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Tulalip Landfill

Marysville, Washington

Cerclis # WAD980369256

Site Exposure Potential

The Tulalip Landfill site covers 60 hectares on North Ebey Island at the mouth of the Snohomish River, 1 km southwest of Marysville, Washington (Figure 1). The site is located within the 100-year floodplain of the Snohomish River, and the landfill is surrounded by low-lying tidal wetlands. Two tributaries of the Snohomish River, Ebey and Steamboat sloughs, border the site to the north and south, respectively. The sloughs discharge to Possession Sound 2 km west of the site. The confluence of these sloughs and the Snohomish River in Possession Sound forms the Snohomish River delta.

From 1964 to 1979, approximately 3.1 million m³ of domestic and industrial wastes were disposed of at the site. The waste materials were delivered to the site via barges, which reached the

landfill via on-site canals, and were buried in unlined cells dredged below the water table in tidal wetlands. Waste materials were also used to fill these canals. Materials disposed of at the site included construction debris, paper and printing wastes, utility company wastes, hospital and laboratory materials, and fertilizers (Tetra Tech, 1987; Ecology & Environment, 1988). In 1979, the site was closed and the landfill was diked and capped (Ecology & Environment, 1988). However, open disposal of construction debris was observed at the site in 1990 (Stuart, personal communication 1990).

Groundwater at the site ranges from 1.5 to 10 m below ground surface, and generally flows southwest, discharging to the Snohomish River delta. Numerous leachate seeps are discharging to the

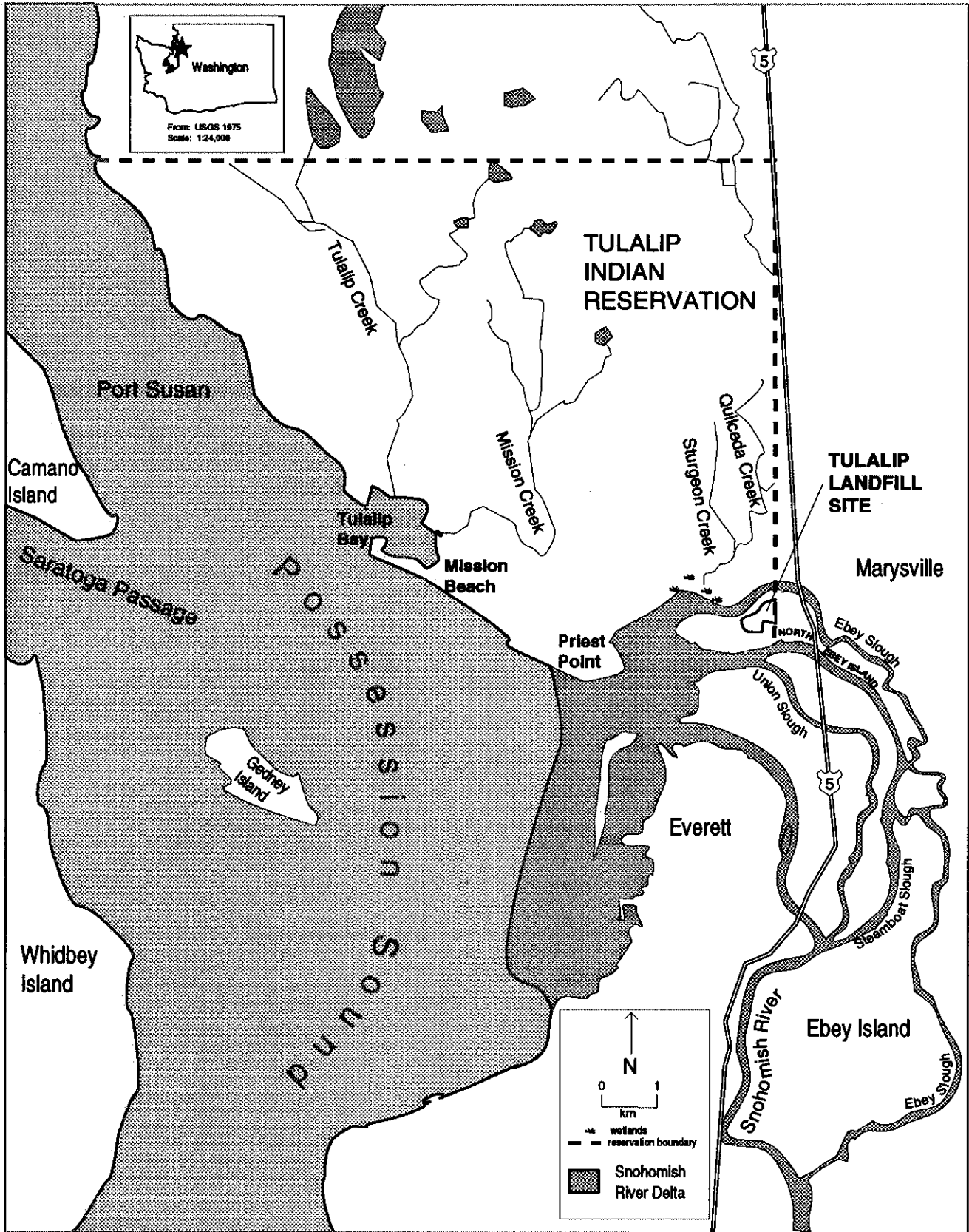


Figure 1. General vicinity of the Tulalip Landfill site in Marysville, Washington

