3	Gamma	4.59		NA	na	0.032	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Benzo(a)pyrene	15	67%	0.0289	11.7	Gamma	4.32		NA	na	0.032	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**

Table 5-6. List of COIs in Soil from Sandblast Area: Upland Transport, Bradford Island

Analyte (1)	Summary Statistics							Soil Background Comparison		Upland to River Transport Pathway Evaluation						
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/kg)	Max Detected Conc. (mg/kg)	Statistical Distribution	90% UCL (mg/kg) (2)	Notes	Lowest Background Conc. (mg/kg) (4)	Max Conc. Exceeds Background?	Selected Sediment Screening Level (mg/kg) (5)	Is Max Detected Greater than Selected Sediment Screening Level?	Is Chemical Detected Outside of Drainage System? - Distance to Shoreline (feet) (6)			Is Chemical Detected Inside of System (CB#1)? (6)	Is Chemical Detected in Forebay Sediment?	Is Further Investigation of Overland Runoff Necessary? (7)
												0 to 50	50 to 100	100 to 150			
Benzo(g,h,i)perylene	15	73%	0.00433	3.83	Gamma	1.68		NA	na	0.3	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Benzofluoranthenes	15	73%	0.0077	16.3	Gamma	6.76		NA	na	NA	No SLV	Yes	Yes	Yes	Yes	No	**Yes - Qual**
Benzoic acid	14	29%	0.0273	0.377	Non-parametric	0.108		NA	na	NA	No SLV	Yes	No	Yes	Yes	No	**Yes - Qual**
Benzyl alcohol	14	7%	0.00781	0.00781	Non-parametric	0.00781	(3)	NA	na	NA	No SLV	No	Yes	No	No	No	No
Benzyl butyl phthalate	14	11%	0.0205	0.0317	Non-parametric	0.0240		NA	na	NA	No SLV	Yes	No	No	No	No	**Yes - Qual**
Bis(2-ethylhexyl)phthalate	15	87%	0.00667	43.5	Gamma	19.5		NA	na	0.75	Yes	Yes	Yes	Yes	No	Yes	**Yes**
Carbazole	14	46%	0.00456	0.524	Non-parametric	0.135		NA	na	0.14	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Chrysene	15	67%	0.0327	12	Gamma	4.95		NA	na	0.057	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Di-n-butyl phthalate	14	29%	0.0239	0.251	Non-parametric	0.103		NA	na	0.11	Yes	Yes	No	No	Yes	Yes	**Yes**
Di-n-octyl phthalate	14	39%	0.0161	0.425	Lognormal	0.224		NA	na	NA	No SLV	Yes	Yes	Yes	Yes	No	**Yes - Qual**
Dibenz(a,h)anthracene	15	57%	0.00123	1.43	Gamma	0.636		NA	na	0.033	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Dibenzofuran	15	50%	0.000996	0.485	Gamma	0.165		NA	na	5.1	No	Yes	Yes	No	Yes	No	No
Fluoranthene	15	73%	0.00629	28.6	Gamma	12.7		NA	na	0.01	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Fluorene	15	53%	0.00713	0.779	Gamma	0.266		NA	na	0.077	Yes	Yes	No	Yes	Yes	No	**Yes**
Indeno(1,2,3-cd)pyrene	15	73%	0.00352	4.17	Gamma	1.86		NA	na	0.017	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Naphthalene	15	37%	0.00204	0.256	Gamma	0.165		NA	na	0.176	Yes	Yes	Yes	Yes	No	No	**Yes**
Phenanthrene	15	80%	0.00247	6.55	Gamma	2.77		NA	na	0.042	Yes	Yes	Yes	No	Yes	Yes	**Yes**
Pyrene	15	73%	0.00914	32	Gamma	14.26		NA	na	0.01	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
TPHs																	
Diesel Range Hydrocarbons	48	81%	6.44	1440	Non-parametric	457		NA	na	NA	No SLV	Yes	Yes	No	Yes	Yes	**Yes**
Gasoline Range Hydrocarbons	12	17%	132	3960	Non-parametric	3960	(3)	NA	na	NA	No SLV	No	Yes	No	No	No	No
Motor Oil Range Hydrocarbons	48	83%	29.8	1980	Gamma	450		NA	na	NA	No SLV	Yes	Yes	No	Yes	Yes	**Yes**

Notes:

COIs identified for in-place upland
CB = Catch Basin
COI = Chemical of Interest
NA = Not Available
na = not applicable
SLV = Screening Level Value
UCL = upper confidence level on the mean

(1) Only chemicals with detection frequency equal to or greater than 5% are shown in the table. The following essential nutrients were excluded as COIs in soil: calcium, iron, magnesium, potassium, and sodium.

(2) For non-detect samples, the 90% UCL was calculated using values determined by the robust method.

(3) The calculated 90% UCL is above the max detected, hence the max detected value is shown.

(4) Lowest of the three available background concentrations in soil (see "Subtask 2.2.2(a) - Preliminary List of COIs in Soil from Sandblast Area: Upland In-Place List A" table).

(5) Lowest of Freshwater Sediment SLVs (ODEQ, 2001) and Bioaccumulation SLVs for Individual Bird, Individual Mammal, Freshwater Fish, and Subsistence Humans (ODEQ, 2007) are selected as final Sediment Screening Levels (Table entitled "Subtask 2.2.1(a,b) - Preliminary List of COIs in Sediment" provides all SLVs considered during selection process).

(6) Locations outside of the drainage system include: HA1, HA2, HA3, HA9, HA10, and HA11. These locations were evaluated in terms of their proximity to the river. Within the drainage system, location CB #1 is the catch basin closest to the river, and all draining ditches from the site flow into to this basin. (No data are available for CB #2.) For conservative purposes, COIs detected within the CB #1 soils were considered a potential source to the river. However, if the soil COI was detected below the SLV and was not detected in forebay sediment, further investigation of the transport pathway was not recommended.

(7) Analytes for which two or more of the following criteria were met were retained as COIs: 1) detection frequency equal to or greater than 5%, 2) max conc. above soil background conc. (inorganics only), 3) max conc. above the selected sediment screening level, 4) no sediment SLV available, 5) detected in upla shoreline soil (within 100 feet of the river), 6) detected in forebay sediment. All COIs that may require further investigation are shown in bold font. COIs for which no SLVs are available but were detected at the shoreline OR in forebay sediment will be retained for a qualitative analysis in the uncertainties section.

(8) Although other VOCs were detected in soils from the Sandblast Area, only those for which sediment SLVs were presented in the Portland Harbor - Joint Source Control Strategy report (December 2005) were included in this river transport evaluation. No DEQ Level II SLVs protective of a freshwater benthic community are available for the detected VOCs, and the actual potential for these chemicals to erode into the river is expected to be low given their low persistence in surface soil, sediment, and surface water. The sediment SLVs for these two VOCs are USEPA Sediment Quality Advisory Levels (MacDonald 1999).

Table 5-7. List of COIs in Soil from Pistol Range: Upland Transport, Bradford Island

Analyte (1)	Summary Statistics						Soil Background Comparison		Upland to River Transport Pathway Evaluation						
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/kg)	Max Detected Conc. (mg/kg)	Statistical Distribution	90% UCL (mg/kg) (2)	Lowest Background Conc. (mg/kg) (3)	Max Conc. Exceeds Background?	Selected Sediment Screening Level (4)	Is Max Detected Greater than Selected Sediment Screening Level?	Is Chemical Detected at Upland Shoreline? - Distance to Shoreline (feet)			Is Chemical Detected in Forebay Sediment?	Is Further Investigation of Overland Runoff Necessary? (5)
											0 to 50	50 to 100	100 to 150		
INORGANICS															
Copper	10	100%	37.6	53.1	Normal	48.1	34	Yes	36	Yes	No	Yes	No	Yes	**Yes**
Lead	71	100%	7	1110	Non-parametric	332	13.86	Yes	35	Yes	Yes	Yes	Yes	Yes	**Yes**
Nickel	10	100%	19	27	Normal	24.4	19.9	Yes	18	Yes	No	Yes	No	Yes	**Yes**
Zinc	10	100%	74	199	Normal	142	56.63	Yes	123	Yes	No	Yes	No	Yes	**Yes**

Notes:

COIs identified for in-place upland soils based on samples collected from 0 to 10 feet bgs were investigated for their potential to be transported to the river. For the "Upland to River Transport Pathway Evaluation," only soils from 0 to 1 foot bgs were evaluated, as soils below this depth are not likely to erode.

COI = Chemical of Interest

NA = Not Available

na = not applicable

SLV = Screening Level Value

UCL = upper confidence level on the mean

(1) Only chemicals with detection frequency equal to or greater than 5% are shown in the table.

(2) For non-detect samples, the 90% UCL was calculated using values determined by the robust method.

(3) Lowest of the three available background concentrations in soil (see "Subtask 2.2.2(a) - Preliminary List of COIs in Soil from Pistol Range: Upland In-Place List A" table).

(4) Lowest of Freshwater Sediment SLVs (ODEQ, 2001) and Bioaccumulation SLVs for Individual Bird, Individual Mammal, Freshwater Fish, and Subsistence Humans (ODEQ, 2007) are selected as final Sediment Screening Levels (Table entitled "Subtask 2.2.1(a,b) - Preliminary List of COIs in Sediment" provides all SLVs considered during selection process).

(5) Analytes for which two or more of the following criteria were met were retained as COIs: 1) detection frequency equal to or greater than 5%, 2) max conc. above soil background conc. (inorganics only), 3) max conc. above the selected sediment screening level, 4) no sediment SLV available, 5) detected in upland shoreline soil (within 100 feet of the river), 6) detected in forebay sediment. All COIs that may require further investigation are shown in bold font. COIs for which no SLVs are available but were detected at the shoreline OR in forebay sediment will be retained for a qualitative analysis in the uncertainties section.

Table 5-8. List of COIs in Soil from Bulb Slope: Upland Transport, Bradford Island

Analyte (1)	Summary Statistics				Soil Background Comparison		Upland to River Transport Pathway Evaluation				
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/kg)	Max Detected Conc. (mg/kg)	WDOE Clark County Background Conc. (mg/kg) (2)	Max Conc. Exceeds Background?	Selected Sediment Screening Level (mg/kg) (3)	Is Max Detected Greater than Selected Sediment Screening Level?	Is Chemical Detected at Upland Shoreline?	Is Chemical Detected in Forebay Sediment (4)?	Is Further Investigation of Overland Runoff Necessary? (5)
INORGANICS											
Lead	9	100%	25	444	17	Yes	35	Yes	Yes	Yes	**Yes**
Mercury	9	100%	0.05	0.74	0.04	Yes	0.2	Yes	Yes	Yes	**Yes**
PCBs											
Aroclor 1260	9	67%	0.027	0.16	NA	na	0.000046	Yes	Yes	Yes	**Yes**
TPHs											
Diesel Range Hydrocarbons	9	100%	8.3	170	NA	na	NA	No SLV	Yes	Yes	**Yes**
Motor Oil Range Hydrocarbons	9	100%	44	410	NA	na	NA	No SLV	Yes	Yes	**Yes**

Notes:

COIs identified for in-place upland soils based on samples collected from 0 to 10 feet bgs were investigated for their potential to be transported to the river. For the "Upland to River Transport Pathway Evaluation," only soils from 0 to 1 foot bgs were evaluated, as soils below this depth are not likely to erode.