surrounding wetlands and the sloughs. Pooled water was also observed in areas across the site (Ecology & Environment, 1988; Stuart, personal communication 1990). Surface water, leachate, and groundwater discharge represent potential pathways of contamination from the site to NOAA resources and associated habitats.

NOAA Trust Habitats and Species

The surface waters and associated bottom substrates of the Snohomish River delta are the primary habitats of concern to NOAA. The tidal mudflats and emergent marshes near the site provide spawning, nursery, and adult habitat for numerous species (Table 1; English, 1976; Moore, 1976; Roetcisoender and English, 1976; Shapiro and Associates, 1978; City of Everett, 1982; Jones & Stokes, 1984; Hoynes, personal communication 1990; Mead, personal communication 1990; Sekulich, personal communication 1990). During high tide periods, the channels in the wetlands surrounding the landfill may also be used by trustee species for adult forage.

Pacific salmon use the delta as a congregating area during upstream migration. The out-migrating juvenile salmon use the nearshore areas for nurseries. Young shad use the delta as a spring nursery. Juveniles and adults of English sole, the most abundant demersal species, likely

forage in intertidal areas near the site during flood tides. Dungeness crab are abundant and ubiquitous throughout the delta.

There are important commercial and recreational fisheries in the delta for pink, chum, coho, and chinook salmon; steelhead and cutthroat trout; American shad; English sole; and Dungeness crab. There are salmon hatcheries northwest of the Tulalip Landfill site in Tulalip Bay, and 85 km upstream of the site in Skykomish, Washington.

Site-Related Contamination

Data collected during preliminary site investigations indicate that groundwater, leachate, surface water, soils, and sediments are contaminated (Ecology & Environment, 1988; PTI Environmental Services and Tetra Tech, 1988). Primary contaminants of concern to NOAA are the trace elements, PCBs, fecal coliforms, and antibiotic-resistant pathogens. Maximum concentrations of trace elements detected at the site are summarized in Table 2, as are applicable screening levels.

Concentrations of chromium, copper, lead, mercury, nickel, silver, and zinc were highly elevated in groundwater and leachate and exceeded applicable ambient water quality criteria (U.S. EPA, 1986) by one to two orders of magnitude. Except for silver, these trace elements were also detected at high concentrations

Table 1. Species and habitat use in the Snohomish River delta.

Species		Habitat			Fisheries	
Common	Scientific Name	Spawning	Nursery	Adult Forage	Comm.	Recr.
ANADROMOUS SPECIES						
American shad	<i>Alosa sapidissima</i>	♦	♦	♦	♦	
Pacific lamprey	<i>Entosphenus tridentatus</i>			♦		
pink salmon	<i>Oncorhynchus gorbuscha</i>		♦		♦	♦
chum salmon	<i>Oncorhynchus keta</i>		♦		♦	♦
coho salmon	<i>Oncorhynchus kisutch</i>		♦		♦	♦
chinook salmon	<i>Oncorhynchus tshawytscha</i>		♦		♦	♦
cutthroat trout	<i>Oncorhynchus clarki</i>		♦			♦
steelhead trout	<i>Oncorhynchus mykiss</i>		♦			♦
Dolly varden	<i>Salvelinus malma</i>		♦			♦
longfin smelt	<i>Spirinchus thaleichthys</i>	♦	♦	♦	♦	♦
eulachon	<i>Thaleichthus pacificus</i>	♦	♦	♦		
RESIDENT SPECIES						
Fish						
Pacific sand lance	<i>Ammodytes hexapterus</i>	♦	♦	♦		
sablefish	<i>Anoplopoma fimbria</i>		♦		♦	
arrow goby	<i>Clevelandia ios</i>	♦	♦	♦		
Pacific herring	<i>Clupea harengus pallasii</i>		♦			
shiner perch	<i>Cymatogaster aggregata</i>		♦	♦		
striped sea perch	<i>Embiotoca lateralis</i>		♦	♦		
buffalo sculpin	<i>Enophrys bison</i>		♦	♦		
Pacific cod	<i>Gadus macrocephalus</i>	♦	♦	♦	♦	♦
3 spine stickleback	<i>Gasterosteus aculeatus</i>	♦	♦	♦		
P. staghorn sculpin	<i>Leptocottus armatus</i>	♦	♦	♦		
Pacific hake	<i>Merluccius productus</i>	♦	♦		♦	
Pacific tomcod	<i>Microgadus proximus</i>		♦	♦	♦	
Dover sole	<i>Microstomus pacificus</i>	♦	♦	♦	♦	
English sole	<i>Parophrys vetulus</i>	♦	♦	♦	♦	♦
starry flounder	<i>Platichthys stellatus</i>	♦	♦	♦	♦	♦
sand sole	<i>Psettichthys melanostictus</i>	♦	♦			
Invertebrates						
pink mud shrimp	<i>Callinassa californiensis</i>	♦	♦	♦		
Dungeness crab	<i>Cancer magister</i>	♦	♦	♦	♦	♦
bent-nosed clam	<i>Macoma nasuta</i>	♦	♦	♦		
sand clam	<i>Macoma secta</i>	♦	♦	♦		
soft shell clam	<i>Mya arenaria</i>	♦	♦	♦		♦
edible mussel	<i>Mytilus edulis</i>	♦	♦	♦		♦
marine crayfish	<i>Upogebia pugettensis</i>	♦	♦	♦		
Marine mammals						
killer whale	<i>Orcinus orca</i>			♦		
harbor seal	<i>Phoca vitulina</i>			♦		
Dall porpoise	<i>Phocoenoides dallii</i>			♦		
California sea lion	<i>Zalophus californicus</i>			♦		

in surface waters from the wetlands adjacent to the landfill. Copper and lead were the only trace elements measured at concentrations exceeding applicable screening criteria in surface waters from the sloughs.

Arsenic, copper, lead, and zinc were consistently detected at concentrations greater than screening criteria in on-site, leachate-stained soils and sediments from the wetlands surrounding the landfill. Elevated concentrations of chromium, nickel, and silver were measured in sediments from the sloughs and Priest Point, approximately 2 km west of the site.

PCBs were measured at high concentrations in leachate and leachate-stained soils. PCBs were also detected in tissue samples of fish collected

from Ebey and Steamboat sloughs. Concentrations in tissues ranged from 10 to 120 µg/kg (Lane, 1986).

Little significance is attached to the presence of total coliform bacteria in non-drinking waters except at concentrations greater than 2,000 organisms/100 ml. Total coliform bacteria were detected at concentrations exceeding this level in leachate, pooled water, and surface water in the wetlands adjacent to the landfill. Comparison values for opportunistic mammalian pathogens are not available, but high concentrations of three opportunistic antibiotic-resistant pathogens were measured in leachate and pooled water at the site. Concentrations of the pathogens and coliform bacteria decreased in surface waters away from the landfill.

Table 2. Maximum concentrations of contaminants of concern at the site.

	Water				Soil		Sediment	
	Ground - water µg/l	Leachate µg/l	Surface Water µg/l	AWQC ¹ µg/l	Surface Soil mg/kg	Average ² U.S. Soil mg/kg	Sediment mg/kg	ER-L ³ mg/kg
INORGANIC SUBSTANCES								
arsenic	200	35	13	36	44	5	76	33
cadmium	38	14	13	9.3	ND	0.06	ND	5
chromium	1,300	1,000	180	50	170	100	170	80
copper	1,600	480	94	2.9	74	30	180	70
cyanide	17	ND	ND	1	ND	NA	ND	NA
lead	6,300	410	120	5.6	340	10	140	35
mercury	1.3	2.1	ND	0.025	ND	0.03	ND	0.15
nickel	1,300	500	98	8.3	74	40	120	30
silver	61	34	ND	NA	ND	0.05	1.7	1
zinc	2,500	1,500	210	85	310	50	1,100	120
1: Ambient water quality criteria for the protection of aquatic organisms. Marine chronic criteria presented (EPA, 1986). 2: Lindsay (1979). 3: Effects range-low; the concentration representing the lowest 10 percentile value for the data in which effects were observed or predicted in studies compiled by Long and Morgan (1990). NA: Screening level not available. ND: Not detected at method detection limit.								

As part of an EPA Puget Sound Estuary Program study, bioassays using *Rhepoxynius abronius* were conducted using sediment samples collected from Ebey and Steamboat sloughs (PTI Environmental Services and Tetra Tech, 1988). Toxicity ranged from 0 to 25 percent for sediments from Ebey Slough, 0 to 10 percent for sediments from Steamboat Slough, and 0 to 10 percent for control sediments. The results of the bioassays indicated that sediments in Ebey Slough may be toxic to some marine organisms.

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