COI = Chemical of Interest

NA = Not Available

na = not applicable

SLV = Screening Level Value

(1) Only chemicals with detection frequency equal to or greater than 5% are shown in the table.

(2) Natural Background Soil Metals Concentrations in Washington State, October 1994 (Regional 90th percentile values for Clark County selected).

(3) Lowest of Freshwater Sediment SLVs (ODEQ, 2001) and Bioaccumulation SLVs for Individual Bird, Individual Mammal, Freshwater Fish, and Subsistence Humans (ODEQ, 2007) are selected as final Sediment Screening Levels.

(4) All chemicals detected in soil at the bulb slope have the potential to erode into the in-water environment because the entire site resides on a steep incline less than 50 feet from the river.

(5) Analytes for which two or more of the following criteria were met were retained as COIs: 1) detection frequency equal to or greater than 5%, 2) max conc. above soil background conc. (inorganics only), 3) max conc. above the selected sediment screening level, 4) no sediment SLV available, 5) detected in upland shoreline soil (within 100 feet of the river), 6) detected in forebay sediment. All COIs that may require further investigation are shown in bold font. COIs for which no SLVs are available but were detected at the shoreline OR in forebay sediment will be retained for a qualitative analysis in the uncertainties section.

Table 5-9. List of COIs for Groundwater in Landfill:
Discharge to Potable Surface Water,
Bradford Island

Analyte (1)	Summary Statistics				Water Benchmark Comparison		Retain as COI (3)?
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/L)	Max Detected Conc. (mg/L)	USEPA Region 9 Tap Water PRGs (mg/L) (2)	Is Max Detected Greater than Tap Water PRGs?	
INORGANICS (TOTAL)							
Antimony	9	100%	0.000294	0.00389	0.015	No	No
Arsenic	9	100%	0.000728	0.0189	0.000045	Yes	**Yes**
Barium	9	100%	0.0508	0.304	2.55	No	No
Beryllium	9	89%	0.000222	0.000435	0.073	No	No
Cadmium	9	44%	0.000026	0.00468	0.018	No	No
Chromium	9	89%	0.00336	0.0185	55	No	No
Copper	9	100%	0.00233	0.201	1.46	No	No
Iron	9	100%	0.929	42.9	10.9	Yes	**Yes**
Lead	9	89%	0.00105	0.0782	0.05	Yes	**Yes**
Manganese	9	100%	0.0717	2.56	0.88	Yes	**Yes**
Nickel	9	100%	0.00211	0.117	0.73	No	No
Selenium	9	56%	0.00053	0.00823	0.18	No	No
Silver	9	56%	0.000081	0.000658	0.18	No	No
Thallium	9	100%	0.000115	0.000323	0.0024	No	No
Zinc	9	100%	0.0112	1.75	10.95	No	No
BUTYLTINS							
Dibutyltin	8	75%	0.00000501	0.000447	NA	No PRG	**Yes**
Monobutyltin	8	75%	0.00000449	0.00024	NA	No PRG	**Yes**
Tributyltin	8	75%	0.0000171	0.0000601	0.0109	No	No
HERBICIDES							
PCP	8	13%	0.000112	0.000112	0.00056	No	No
p-Nitrophenol	8	13%	0.00084	0.00084	NA	No PRG	**Yes**
VOCs							
Acetone	9	44%	0.00839	0.0154	5.48	No	No
Carbon disulfide	9	11%	0.00395	0.00395	1.04	No	No
Chloroform	9	22%	0.000609	0.001775	0.00017	Yes	**Yes**
Methyl isobutyl ketone (MIBK)	9	11%	0.00304	0.00304	2.00	No	No
Tetrachloroethylene	9	11%	0.00195	0.00195	0.00010	Yes	**Yes**
Vinyl chloride	9	22%	0.000507	0.000531	0.000020	Yes	**Yes**
cis-1,2-Dichloroethylene	9	11%	0.000791	0.000791	0.061	No	No
SVOCs							
2-Methylnaphthalene	9	44%	0.0000385	0.00036	0.0062	No	No
Acenaphthene	9	22%	0.000111	0.000239	0.37	No	No

Table 5-9. List of COIs for Groundwater in Landfill: Discharge to Potable Surface Water, Bradford Island

Analyte (1)	Summary Statistics				Water Benchmark Comparison		Retain as COI (3)?
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/L)	Max Detected Conc. (mg/L)	USEPA Region 9 Tap Water PRGs (mg/L) (2)	Is Max Detected Greater than Tap Water PRGs?	
Anthracene	9	11%	0.0000589	0.0000589	1.83	No	No
Bis(2-ethylhexyl)phthalate	9	11%	0.00092	0.00092	0.0048	No	No
Carbolic acid	9	11%	0.000382	0.000382	NA	No PRG	**Yes**
Di-n-octyl phthalate	9	33%	0.00145	0.00708	1.50	No	No
Diethyl phthalate	9	33%	0.000356	0.0019	29	No	No
Dimethyl phthalate	9	11%	0.000235	0.000235	360	No	No
Isophorone	9	33%	0.000116	0.000282	0.071	No	No
Naphthalene	9	33%	0.000046	0.000157	0.0062	No	No
Phenanthrene	9	22%	0.00008	0.000108	NA	No PRG	**Yes**
Pyrene	9	11%	0.000031	0.000031	0.18	No	No
p-Dichlorobenzene	9	11%	0.0000258	0.0000258	NA	No PRG	**Yes**
TPHs							
Diesel Fuel No. 2	9	100%	0.122	1.1	NA	No PRG	**Yes**
Residual Range Organics	9	100%	0.275	1.27	NA	No PRG	**Yes**
Gasoline Range Hydrocarbons	9	22%	0.0631	0.281	NA	No PRG	**Yes**

Notes:

Statistics are provided for total concentrations of inorganic analytes and total concentrations of organic analytes.
COI = Chemical of Interest
NA = not available
na = not applicable
PRG = Preliminary Remediation Goal
(1) Only chemicals with detection frequency equal to or greater than 5% are shown in the table.
(2) USEPA 2004 used with exception of Lead for which the ODEQ Water Quality Criterion - Drinking Water MCL was used.
(3) Analytes for which both of the following criteria were met were retained as COIs: 1) detection frequency equal to or greater than 5%, 2) max conc. above the Region 9 Tap Water PRG. (No background dataset available for groundwater.) Also, analytes lacking a Tap Water PRG were retained as COIs. All COIs are shown in bold font.

Table 5-10. List of COIs for Groundwater in Sandblast Area:
Discharge to Potable Surface Water,
Bradford Island

Analyte (1)	Summary Statistics				Water Benchmark Comparison		Retain as COI (3)?
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/L)	Max Detected Conc. (mg/L)	USEPA Region 9 Tap Water PRGs (mg/L) (2)	Is Max Detected Greater than Tap Water PRGs?	
INORGANICS (TOTAL)							
Aluminum	10	100%	0.0742	17.9	36.5	No	No
Antimony	10	90%	0.000233	0.00157	0.015	No	No
Arsenic	10	75%	0.0000825	0.0077	0.000045	**Yes**	**Yes**
Barium	10	100%	0.003755	0.0978	2.55	No	No
Beryllium	10	40%	0.000157	0.000785	0.073	No	No
Chromium	10	100%	0.00261	0.0318	55	No	No
Cobalt	10	60%	0.00168	0.0131	0.73	No	No
Copper	10	100%	0.00138	0.204	1.46	No	No
Iron	10	90%	0.0844	25.9	10.9	**Yes**	**Yes**
Lead	10	70%	0.000058	0.0137	0.05	No	No
Manganese	10	100%	0.00210	0.70850	0.88	No	No
Mercury	10	20%	0.000076	0.0001	0.011	No	No
Nickel	10	90%	0.00102	0.0214	0.73	No	No
Selenium	10	100%	0.000815	0.00206	0.18	No	No
Silver	10	90%	0.0000195	0.000376	0.18	No	No
Thallium	10	70%	0.000043	0.000146	0.0024	No	No
Vanadium	10	100%	0.00182	0.0776	0.036	**Yes**	**Yes**
Zinc	10	100%	0.00288	0.0444	10.95	No	No
INORGANICS (DISSOLVED)							
Aluminum	10	65%	0.00441	1.37	36.5	No	No
Antimony	10	100%	0.000149	0.00167	0.015	No	No
Arsenic	10	100%	0.000262	0.00136	0.000045	**Yes**	**Yes**
Barium	10	100%	0.00339	0.02065	2.55	No	No
Cadmium	10	10%	0.00003	0.00003	0.018	No	No
Chromium	10	100%	0.000838	0.00429	55	No	No
Cobalt	10	75%	0.000958	0.00508	0.73	No	No
Copper	10	70%	0.000752	0.00438	1.46	No	No
Iron	10	40%	0.0373	0.476	10.9	No	No
Lead	10	55%	0.000019	0.000378	0.05	No	No
Manganese	10	100%	0.00171	0.587	0.88	No	No
Mercury	10	15%	0.0000408	0.00006	0.011	No	No
Nickel	10	30%	0.000403	0.0021	0.73	No	No
Selenium	10	100%	0.000235	0.0013	0.18	No	No
Silver	10	80%	0.000024	0.000079	0.18	No	No
Thallium	10	30%	0.000031	0.0000855	0.0024	No	No
Vanadium	10	60%	0.000582	0.00261	0.036	No	No
Zinc	10	35%	0.001047	0.00348	10.95	No	No
BUTYLTINS							
Monobutyltin	4	50%	0.0000052	0.00000671	NA	No PRG	**Yes**
Tributyltin	4	38%	0.00000154	0.00000435	0.0109	No	No
PESTICIDES							
Methoxychlor	3	50%	0.000000621	0.00000521	0.18	No	No
gamma-BHC (Lindane)	3	100%	0.00000093	0.00000249	0.000052	No	No
VOCs							
1,1,1-Trichloroethane	10	70%	0.0000701	0.00223	3.17	No	No
1,1-Dichloroethane	10	50%	0.0000555	0.002515	0.81	No	No
1,1-Dichloroethene	10	20%	0.0000624	0.001165	0.34	No	No
1,2,4-Trimethylbenzene	10	30%	0.0000317	0.0000485	0.012	No	No
1,3,5-Trimethylbenzene	10	10%	0.0000297	0.0000297	0.012	No	No
2,2-Dichloropropane	10	30%	0.000117	0.000179	NA	No PRG	**Yes**
Acetone	10	25%	0.00091	0.00388	5.48	No	No
Benzene	10	60%	0.0000545	0.000137	0.00035	No	No
Bromoform	10	10%	0.000151	0.000151	0.0085	No	No
Carbon disulfide	10	10%	0.0000619	0.0000619	1.04	No	No

Table 5-10. List of COIs for Groundwater in Sandblast Area:
Discharge to Potable Surface Water,
Bradford Island

Analyte (1)	Summary Statistics				Water Benchmark Comparison		Retain as COI (3)?
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/L)	Max Detected Conc. (mg/L)	USEPA Region 9 Tap Water PRGs (mg/L) (2)	Is Max Detected Greater than Tap Water PRGs?	
Chloroform	10	20%	0.0000907	0.000174	0.00017	**Yes**	**Yes**
Ethylbenzene	10	40%	0.0000357	0.0000447	1.34	No	No
Isopropylbenzene	10	10%	0.0000197	0.0000197	0.66	No	No
Naphthalene	10	35%	0.0000206	0.001	0.0062	No	No
Tetrachloroethene	10	100%	0.000336	0.0545	0.00010	**Yes**	**Yes**
Toluene	10	60%	0.0000917	0.000299	0.72	No	No
Trichloroethene	10	90%	0.0000904	0.0437	0.000028	**Yes**	**Yes**
Vinyl chloride	10	15%	0.000132	0.000321	0.000020	**Yes**	**Yes**
cis-1,2-Dichloroethene	10	90%	0.0000948	0.341	0.061	**Yes**	**Yes**
m,p-Xylene	10	40%	0.0000823	0.000132	0.21	No	No
o-Xylene	10	40%	0.0000304	0.0000735	0.21	No	No
trans-1,2-dichloroethene	10	30%	0.0000955	0.0018	0.12	No	No
SVOCs							
2-Methylnaphthalene	9	61%	0.0000166	0.000153	0.0062	No	No
Acenaphthene	9	44%	0.00000361	0.000023	0.37	No	No
Anthracene	9	11%	0.0000126	0.0000126	1.83	No	No
Benzo(a)pyrene	9	11%	0.00000895	0.00000895	0.0000092	No	No
Benzofluoranthenes	9	11%	0.0000173	0.0000173	NA	No PRG	**Yes**
Benzyl alcohol	7	29%	0.00005	0.0000523	10.95	No	No
Benzyl butyl phthalate	9	67%	0.00012	0.000228	7.30	No	No
Bis(2-ethylhexyl)phthalate	9	11%	0.000408	0.000408	0.0048	No	No
Di-n-butylphthalate	9	67%	0.0001	0.000239	3.65	No	No
Dibenz(a,h)anthracene	9	11%	0.00000671	0.00000671	0.0000092	No	No
Dibenzofuran	9	22%	0.0000237	0.0000421	0.012	No	No
Fluoranthene	9	11%	0.0000311	0.0000311	1.46	No	No
Fluorene	9	56%	0.00000461	0.0000351	0.24	No	No
Indeno(1,2,3-cd)pyrene	9	11%	0.00000797	0.00000797	0.000092	No	No
Isophorone	9	22%	0.0000486	0.0000842	0.071	No	No
Naphthalene	9	50%	0.0000173	0.001	0.0062	No	No
Phenanthrene	9	89%	0.00000759	0.000144	NA	No	**Yes**
Phenol	8	63%	0.0000111	0.0000291	10.95	No	No
Pyrene	9	28%	0.00000239	0.0000261	0.18	No	No
TPHs							
Gasoline Range Hydrocarbons	6	33%	0.0147	0.0209	NA	No PRG	**Yes**
Motor Oil Range Hydrocarbons	4	25%	0.113	0.113	NA	No PRG	**Yes**

Notes:

Statistics are provided for total and dissolved concentrations of inorganic analytes and total concentrations of organic analytes.
COI = Chemical of Interest
NA = not available
na = not applicable
PRG = Preliminary Remediation Goal
(1) Only chemicals with detection frequency equal to or greater than 5% are shown in the table.
(2) USEPA 2004 used with exception of Lead for which the ODEQ Water Quality Criterion - Drinking Water MCL was used.
(3) Analytes for which both of the following criteria were met were retained as COIs: 1) detection frequency equal to or greater than 5%, 2) max conc. above the Region 9 Tap Water PRG. (No background dataset available for groundwater.) Also, analytes lacking a Tap Water PRG were retained as COIs. All COIs are shown in bold font.

Table 5-11. List of COIs in Sediment from Bonneville Dam Forebay, Bradford Island

Analyte (1)	Sediment Data Summary Statistics				Reference Area Data Summary Statistics							Selection of COIs	
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/kg)	Max Detected Conc. (mg/kg)	No. Usable Data Points	Detection Frequency (%)	Min	Max	Statistical Distribution	95% Confidence 95% Coverage UTL (mg/kg) (2)	Notes	Max Conc. Exceeds Background?	Retain as COI?
INORGANICS													
Aluminum	96	100%	5360	26500	20	100%	9320	23100	Normal	**24448**		Yes	**Yes**
Antimony	4	100%	0.3	0.9	1	100%	0.4	0.4	na	**0.4**	(3)	Yes	**Yes**
Arsenic	24	100%	0.7	32	20	100%	2.1	8.8	Lognormal	**8.57**		Yes	**Yes**
Barium	96	100%	25.8	283	20	100%	64.2	177	Normal	**203**		Yes	**Yes**
Beryllium	96	82%	0.1	0.6	20	90%	<0.1	0.5	Normal	**0.495**		Yes	**Yes**
Cadmium	82	39%	0.2	4.1	20	70%	<0.3	0.9	Normal	**1.06**		Yes	**Yes**
Chromium	96	100%	11.7	620	20	100%	14.6	27	Normal	**27.2**		Yes	**Yes**
Cobalt	24	100%	6.7	23.6	20	100%	7.3	15.1	Normal	**16.1**		Yes	**Yes**
Copper	96	100%	17.2	6577	20	100%	12.1	51.4	Lognormal	**57.1**		Yes	**Yes**
Lead	96	100%	2.9	121	20	100%	4.7	16	Normal	**18.4**		Yes	**Yes**
Manganese	24	100%	202	773	20	100%	317	815	Normal	**814**		No	No
Mercury	38	68%	0.03	1.1	20	60%	<0.03	0.21	Normal	**0.227**		Yes	**Yes**
Nickel	96	100%	12	520	20	100%	14	39	Lognormal	**38.2**		Yes	**Yes**
Thallium	96	60%	0.1	0.9	20	63%	<0.1	0.4	Lognormal	**0.444**		Yes	**Yes**
Vanadium	24	100%	19.3	93.7	20	100%	54.9	88.2	Normal	**89.3**		Yes	**Yes**
Zinc	96	100%	50.6	787	20	100%	72	154	Normal	**175**		Yes	**Yes**
PCBs													
Aroclor 1254	96	86%	0.0009	605	na	na	na	na	na	na		na	**Yes**
Aroclor 1260	96	5%	0.0058	0.195	na	na	na	na	na	na		na	**Yes**
SVOCs													
Acenaphthene	96	5%	0.00973	0.036	na	na	na	na	na	na		na	**Yes**
Anthracene	96	5%	0.0105	0.14	na	na	na	na	na	na		na	**Yes**
Benzo(a)anthracene	96	30%	0.0095	0.89	na	na	na	na	na	na		na	**Yes**
Benzo(a)pyrene	96	30%	0.0095	0.655	na	na	na	na	na	na		na	**Yes**
Benzo(b)fluoranthene	96	31%	0.0089	0.75	na	na	na	na	na	na		na	**Yes**
Benzo(g,h,i)perylene	96	22%	0.012	0.441	na	na	na	na	na	na		na	**Yes**
Benzo(k)fluoranthene	96	30%	0.0108	0.715	na	na	na	na	na	na		na	**Yes**
Bis(2-ethylhexyl)phthalate	53	75%	0.01	3.8	na	na	na	na	na	na		na	**Yes**
Carbazole	24	13%	0.018	0.12	na	na	na	na	na	na		na	**Yes**
Chrysene	96	34%	0.011	1.2	na	na	na	na	na	na		na	**Yes**
Dibenz(a,h)anthracene	96	7%	0.0107	0.167	na	na	na	na	na	na		na	**Yes**
Di-n-Butyl Phthalate	24	17%	0.015	0.087	na	na	na	na	na	na		na	**Yes**
Fluoranthene	96	33%	0.00803	1.7	na	na	na	na	na	na		na	**Yes**
Indeno(1,2,3-cd)pyrene	96	22%	0.01	0.487	na	na	na	na	na	na		na	**Yes**
p-Cresol	24	13%	0.018	0.18	na	na	na	na	na	na		na	**Yes**
Phenanthrene	96	27%	0.00548	0.51	na	na	na	na	na	na		na	**Yes**
Pyrene	96	34%	0.007	2	na	na	na	na	na	na		na	**Yes**
TPHs													
Diesel Range Hydrocarbons	24	54%	3.2	515	na	na	na	na	na	na		na	**Yes**
Motor Oil Range Hydrocarbons	24	79%	11	175	na	na	na	na	na	na		na	**Yes**

Notes:

All bolded chemicals were retained as COIs, which are defined as those analytes with a 5% detection frequency or greater and, for inorganics only, with a maximum detected concentration above the reference area UTL.

COI = Chemical of Interest

NA = not available

na = not applicable

UTL = upper threashold limit

(1) Only chemicals with detection frequency equal to or greater than 5% are shown in the table. The following essential nutrients were excluded as COIs in sediment: calcium, iron, magnesium, potassium, and sodium.

(2) For non-detect samples, the 95% UTL was calculated using values determined by the robust regression on order statistics (Helsel 2005).

(3) Sample size was too small to calculate the 95% UTL, hence the max detected value is shown.

Table 5-12. List of COIs in Sediment from Bonneville Dam Forebay with Potential to Migrate Downstream
Bradford Island

Analyte (1)	Sediment Data Summary Statistics				Reference Area Data Summary Statistics								Sediment Benchmark Comparison							Identification of Forebay to Downstream COIs				SLVs available?	Retain as COI (7)?
													Oregon DEQ Level II SLV for Freshwater Sediment (mg/kg) (4)	Oregon DEQ Sediment Bioaccumulation SLV (5)				Selected Sediment Screening Level (mg/kg) (6)	Is Max Detected Greater than Selected Sediment Screening Level?	Extent Defined Near Bradford Island?	Extent Defined in Rest of Forebay?	Point Sources Identified?	Decreasing Trend Away from Source?		
	No. Usable Data Points	Detection Frequency (%)	Min Detected Conc. (mg/kg)	Max Detected Conc. (mg/kg)	No. Usable Data Points	Detection Frequency (%)	Min	Max	Statistical Distribution	Reference (95% Confidence 95% Coverage UTL) (mg/kg) (2)	Notes	Max Conc. Exceeds Reference?		Birds - Individual (mg/kg dry wt)	Mammals - Individual (mg/kg dry wt)	Fish - Freshwater (mg/kg dry wt)	Humans - Subsistence (mg/kg dry wt)							
INORGANICS																									
Aluminum	96	100%	5360	26500	20	100%	9320	23100	Normal	24448		Yes	NA	NA	NA	NA	NA	NA	No SLV	Yes	No	--	--	No	No (a)
Antimony	4	100%	0.3	0.9	1	100%	0.4	0.4	na	0.4	(3)	Yes	3	NA	NA	NA	NA	3	No	--	--	--	--	Yes	No
Arsenic	24	100%	0.7	32	20	100%	2.1	8.8	Lognormal	8.57		Yes	6	Screening levels below background				6	Yes	Yes	No	No	No	Yes	**Yes**
Barium	96	100%	25.8	283	20	100%	64.2	177	Normal	203		Yes	NA	NA	NA	NA	NA	NA	No SLV	Yes	No	--	--	No	No (a)
Beryllium	96	82%	0.1	0.6	20	90%	<0.1	0.5	Normal	0.495		Yes	NA	NA	NA	NA	NA	NA	No SLV	Yes	No	--	--	No	**Yes**
Cadmium	82	39%	0.2	4.1	20	70%	<0.3	0.9	Normal	1.06		Yes	0.6	Screening levels below background				0.6	Yes	Yes	Yes	Yes		Yes	**Yes**
Chromium	96	100%	11.7	620	20	100%	14.6	27	Normal	27.2		Yes	37	NA	NA	NA	NA	37	Yes	Yes	Yes	Yes	Yes	Yes	**No**
Cobalt	24	100%	6.7	23.6	20	100%	7.3	15.1	Normal	16.1		Yes	NA	NA	NA	NA	NA	NA	No SLV	--	--	--	--	No	**Yes**
Copper	96	100%	17.2	6577	20	100%	12.1	51.4	Lognormal	57.1		Yes	36	NA	NA	NA	NA	36	Yes	Yes	Yes	Yes		Yes	**Yes**
Lead	96	100%	2.9	121	20	100%	4.7	16	Normal	18.4		Yes	35	Screening levels below background				35	Yes	Yes	Yes	Yes	Yes	Yes	**No**
Manganese	24	100%	202	773	20	100%	317	815	Normal	814		No	na	na	na	na	na	na	na	--	--	--	--	NA	No (b)
Mercury	38	68%	0.03	1.1	20	60%	<0.03	0.21	Normal	0.227		Yes	0.2	Screening levels below background				0.2	Yes	Yes	Yes	No	No	Yes	**Yes**
Nickel	96	100%	12	520	20	100%	14	39	Lognormal	38.2		Yes	18	NA	NA	NA	NA	18	Yes	Yes	Yes	Yes	Yes	Yes	No
Thallium	96	60%	0.1	0.9	20	63%	<0.1	0.4	Lognormal	0.444		Yes	NA	NA	NA	NA	NA	NA	No SLV	Yes	No	--	--	No	**Yes**
Vanadium	24	100%	19.3	93.7	20	100%	54.9	88.2	Normal	89.3		Yes	NA	NA	NA	NA	NA	NA	No SLV	Yes	No	--	--	No	**Yes**
Zinc	96	100%	50.6	787	20	100%	72	154	Normal	175		Yes	123	NA	NA	NA	NA	123	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
PCBs																									
Aroclor 1254	96	86%	0.0009	605	na	na	na	na	na	na		na	0.007	0.057	0.044	0.022	0.000046	0.000046	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Aroclor 1260	96	5%	0.0058	0.195	na	na	na	na	na	na		na	0.007	0.057	0.044	0.022	0.000046	0.000046	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
SVOCs																									
Acenaphthene	96	5%	0.00973	0.036	na	na	na	na	na	na		na	0.29	NA	NA	NA	NA	0.29	No	Yes	Yes	No	Yes	Yes	No
Anthracene	96	5%	0.0105	0.14	na	na	na	na	na	na		na	0.057	NA	NA	NA	NA	0.057	Yes	Yes	Yes	No	Yes	Yes	No
Benzo(a)anthracene	96	30%	0.0095	0.89	na	na	na	na	na	na		na	0.032	NA	NA	NA	NA	0.032	Yes	Yes	Yes	No	Yes	Yes	No
Benzo(a)pyrene	96	30%	0.0095	0.655	na	na	na	na	na	na		na	0.032	NA	NA	NA	NA	0.032	Yes	Yes	Yes	No	Yes	Yes	No
Benzo(b)fluoranthene	96	31%	0.0089	0.75	na	na	na	na	na	na		na	NA	NA	NA	NA	NA	NA	No SLV	Yes	Yes	No	Yes	No	No
Benzo(g,h,i)perylene	96	22%	0.012	0.441	na	na	na	na	na	na		na	0.3	NA	NA	NA	NA	0.3	Yes	Yes	Yes	No	Yes	Yes	No
Benzo(k)fluoranthene	96	30%	0.0108	0.715	na	na	na	na	na	na		na	0.027	NA	NA	NA	NA	0.027	Yes	Yes	Yes	No	Yes	Yes	No
Bis(2-ethylhexyl)phthalate	53	75%	0.01	3.8	na	na	na	na	na	na		na	0.75	NA	NA	NA	NA	0.75	Yes	Yes	Yes	No	Yes	Yes	No
Carbazole	24	13%	0.018	0.12	na	na	na	na	na	na		na	0.14	NA	NA	NA	NA	0.14	No	--	--	--	--	Yes	No
Chrysene	96	34%	0.011	1.2	na	na	na	na	na	na		na	0.057	NA	NA	NA	NA	0.057	Yes	Yes	Yes	No	Yes	Yes	No
Dibenz(a,h)anthracene	96	7%	0.0107	0.167	na	na	na	na	na	na		na	0.033	NA	NA	NA	NA	0.033	Yes	Yes	Yes	No	Yes	Yes	No
Di-n-Butyl phthalate	24	17%	0.015	0.087	na	na	na	na	na	na		na	0.11	NA	NA	NA	NA	0.11	No	--	--	--	--	Yes	No
Fluoranthene	96	33%	0.00803	1.7	na	na	na	na	na	na		na	0.111	NA	360	37	62	0.111	Yes	Yes	Yes	No	Yes	Yes	No
Indeno(1,2,3-cd)pyrene	96	22%	0.01	0.487	na	na	na	na	na	na		na	0.017	NA	NA	NA	NA	0.017	Yes	Yes	Yes	No	Yes	Yes	No
p-Cresol	24	13%	0.018	0.18	na	na	na	na	na	na		na	NA	NA	NA	NA	NA	NA	No SLV	Yes	Yes	No	Yes	Yes	No
Phenanthrene	96	27%	0.00548	0.51	na	na	na	na	na	na		na	0.042	NA	NA	NA	NA	0.042	Yes	Yes	Yes	No	Yes	Yes	No
Pyrene	96	34%	0.007	2	na	na	na	na	na	na		na	0.053	NA	18,000	1.9	47	0.053	Yes	Yes	Yes	No	Yes	Yes	No
TPHs																									
Diesel Range Hydrocarbons	24	54%	3.2	515	na	na	na	na	na	na		na	NA	NA	NA	NA	NA	NA	No SLV	Yes	Yes	No	--	No	**Yes**
Motor Oil Range Hydrocarbons	24	79%	11	175	na	na	na	na	na	na		na	NA	NA	NA	NA	NA	NA	No SLV	Yes	Yes	No	--	No	**Yes**

Notes:

COI = Chemical of Interest

NA = Not Available

na = not applicable. No further screening needed for manganese as max concentration was below reference concentration. Comparison to reference concentration was not applicable for organics.

SLV = Screening Level Value

UTL = upper threashold limit

(1) Only chemicals with detection frequency equal to or greater than 5% are shown in the table. The following essential nutrients were excluded as COIs in sediment: calcium, iron, magnesium, potassium, and sodium.

(2) For non-detect samples, the 95% UTL was calculated using values determined by the robust regression on order statistics (Helsel 2005).

(3) Sample size was too small to calculate the 95% UTL, hence the max detected value is shown.

(4) Oregon Department of Environmental Quality, December 2001. SLV for Aroclor 1254 used as a surrogate for Aroclor 1260.

(5) *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment* (Final), Oregon Department of Environmental Quality, January 2007. Risk-based SLVs for sediment calculated in this report were reported below background levels for Arsenic, Cadmium, Lead, and Mercury. ODEQ recommends the use of site-specific reference concentrations for these chemicals. SLVs for Total PCBs (as Aroclors) used as SLVs for individual Aroclors 1254 and 1260.

(6) Lowest of Freshwater Sediment SLVs (ODEQ, 2001) and Bioaccumulation SLVs for Individual Bird, Individual Mammal, Freshwater Fish, and Subsistence Humans (ODEQ, 2007) are selected as final Sediment Screening Levels.

(7) Analytes for which all of the following criteria were met were retained as COIs: 1) detection frequency equal to or greater than 5%, 2) max conc. above reference conc. (inorganics only), 3) max conc. above the selected sediment screening level. Also, most analytes lacking any SLVs were retained as COIs. All COIs are shown in bold font.

(a) No SLV available. However, this chemical was not retained as a COI based on its low potential for toxicity.

(b) Not retained as COI based on comparison to reference.

-- no information

Table 5-13. List of COIs for Surface Water:
Bonneville Lock and Dam,
Bradford Island

Analyte	Summary Statistics				Selection of COIs										
						Oregon Water Quality Criteria (mg/L) (3)				National Ambient Water Quality Criteria (mg/L) (4)					
	No. Usable Data Points (1)	Detection Frequency (%)	Min Detected Conc. (mg/L)	Max Detected Conc. (mg/L)	Oregon DEQ Level II SLV for Aquatic Life (mg/L) (2)	Aquatic Life Freshwater Chronic	Human Health - Water and Fish Ingestion	Human Health - Fish Consumption Only	Drinking Water MCL	Aquatic Life Freshwater CCC	Human Health - Water and Organism	Human Health - Organism Only	Selected Water Quality Criteria (5)	Is Max Detected Greater than Water Quality Criteria?	Retain as COI? (8)
INORGANICS (TOTAL)															
Copper	1	100%	0.0014	0.0014	0.009	0.009	1.3	NA	NA	0.009	1.3	NA	0.009	No	No
INORGANICS (DISSOLVED)															
Copper	1	100%	0.0024	0.0024	0.009	0.009	1.3	NA	NA	0.009	1.3	NA	0.009	No	No
PCBs															
Total PCBs (as Aroclors) (6)	3	60%	1.98E-08	5.00E-06	0.094	0.000014	6.40E-08	6.40E-08	NA	0.000014	6.40E-08	6.40E-08	6.40E-08	Yes	**Yes**
Total PCBs (as Congeners) (6)	2	100%	3.06E-08	6.89E-08	0.000014	0.000014	6.40E-08	6.40E-08	NA	0.000014	6.40E-08	6.40E-08	6.40E-08	Yes	**Yes**
Dioxin-like PCBs (2,3,7,8-TCDDeq for fish) (7)	2	100%	3.50E-14	4.60E-14	NA	3.80E-08	5.00E-12	5.10E-12	NA	NA	5.00E-12	5.10E-12	5.00E-12	No	No
PAHs															
Benzo(a)anthracene	2	50%	1.10E-08	1.10E-08	2.70E-05	NA	3.80E-06	1.80E-05	NA	NA	3.80E-06	1.80E-05	3.80E-06	No	No
Benzo(a)pyrene	2	50%	6.00E-08	6.00E-08	1.40E-05	NA	3.80E-06	1.80E-05	NA	NA	3.80E-06	1.80E-05	3.80E-06	No	No
Benzo(b/j)fluoranthene	2	50%	8.00E-08	8.00E-08	NA	NA	3.80E-06	1.80E-05	NA	NA	NA	NA	NA	No SLV	**Yes**
Benzo(g,h,i)perylene	2	50%	6.30E-08	6.30E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	No SLV	**Yes**
Benzo(k)fluoranthene	2	100%	5.00E-09	4.90E-08	NA	NA	3.80E-06	1.80E-05	NA	NA	3.80E-06	1.80E-05	3.80E-06	No	No
Chrysene	2	100%	5.50E-08	1.52E-07	NA	NA	3.80E-06	1.80E-05	NA	NA	3.80E-06	1.80E-05	3.80E-06	No	No
Dibenz(a,h)anthracene	2	50%	1.20E-08	1.20E-08	NA	NA	3.80E-06	1.80E-05	NA	NA	3.80E-06	1.80E-05	3.80E-06	No	No
Fluoranthene	2	50%	4.62E-07	4.62E-07	6.16E-03	NA	0.13	0.14	NA	NA	1.30E-01	1.40E-01	6.16E-03	No	No
Indeno(1,2,3-cd)pyrene	2	50%	5.00E-08	5.00E-08	NA	NA	3.80E-06	1.80E-05	NA	NA	3.80E-06	1.80E-05	3.80E-06	No	No
Phenanthrene	2	50%	7.88E-07	7.88E-07	6.30E-03	NA	NA	NA	NA	NA	NA	NA	6.30E-03	No	No
Pyrene	2	50%	1.71E-07	1.71E-07	NA	NA	8.30E-01	4.00E+00	NA	NA	8.30E-01	4.00E+00	8.30E-01	No	No

Notes:

CCC = Criteria Continuous Concentration
COI = Chemical of Interest
MCL = Maximum Contaminant Level
mg/L = milligrams per liter
NA = not available
SLV = Screening Level Value

(1) n=1 (primary and duplicate samples) for inorganics from grab samples, n=3 (primary and duplicate samples) for Total PCBs (as Aroclors) from 2 high-volume and 1 grab samples, and n=2 (primary samples) for Total PCBs (as Congeners), Dioxin-like PCBs (2,3,7,8-TCDDeq for fish), and PAHs from 2 high-volume samples. Only detected chemicals reported.
(2) Oregon DEQ Guidance for Ecological Risk Assessment 2001.
(3) Oregon DEQ Water Quality Criteria Summary (OAR 340-041, Table 33A, 33B, and 33C).
In the absence of site-specific hardness data, a hardness of 100 mg/L was assumed in the development of the freshwater chronic WQC for copper (EPA 2006).
(4) National Recommended Ambient Water Quality Criteria (EPA 2006).
(5) Lowest of DEQ Level II SLV Protective of freshwater aquatic life, DEQ Water Quality Criteria (for Aquatic Life Freshwater Chronic, Water and Fish Ingestion, Fish Consumption, and Drinking Water MCL), or National Ambient Water Quality Criteria (for Freshwater CCC, Water and Organism, and Organism) are the selected Water Quality Criteria.
(6) Total PCBs (as Arcolors) and Total PCBs (as Congeners) were calculated as the sum of the detected concentrations for individual Aroclors or congeners and one half maximum detection limit for the non-detected samples.
(7) 2,3,7,8-TCDD Toxicity Equivalent (TCDDeq) for the 12 dioxin-like PCBs calculated with World Health Organization toxic equivalency factors (TEFs) for fish (Vandenberg et al. 1998). 2,3,7,8-TCDDeqs were calculated as described in previous footnote for Total PCBs (as Aroclors) and Total PCBs (as Congeners).
(8) Analytes for which both of the following criteria were met were retained as COIs: 1) detected at least once, 2) max conc. above the Selected Water Quality Criteria. (No background dataset available for surface water.) Also, analytes lacking a Water Quality Criteria were retained as COIs. All COIs are shown in bold font.

Table 6-1. Current Status of Risk Evaluation by OU and AOPC

OU/AOPC	Risk Assessment Level*		
	Scoping Level (I)	Screening Level (II)	Baseline (III and IV)
Landfill (including gully area)	Complete	Complete except for soil-to-river pathway with respect to bird, mammal SLVs. This screening may be done preliminarily, but erosive soils need to be identified in the RI.	A Human Health Baseline Risk Assessment (URS 2004a) was submitted to DEQ and commented upon; both this human health assessment and a baseline ecological assessment remain to be completed during the RI.
Sandblast Area (including hazardous waste storage area, former transformer oil release area, and former drum storage area)	Complete	This screening may be done preliminarily, but erosive soils need to be identified in the RI.	To be accomplished during RI.
Pistol Range	Complete. See Section 4.3	Based upon knowledge of site activity, only metals and wood treatment chemicals were measured. Screening will be done as part of the RI.	Limited risk assessment for COPC will be accomplished during the RI
Bulb Slope	Complete	COPC screening will be accomplished during RI/FS Work Plan	Risk assessment for COPC will be accomplished during the RI.
Goose Island sediments	Complete, but few samples	Data will be acquired in RI to accomplish screening.	Risk assessment will be accomplished during RI.
Forebay vicinity (including mouth of Eagle Creek and Southern Lagoon)	Complete	Nearly complete. COPC screening will be completed as part of the RI.	Additional data collection will occur as part of the RI, after completion of interim removal action. Screening and baseline risk assessments will be completed as part of the RI.
Downstream of Bonneville Dam	Complete with this Work Plan	Incomplete. Nature and extent delineation and risk screening will be accomplished during the RI.	Data may be needed on tissue and relationship to sediment. Risk assessment will be accomplished during RI.
Surface Water	Complete with this Work Plan	Incomplete. Additional data will be collected for as part of the RI. All data will be screened during the RI.	Risk assessment will be accomplished during RI.
Reference Areas	Complete—these are for background comparison	Incomplete. COI are assumed to be the same as in the Forebay. Screening for COPC will occur in parallel to the sites potentially impacted by releases from Bradford Island vicinity during the RI.	Data are needed on tissue and relationship to sediment. Risk assessment will be accomplished during RI.

* Scoping and Screening Level Assessments for ERA are equivalent to Problem Formulation phase of HHRA.

Table 8-1. General Data Quality Objectives for Remedial Investigation for River OU

Problem Statement:
Additional data are required to characterize the Bradford Island site OUs for preparation of an RI report and baseline risk assessment, and to permit evaluation of engineering alternatives to address areas requiring remediation.

Decisions to Be Made	Data Requirements	Investigation Strategy	Decision Criteria/ Performance Specifications
Determine the nature and magnitude of sediment contamination in the Forebay	Sediment chemical data	Collect surface sediment from within the forebay. Sample locations will be at 21 randomly selected grid stations. 14 of the 21 stations will be initially analyzed and the remaining 7 stations will be analyzed if necessary to obtain the statistical power for comparison to upstream.	Laboratory reporting limits will be based on screening levels. Laboratory analyses will be based on the chemicals of interest as defined in the Management Plan.
Determine the nature and extent of sediment impacts related to releases from the site downstream of the dam.	Sediment chemical data	Collect surface sediment samples from 5 locations between the tailrace of the dam and Pierce and Ives Islands (River Mile 142).	Locations of the sediment samples will be based on identifying areas of lower relative velocity that correspond to depositional areas in the river. Laboratory analyses will be based on the chemicals of interest as defined in the Management Plan. Laboratory reporting limits will be based on screening levels.

Table 8-1. General Data Quality Objectives for Remedial Investigation for River OU

Decisions to Be Made	Data Requirements	Investigation Strategy	Decision Criteria/ Performance Specifications
Determine the magnitude of PCB impacts to selected ecological receptors in the Forebay	Tissue chemical data.	Collect 21 benthic tissue (clams) samples that are co-located with sediment locations in the forebay. Attempt to acquire 21 sculpin and crayfish samples corresponding to sediment/clam collection area. Analyze 17 archived smallmouth bass samples and 5 largescale sucker collected from within forebay.	Laboratory analyses will be based on the chemicals of interest as defined in the Management Plan. Laboratory reporting limits will be based on screening levels.
Describe the potential for PCBs to bioaccumulate in selected receptors	Physical data required for the food web model. Tissue, sediment and surface water data.	Use data from other data needs to fill this requirement.	Laboratory reporting limits will be based on screening levels.
Determine the ambient contaminant contribution from upstream sources to site contamination levels	Sediment chemical data	Collect 21 co-located surface sediment and clam samples from area that is similar in nature to forebay, i.e. grain size and TOC content. Sample locations will be at 21 randomly selected grid points. Attempt to acquire 21 sculpin and crayfish samples in the area of the sediment/clam collections. Collect 17 smallmouth bass from within reference area. 14 of the 21 stations will be initially analyzed and the remaining 7 stations will be analyzed if necessary to obtain the statistical power for comparison to upstream.	Laboratory reporting limits will be based on screening levels.

Table 8-1. General Data Quality Objectives for Remedial Investigation for River OU

Decisions to Be Made	Data Requirements	Investigation Strategy	Decision Criteria/ Performance Specifications
Determine the clam sediment relationship at higher sediment concentrations	Sediment and clam chemical data	Collect 5 co-located surface sediment and clam samples from within the removal area footprint prior to implementing the removal action	Laboratory reporting limits will be based on screening levels.
Determine a preliminary cleanup goal for sediments that includes PCBs as Aroclors	Sediment chemical data for both Aroclors and congeners	All sediment samples will be analyzed for PCBs as Aroclors and then archived samples will be selected for congeners analysis based on a range of Aroclor results.	Laboratory reporting limits will be based on screening levels.

Table 8-2. Data Quality Objectives for Human Health and Ecological Risk Assessment, Upland OU

Source Media	Exposure Media	Receptors	Exposure Routes	Data Needs for ERA/HRA	Summary of Existing Data for Exposure Scenario	Data gaps/ Investigation Objective	Proposed Data Collection	Data use and Evaluation Strategy [c]	Decision Rules
Objective 1: Determine Potential for COIs in Soil or Groundwater of Upland OU to Impact River OU									
• Soil from upland AOPCs • Groundwater Seeps	• Soil washed off into River OU • Groundwater discharging into Surface Water	• **Benthic and Aquatic Communities** • **Piscivorous Wildlife** • **Human receptors for River OU**	• Ingestion of and contact with sediment (former soil) and surface water (groundwater seeps) • Dietary uptake through trophic transfer	• Determination of stability of surface soils • COI concentrations in surface soils at upland AOPCs • COI concentrations in groundwater seeps at the point of discharge to the river • Upgradient groundwater data for inorganics representative of background levels	• High density of surface soil data for COIs in the source areas of each AOPC • Limited measurements of COIs in seeps • Groundwater data from Landfill and Sandblast Area	• Stability of surface soils within specific areas of each AOPC • Several rounds of seep data from north shore of Bradford Island [a] • Upgradient groundwater data for inorganics unaffected by the past releases at the Landfill and Sandblast Area	• Surface soil samples from locations within the Landfill gully area, Sandblast Area and Pistol Range to be analyzed for erodibility potential • Survey of surface soils to develop detailed topographical data and groundcover (assess soil mobility) • Seep water from 1 to 3 locations (depending on availability) adjacent to upland landfill, Sandblast AOPC and Pistol Range AOPC. • Groundwater samples from wells closest to seep locations at Landfill, Sandblast AOPC and Pistol Range AOPC.	• Identify COPCs/CPECs in soil and groundwater as having the potential to be transported to sediments and surface water of the forebay [b] (Tables 5-5 to 5-8) • Perform more thorough investigation of soil stability in targeted areas of concern, evaluate spatial trends in soil and sediment concentrations • For mobile COPCs/CPECs in ground water [b], evaluate if impacts to River OU receptors are possible, using surface water data (Tables 5-9, 5-10). • If seeps determined to impact surface water, evaluate groundwater data and data for soils of upland AOPCs to identify source of groundwater contamination	• If COPCs/CPECs in soil are determined to wash off into the river at concentrations of potential concern, identify means of minimizing this transport pathway in the FS (localized soil removal, erosion control measures) • If COPCs/CPECs in surface water are determined to originate from upland groundwater, and primary source medium is soil of the Upland OU, identify means of minimizing this transport pathway in the FS (e.g., localized soil removal, groundwater barrier)

Table 8-2. Data Quality Objectives for Human Health and Ecological Risk Assessment, Upland OU

Source Media	Exposure Media	Receptors	Exposure Routes	Data Needs for ERA/HRA	Summary of Existing Data for Exposure Scenario	Data gaps/ Investigation Objective	Proposed Data Collection	Data use and Evaluation Strategy [c]	Decision Rules
Objective 2: Determine Baseline Risk to Ecological Receptors from COIs in Soil of the Upland OU under "No Action" Conditions									
Soil at Upland AOPCs (Landfill, Sand Blast Area, Pistol Range and Bulb Slope)	• Surface Soil	**Terrestrial Plant and Soil Invertebrate Communities**	• Ingestion (invertebrates only) and contact with soil	• COI concentrations in surface soils (0-3 ft bgs) at each AOPC	High density of surface soil data in the source areas of each AOPC	No data gaps exist for these receptor groups	• None, existing soil data sufficient to assess risks to these receptor groups at each AOPC of the Upland OU	• Compare soil data to DEQ Level II SLVs protective of plants and invertebrates (2001). • When necessary, perform more detailed evaluation of site data and assumptions of risk assessment: ➢ Frequency and magnitude of SLV exceedences ➢ Spatial trends of data. ➢ Habitat conditions present ➢ Level of confidence in the SLVs, etc.	• If site concentrations are lower than SLVs, no further evaluation. • If site concentrations are higher than the above measures, additional evaluation may be recommended based on weight-of-evidence.
Soil at Upland AOPCs (Landfill, Sand Blast Area, Pistol Range and Bulb Slope)	• Soil • Water	• Terrestrial Mammals represented by the **Vagrant Shrew** (Burrowing insectivorous/ invertivorous rodent)	• Ingestion of soil and surface water of Upland OU • Dietary uptake through trophic transfer	• COI concentrations in surface and subsurface soils • COI concentrations in soil invertebrates for the diet of the shrew	• High density of soil data in the source areas of each AOPC • No terrestrial tissue or surface water data available (upland surface water comprised only of drainage ditches in the former Sandblast Area	• Minor cores in the Landfill gully area to address VOCs in soil • Concentrations of lead in surface soil of the Sandblast Area at a size fraction that would be bioavailable • No data gaps exist for the Pistol Range • No data gaps exist for the Bulb Slope	• Soil borings from locations in the gully area of the Landfill that will be analyzed for VOCs • Surface soil samples from locations in the Sandblast Area containing grit or fine-grained materials	• Compare soil data to DEQ Level II SLVs protective of mammals (2001) • Use soil data and literature-based uptake factors to predict bioaccumulative COI concentrations in soil invertebrates tissues • Use measured or predicted water concentrations for COI intake from water in ditches of Sandblast Area • Calculate HQs and HIs through a simple foodweb model on an AOPC basis	• If hazard index (HI) for shrew is less than 1.0, no further evaluation. • If HI for shrew is greater than 1.0, additional evaluation or action may be recommended based on weight of evidence. • Examples of additional evaluation may include additional data collection to characterize dietary exposure for shrew, such as CPEC concentrations measured in soil invertebrates or adjusting dietary composition, or further evaluation of confidence in TRVs
Soil at Upland AOPCs (Landfill, Sand Blast Area, Pistol Range and Bulb Slope)	• Soil • Water	• Terrestrial Birds represented by the **Canada Goose** (herbivorous birds), **American robin** (invertivorous birds), and **American Kestrel** (predatory birds) • (All known to occur at the site.)	• Ingestion of soil and surface water of Upland OU • Dietary uptake through trophic transfer	• COI concentrations in surface and subsurface soils • COI concentrations in terrestrial plants for the diet of the goose • COI concentrations in small mammals for the diet of the kestrel	• Similar to terrestrial mammals	• Similar to terrestrial mammals	• Provided by the data collection for terrestrial mammals	• Compare soil data to DEQ Level II SLVs protective of birds (2001). • Use soil data and literature-based uptake factors to predict bioaccumulative COI concentrations in terrestrial plants and small mammal tissues • Use measured or predicted water concentrations for COI intake from water in ditches of Sandblast Area • Calculate HQs and HIs through a simple foodweb model on an AOPC basis and a Upland OU-wide basis for birds with adequately large home ranges	• If hazard index (HI) for avian receptors is less than 1.0, no further evaluation. • If HI for avian receptors is greater than 1.0, additional evaluation or action may be recommended based on weight of evidence. • Examples of additional evaluation may include additional data collection to characterize dietary exposure for avian receptors, such as CPEC concentrations measured in plants or adjusting dietary composition, or further evaluation of confidence in TRVs

Table 8-2. Data Quality Objectives for Human Health and Ecological Risk Assessment, Upland OU

Source Media	Exposure Media	Receptors	Exposure Routes	Data Needs for ERA/HRA	Summary of Existing Data for Exposure Scenario	Data gaps/ Investigation Objective	Proposed Data Collection	Data use and Evaluation Strategy [c]	Decision Rules
Objective 3: Determine Baseline Risk to Human Receptors from COIs in Soil and Groundwater of the Upland OU under "No Action" Conditions									
• Soil at Upland AOPCs (Landfill, Sand Blast Area, Pistol Range and Bulb Slope) • Groundwater	• Surface Soil (0-3 ft bgs) • Subsurface soil (0-10 ft bgs, trench worker only) • Shallow groundwater (trench worker only)	• **Adult Outdoor Maintenance Worker** • **Adult Outdoor Trench Worker**	• Ingestion of and dermal contact with COIs in soil and shallow groundwater	COI concentrations in surface soils COI concentrations in shallow groundwater	• High density of surface soil data in the source areas of each AOPC • Groundwater data from Landfill and Sandblast Area	• Soil data gaps similar to terrestrial mammals • Recent shallow groundwater data	• Provided by the data collection for terrestrial mammals and for Objective 1	• Compare soil data against DEQ RBCs or USEPA Region 6 RBCs, for occupational and trench workers. • Retain exceeded chemicals as COPCs. • Estimate individual and cumulative risks and HQs on an AOPC-specific basis and OU-wide basis for direct contact pathways, as described in Appendix B	• If excess lifetime cancer risk (ELCR) is less than 1E-06 or hazard index (HI) is less than 1.0, no further evaluation. • If ELCR is greater than 1E-06 or HI is greater than 1.0, additional evaluation or action may be recommended. • Examples of additional evaluation may include refining estimates of exposure frequency and duration.

Table 8-2. Data Quality Objectives for Human Health and Ecological Risk Assessment, Upland OU

Source Media	Exposure Media	Receptors	Exposure Routes	Data Needs for ERA/HRA	Summary of Existing Data for Exposure Scenario	Data gaps/ Investigation Objective	Proposed Data Collection	Data use and Evaluation Strategy [c]	Decision Rules
Objective 3: Determine Baseline Risk to Human Receptors from COIs in the Forebay under Post-removal Action Conditions									
• Soil at the Sandblast Area • Shallow groundwater near the Sandblast area	• VOCs in indoor air	• **Onsite Indoor Worker**	• Inhalation of VOCs emanating from subsurface soil and/or groundwater	• COI concentrations in surface and subsurface soil of the Sandblast Area • COI concentrations in groundwater and air in the vicinity of the Sandblast Area (i.e., near the hazardous waste storage area)	• High density of soil data from Sandblast Area • Some groundwater data for VOCs from Sandblast Area (grab samples from temporary well points) • No soil gas data collected to date	• Concentrations of VOCs in soil gas and groundwater, primarily TCE and PCE, upto 10 ft away from from the Sandblast Area (hazardous waste storage area) • Concentrations of VOCs in groundwater upto 10 ft away from likely enclosed structures • Soil properties data for use in VI models	• Groundwater data from newly installed monitoring well in the Sandblast Area, near the prospective source of TCE • Soil gas and sub-slab air samples in the sandblast building and service building • Site-specific soil properties data (e.g., moisture content, bulk density, soil type).	• Compare soil and groundwater data against DEQ RBCs or USEPA Region 6 RBCs, for indoor workers. • Retain exceeded chemicals as COPCs. • Estimate individual and cumulative risks and HQs on an AOPC-specific basis and OU-wide basis for direct contact pathways • Estimate risks and HQs for soil gas data separately, using site-specific application of USEPA's revised Johnson and Ettinger model.	• If excess lifetime cancer risk (ELCR) is less than 1E-06 or hazard index (HI) is less than 1.0, no further evaluation. • If ELCR is greater than 1E-06 or HI is greater than 1.0, additional evaluation or action may be recommended. • Examples of additional evaluation may include refining estimates of exposure frequency and duration, and refinement of USEPA's revised Johnson and Ettinger model.
• Soil washoff from upland AOPCs to River OU • Groundwater seeps discharging into surface water of River OU	• Surface water • Sediment	• **Anglers** • **Contact recreationists in River OU** • **Ecological receptors in River OU**	• Direct contact with surface water and sediment • Consumption of bioaccumulative COIs in fish and shellfish	• Provided in DQO Table for River OU (Table 8-3)	• Provided in DQO Table for River OU (Table 8-3)	• Provided in DQO Table for River OU (Table 8-3)	• Provided in DQO Table for River OU (Table 8-3)	• Provided in DQO Table for River OU (Table 8-3) • Evaluate whether risks to River OU receptors are associated with transportable COPCs/CPECs identified in Objective 1.	• If COPCs/CPECs in soil are determined to wash off into the river at concentrations of potential concern, identify means of minimizing this transport pathway in the FS (localized soil removal, erosion control measures) • If COPCs/CPECs in surface water are determined to originate from upland groundwater, and primary source medium is soil of the Upland OU, identify means of minimizing this transport pathway in the FS (e.g., localized soil removal, groundwater barrier)

Table 8-2. Data Quality Objectives for Human Health and Ecological Risk Assessment, Upland OU

Source Media	Exposure Media	Receptors	Exposure Routes	Data Needs for ERA/HRA	Summary of Existing Data for Exposure Scenario	Data gaps/ Investigation Objective	Proposed Data Collection	Data use and Evaluation Strategy [c]	Decision Rules
Objective 3 (cont'd): Determine Baseline Risk to Human Receptors from COIs in the Forebay under Post-removal Action Conditions									
Groundwater seeps discharging into surface water of River OU	Surface Water	**Hypothetical adult or child resident downstream from the dam who could use the Columbia River as a water supply, or whose wells could be recharged from the river**	• Ingestion and inhalation of and contact with COIs in surface water that originated in groundwater	• COI concentrations in groundwater • COI concentrations in seep water	• Groundwater data from Landfill and Sandblast Area	• COI concentrations in groundwater at seep locations • Upgradient groundwater data for inorganics unaffected by the past releases at the Landfill and Sandblast Area • Groundwater at Pistol Range Area	• Groundwater data from newly installed monitoring well in the Sandblast Area, near the prospective source of TCE • Two grab groundwater samples from Pistol Range area • Groundwater data from one newly installed up-gradient well near the Landfill and one near the Pistol Range Area • Surface water data as described in DQO table for River OU	• Compare groundwater concentrations with DEQ RBCs or DEQ potable water screening levels and identify exceeded chemicals as COPCs • Include COPCs in River OU evaluation of surface water as potable water supply • Assess if unacceptable risks in surface water are associated with identified COPCs in groundwater	• If excess lifetime cancer risk (ELCR) is less than 1E-06 or hazard index (HI) is less than 1.0, no further evaluation. • If ELCR is greater than 1E-06 or HI is greater than 1.0, additional evaluation or action may be recommended. • Examples of additional evaluation may include refining estimates of exposure frequency and duration • If COPCs in surface water are determined to originate from upland groundwater, and primary source medium is soil of the Upland OU, identify means of minimizing this transport pathway in the FS (e.g., localized soil removal, groundwater barrier)

[a] Identified data gap overlaps with River OU.
[b] Chemicals of Potential Concern (COPCs) for human receptors and Chemicals of Potential Ecological Concern (CPECs) in forebay sediment and surface water will be identified through the Evaluation Strategy and Decision Rules presented in the DQO table for the River OU.
[c] The Evaluation Strategy may differ for each AOPC depending on the level of risk assessment required to facilitate risk management decisions, in which case only some of the listed steps may be necessary.

Table 8-3. Data Quality Objectives and Data Requirements for Baseline Human Health and Ecological Risk Assessment, River OU

Source Media	Exposure Media	Receptors	Exposure Routes	Data Needs for ERA/HRA	Summary of Existing Data for Exposure Scenario	Data gaps/ Investigation Objective	Proposed Data Collection	Data Use and Evaluation Strategy (Multiple Lines of Evidence Approach)	Decision Rules
Objective 1: Determine if COIs in Forebay should be retained as COPCs for the Baseline HHRA and ERA [(1)]									
• Sediment • Surface water	• Sediment • Water • Diet	• **Benthic Community (Clams)** • **Shellfish (Crayfish)** • **Fish community (sculpin, smallmouth bass)** (The selected receptors are expected to have home ranges that are similar to or smaller than the area of the Forebay [approximately 0.7 miles or 22 acres].) • **Humans** • **Wildlife**	• Ingestion of and contact with sediment and surface water • Dietary uptake through trophic transfer	• COI concentrations in upstream sediment and surface water • COI concentrations in forebay sediment and surface water • COI concentrations in tissues of selected species (clam, crayfish, sculpin, smallmouth bass)	•Limited sediment and surface water data •Sediment and limited surface water available for forebay	Representative sediment, water and tissue data from upstream area and forebay	• Upstream area media and number of locations: ➢ surface sediment – 14 [e], ➢ water above the sediment interface – 5 ➢ clams – 14 to 21[e], ➢ crayfish – 14 to 21[e], ➢ sculpin – 17 to 21[e] ➢ smallmouth bass – 17 to 21[e] • Use randomly selected grid stations to provide a more representative estimate of exposure by the receptors	For all COIs, compare forebay maximum with upstream UTL; if maximum exceeds UTL, perform statistical comparison.	• For inorganic COIs, if forebay maximum is less than UTL, exclude as COPC; if maximum exceeds UTL but statistical comparison indicates no difference from upstream, exclude as COPC; if maximum exceeds UTL and statistical comparison indicates significant difference, include as COPC. • If inorganic COI excluded as COPC, include in hot spot evaluation at conclusion of risk assessment • Retain all organic COIs as COPCs and include in risk assessment; consider the relative contribution of upstream to forebay risks, based on results of statistical comparisons and actual magnitude of concentrations. • Retain COIs elevated in sediment or surface water for direct contact exposures • Retain COIs elevated in tissues for food-web related exposures

Table 8-3. Data Quality Objectives and Data Requirements for Baseline Human Health and Ecological Risk Assessment, River OU

Source Media	Exposure Media	Receptors	Exposure Routes	Data Needs for ERA/HRA	Summary of Existing Data for Exposure Scenario	Data gaps/ Investigation Objective	Proposed Data Collection	Data Use and Evaluation Strategy (Multiple Lines of Evidence Approach)	Decision Rules
Objective 2: Determine Baseline Risk to Ecological Receptors from COIs in the Forebay under Post-removal Action Conditions [2]									
• Sediment, • Groundwater discharging as seeps	• Sediment (and porewater) • Groundwater/ surface water interface (seep zone) • Surface Water	**Benthic community**	• Ingestion and contact with sediment. • Ingestion and contact with water • Ingestion of suspended matter (plankton and seston)	• COI concentrations in forebay sediment representing post-removal conditions • COI concentrations at groundwater seeps • COI concentrations in forebay surface water • COI concentrations in clams and crayfish tissue	•High density of sediment data in the source area for COI concentrations under pre-removal conditions. •Limited measurements of seeps. •Groundwater measurements. •Sparse measurements of surface water PCB (total and dissolved). •Sparse shellfish data collections for PCB	• Sediment and surface water data throughout the forebay, including removal area, that represent post-removal baseline conditions. • Several rounds of seep data from north shore of Bradford Island • Clam and crayfish tissue data throughout the forebay	• Forebay area media and number of locations: ➢ surface sediment – 14 to 21[e] ➢ water above the sediment interface – 5 ➢ seep water adjacent to upland landfill – 1 to 3 ➢ clam and crayfish – 14 to 21[e] • Use randomly selected (stratified) sediment and shellfish grid stations.	• Compare sediment data to DEQ sediment SLVs protective of a freshwater benthic community (2001). • Compare water data to current DEQ WQC protective of freshwater organisms (Criteria Continuous Concentrations, i.e., chronic exposure; OAR 340-041, Tables 33A, 33B, and 33C). • Compare predicted and measured clam and crayfish data to tissue residue levels (e.g., ERED database) or estimated tissue residue benchmarks (e.g. DEQ 2007 methodology, Steevens 2005). • When necessary, perform more detailed evaluation of site data and assumptions of risk assessment: ➢ Frequency and magnitude of SLV exceedences ➢ Spatial trends of data. ➢ Habitat conditions present ➢ Level of confidence in the SLVs, etc.	• If site concentrations are lower than SLVs or WQC, no further evaluation. • If site concentrations are higher than the above measures, additional evaluation may be recommended based on weight-of-evidence. • (Examples of additional evaluation may include review of spatial trends in COI concentrations detected in groundwater from the interior of the landfill, the shoreline wells, and groundwater seeps)
• Sediment partitioning to surface water • Groundwater discharging to surface water	Surface Water	**Aquatic Organisms (plankton, aquatic plants, pelagic invertebrates, and fish)**	• Ingestion and contact with water column • Ingestion of suspended matter • Diet	COI concentrations in surface water (filtered for inorganics and unfiltered for organics)	•Sparse data on surface water quality available from project; •Water column concentrations at two high-volume samples under pre-removal conditions.	Water column samples throughout the forebay.	• Forebay area medium and number of locations: ➢ water above the sediment interface – 5 ➢ Use randomly selected grid stations.	• Compare to current DEQ WQC protective of freshwater organisms (Criteria Continuous Concentrations, i.e., chronic exposure; OAR 340-041, Tables 33A, 33B, and 33C). • Consider other lines of evidence such as spatial trends, frequency, and magnitude of exceedances.	• If site concentrations are lower than WQCs, no further evaluation. • If site concentrations are higher than WQCs, additional evaluation may be recommended based on weight-of-evidence.

Table 8-3. Data Quality Objectives and Data Requirements for Baseline Human Health and Ecological Risk Assessment, River OU

Source Media	Exposure Media	Receptors	Exposure Routes	Data Needs for ERA/HRA	Summary of Existing Data for Exposure Scenario	Data gaps/ Investigation Objective	Proposed Data Collection	Data Use and Evaluation Strategy (Multiple Lines of Evidence Approach)	Decision Rules
Objective 2 (cont.): Determine Baseline Risk to Ecological Receptors from COIs in the Forebay under Post-removal Action Conditions [2]									
• Sediment, • Groundwater discharging to surface water	Sediment, Surface Water, Diet	**Resident Fish represented by sculpin and smallmouth bass** (Anadromous species, like salmonids, and fish with large homeranges, like sturgeon, are expected to be protected by evaluation of resident fish with small home ranges. Sculpin and smallmouth bass are expected to have a higher level of site fidelity and greater exposure to site COIs in sediments.)	• Ingestion and contact with sediment • Uptake from water • Ingestion of food items with trophic uptake of COIs in sediment and water	• COI concentrations in forebay sediment representing post-removal conditions • COI concentrations in forebay surface water, clams, sculpins, crayfish and smallmouth bass	•High density of sediment data for COI concentrations under pre-removal conditions; low density of tissue data •Some SPMD (water column) data available from USGS and Ecology outside of forebay. •Water column concentrations at two high-volume samples under pre-removal conditions. •Archived fin-fish species collected from forebay[a]	• Surface sediment samples throughout the forebay. • Water column data throughout the forebay • Fish tissue data throughout the forebay • Target tissue of invertebrate species along the food web (i.e., clams and crayfish) • Environmental and biological parameters for AQUAWEB v1.1 trophic model (Arnot and Gobas 2004)	• Forebay area media and number of locations: ➢ surface sediment – 14 to 21[e] ➢ water above the sediment interface – 5 ➢ clams – 14 to 21[e], ➢ crayfish – 14 to 21[e], ➢ sculpin – 17 to 21[e] ➢ smallmouth bass – 17 to 21[e] ➢ large scale sucker – 17 (at request of DEQ) • Measurements of sediment and water quality parameters (particulate and dissolved organic carbon, dissolved oxygen, temp, etc.) needed for modeling bioaccumulative COPCs in AQUAWEB will be obtained from 5 sediment and surface water samples described above • Biological parameters for invert and fish species selected for tissue sampling (weight, moisture content, lipid content, etc.) needed for AQUAWEB will be measured in all tissue samples • Use randomly selected grid stations.	• Compare sediment concentrations to DEQ Bioaccumulative SLVs protective of Fish (2007). • Compare predicted and measured [b] fish tissue concentrations to tissue residue levels (e.g., ERED database).	• If site sediment concentrations are lower than SLVs, no further evaluation. • If site concentrations are higher than SLVs, additional evaluation may be recommended based on weight-of-evidence (same logic applied for fish tissue concentrations compared to tissue residue levels). • Examples of additional evaluation may include use of foodweb model or additional data collection to refine estimates of site-related COI concentrations in fish tissue.

Table 8-3. Data Quality Objectives and Data Requirements for Baseline Human Health and Ecological Risk Assessment, River OU

Source Media	Exposure Media	Receptors	Exposure Routes	Data Needs for ERA/HRA	Summary of Existing Data for Exposure Scenario	Data gaps/ Investigation Objective	Proposed Data Collection	Data Use and Evaluation Strategy (Multiple Lines of Evidence Approach)	Decision Rules
Objective 2 (cont.): Determine Baseline Risk to Ecological Receptors from COIs in the Forebay under Post-removal Action Conditions [2]									
• Sediment, • Sediment partitioning to surface water, • Groundwater discharging to surface water	• Surface Water • Fish in osprey diet [f] (carp, crappie, bullhead, salmonids, peamouth, northern squawfish, yellow perch, large-scale sucker)	**Osprey (Higher trophic level piscivore, known to occur at the site)**	• Ingestion of water • Ingestion of fish with trophic uptake of COIs in sediment, water, and dietary tissues (e.g., invertebrates, smaller fish)	Provided by the data collection for resident fish	High density of sediment data for COI concentrations under pre-removal conditions	Similar to resident fish	Provided by the data collection for resident fish	• Use sediment and water data, as well as environmental and biological data, in AQUAWEB to predict bioaccumulative COI concentrations in smallmouth bass, clams and sculpin • Use measured or predicted water concentrations for COI intake from water • Evaluate model performance against field-collected clam, sculpin and smallmouth bass data. • Use predicted or measured smallmouth bass concentrations to characterize dietary exposure for osprey	• If hazard index (HI) for osprey is less than 1.0, no further evaluation. • If HI for osprey is greater than 1.0, additional evaluation or action may be recommended based on weight of evidence. • Examples of additional evaluation may include use of foodweb model or additional data collection to characterize dietary exposure for osprey concentrations for other fish species found at the site that osprey may consume (e.g., large-scale sucker, peamouth)
• Sediment, • Sediment partitioning to surface water, • Groundwater discharging to surface water • Soil	• Surface Water • Fish in bald eagle diet [f] (bullhead, suckers, smallmouth bass, peamouth, perch, salmon, trout, • Terrestrial small mammals	**Bald Eagle (Higher trophic level carnivorous avian scavenger, known to occur at the site)**	• Ingestion of water • Ingestion of fish with trophic uptake of COIs in sediment and water • Ingestion of small mammals with trophic uptake of COIs from soil	• Provided by the data collection for resident fish, and • Predicted concentrations in small mammals, using soil data (from upland OU)	•High density of sediment data for COI concentrations under pre-removal conditions •Soil data from upland OU	Similar to resident fish	Provided by the data collection for resident fish	Similar to osprey	• If hazard index (HI) for bald eagle is less than 1.0, no further evaluation. • If HI for bald eagle is greater than 1.0, additional evaluation or action may be recommended based on weight of evidence. • Examples of additional evaluation may include refinement of upland or in-water food-webs, similar to osprey
• Sediment, • Sediment partitioning to surface water, • Groundwater discharging to surface water • Soil	• Surface Water • Fish in mink diet [f] (trout) • Benthic Invertebrates (crayfish, crabs) • Upland media: soil and prey (e.g., rodents) [c]	**Mink (higher trophic level piscivorous/ carnivorous mammal, known to occur at the site)**	• Ingestion of water • Ingestion of fish with trophic uptake of COIs from sediment and water • Ingestion of invertebrates with trophic uptake of COIs	Provided by the data collection for resident fish	•High density of sediment data for COI concentrations under pre-removal conditions •Limited data for concentrations in crayfish	Similar to resident fish	Provided by the data collection for resident fish	Similar to osprey, except measured crayfish tissue data will also be incorporated into exposure estimates through dietary pathway, as well as incidental sediment ingestion	• If hazard index (HI) for mink is less than 1.0, no further evaluation. • If HI for mink is greater than 1.0, additional evaluation or action may be recommended based on weight of evidence. • Examples of additional evaluation may include refinement of upland or in-water food-webs.
Objective 3: Determine Baseline Risk to Human Receptors from COIs in the Forebay under Post-removal Action Conditions [2]									
• Sediment • Sediment partitioning to surface water	Fish [g] (trout, whitefish, sturgeon, walleye, squawfish, sucker, salmon, lamprey, smelt) Shellfish (crayfish)	**Native American anglers, closest known location about 0.5 mi from Bonneville Dam area [d]** Although Native American fishers	• Ingestion of fish, and possibly shellfish, with trophic uptake of COIs from sediment and water • Contact with COIs in water • Contact with COIs	Provided by the data collection for resident fish	Similar to mink	Similar to resident fish	Provided by the data collection for resident fish	• Use sediment and water data, as well as environmental and biological data, in AQUAWEB to predict COI concentrations in smallmouth bass, clams and sculpin • Use sediment data to estimate exposure dose through direct contact	• If excess lifetime cancer risk (ELCR) is less than 1E-06 or hazard index (HI) is less than 1.0, no further evaluation. • If ELCR is greater than 1E-06 or HI is greater than 1.0, additional evaluation or action may be recommended based on weight of evidence.

Table 8-3. Data Quality Objectives and Data Requirements for Baseline Human Health and Ecological Risk Assessment, River OU

Source Media	Exposure Media	Receptors	Exposure Routes	Data Needs for ERA/HRA	Summary of Existing Data for Exposure Scenario	Data gaps/ Investigation Objective	Proposed Data Collection	Data Use and Evaluation Strategy (Multiple Lines of Evidence Approach)	Decision Rules
		are known to prefer anadromous and large home-range fish species, the resident, small home-range smallmouth bass was selected to be sufficiently protective of all fishers	in sediments					• Use measured or predicted water concentrations for direct contact dose (dermal contact and incidental ingestion) • Evaluate model performance against field-collected clam, sculpin and smallmouth bass data. • Use predicted and/or measured smallmouth tissue concentrations to estimate site risks for tribal anglers from finfish consumption • Use predicted and/or measured crayfish tissue concentrations to estimate site risks for tribal anglers from shellfish consumption	• Examples of additional evaluation may include use of foodweb model or additional data collection to characterize concentrations for other fish species found at the site that tribal fishers may consume (e.g., large-scale sucker, peamouth) • Preliminary sediment remediation goals may be developed using the food-web and risk models.
• Sediment • Sediment partitioning to surface water	Fish (smallmouth bass, largemouth bass, shad, salmon, steelhead, sturgeon, walleye) Shellfish (crayfish)	**Recreational sport anglers, known to utilize Bonneville Dam area** **Non-tribal high consumption anglers (may be present in vicinity)**	• Ingestion of fish, and possibly shellfish, with trophic uptake of COIs from sediment and water • Contact with COIs in water • Contact with COIs in sediments	Similar to tribal angler	Similar to tribal angler	Similar to tribal angler	Provided for by data collection for Native American angler	Similar to Native American angler although ingestion rates may be different	Similar to Native American angler
Objective 3 (cont.): Determine Baseline Risk to Human Receptors from COIs in the Forebay under Post-removal Action Conditions [2]									
• Sediment • Groundwater Seeps	• Surface Water	**Hypothetical users of river water as potable water supply source**	• Ingestion • Dermal contact	• COIs in Surface Water • COIs in seep water	• Limited data for COIs in seep water	• COIs in Surface Water • COIs in other uncharacterized seeps	• COIs in Surface Water • COIs in other uncharacterized seeps	• Compare measured COI concentrations in surface water and seep water against DEQ and/or USEPA screening values for potable water sources	• If COIs in surface water and seep water are lower than potable water criteria, no further evaluation. • If COIs in seep water exceed potable water criteria, additional evaluation of site-related contribution or upland source control may be recommended. • If COIs in surface water exceed potable water criteria, additional evaluation of site-related contribution maybe recommended.

[a] Archived samples for fin-fish species currently available: Smallmouth Bass, Large-scale Sucker, Peamouth and Sculpin.
[b] Crayfish are an important dietary component for the smallmouth bass. Measured crayfish data may be used to predict site-related COI concentrations in smallmouth tissue.
[c] DQOs and data requirements related to upland exposure media are presented in the Upland DQO table.
[d] An additional human receptor who may be present at the site is the non-tribal high-consumption fisher (similar to those at Portland Harbor) who may consume resident and anadromous fish species at higher rates than the recreational fisher. This receptor will be evaluated as follows: first, a literature search will be performed to determine if such populations are present or likely to occur in the vicinity of the Bonneville Dam area. If they are not present or if they are present but their consumption patterns are not substantially different from the recreational fisher or the tribal fisher, this potential receptor will not be evaluated. If they are present, and their consumption rates or species consumed are significantly different from the recreational fisher or tribal fisher, then the non-tribal high consumer fisher will be included as a separate receptor in the baseline risk assessment.

Table 8-3. Data Quality Objectives and Data Requirements for Baseline Human Health and Ecological Risk Assessment, River OU

[e] Sample size was selected to allow statistical comparisons of upstream and forebay areas, with power and confidence levels corresponding to as described in the RI MP. Sample collection for tissue will consist of multi-incremental composites. Multi-incremental sampling is a sampling methodology that provides for the collection of many samples over a broader aerial extent. Several samples are composited from each station into one sample and analyzed. This method provides a more accurate average concentration of contamination across the aerial extent of the station. The method also increases the probability of hitting potential "hot spots" that may have otherwise been missed during conventional discrete sampling since several more samples are being collected.
[f] These are prey items prey items known to be consumed by these receptors in other studies from the literature (USEPA 1993). Not all of these species are present at the site.
[g] Based on CRITFC 1994.

Notes:

1) Baseline conditions for the Risk Assessment are defined as post-removal action conditions in the Forebay.
2) A limited amount of sediment and clam data will be collected in the removal area, prior to removal. A few sediment samples will be collected in the downstream area at the same time. After completion of removal action, sediment, water and tissue data will be collected in the removal area as well as in the rest of the Forebay, in upstream reference areas and for any additional downstream data colleciton.
3) Exposure point concentrations in sediment to represent baseline conditions in the removal area (i.e., residual post-removal concentrations) will be developed from the post-removal action data. Tissue concentrations and BSAFs for the baseline HHRA and ERA will be estimated and used, as appropriate, on the basis of post-removal tissue, sediment and water data.