# BAKER BAY (ILWACO) SEDIMENT QUALITY INVESTIGATION
# 9 JUNE 1997

## Abstract

## Introduction

**Previous Study** Baker Bay is on the Washington side of the Columbia River and is traversed from the west by West Channel, a Federally maintained navigation project, extending from the Columbia River project at River Mile (RM) 2.5 upstream to the entrance of Ilwaco Boat Basin at Channel Mile (CM) 2.5. The channel is maintained to a depth of 16 feet, is 3.2 miles in length and is maintained to a width of 150 to 200 feet. Sediment quality investigations have been carried out at various yearly intervals since 1973, with the last investigation at Baker Bay being done in 1992. In 1987 testing for physical properties, bulk chemistry, the elutriates underwent bioassays and the sediments were found to be acceptable for in-water disposal at a dispersive site to avoid any adverse effect that might derive from ammonia concentrations that were detected during elutriate testing. The results of the physical and bulk chemical testing done in 1992 showed the materials to be clean sands between CM 0.0 and 2.9 and from CM 2.9 to the boat basin entrance the materials were fine grained, all of which was suitable for unconfined in-water disposal.

**Current Study** The purpose of this investigation was to collect and analyze sediment quality samples from West Channel to determine the appropriate disposal methods for dredged materials. Six sites were sampled and subjected to physical analysis and three of these were also subjected to chemical analysis because they included fine-grained sediment. The change from sands to silty sand occurred at about CM 1.5, which was expected based on previous sampling experience.

## Methods

**Sediment Sampling** Sediment sampling in the West Channel of Baker Bay was conducted on 9 June 1996 using a Van Veen corer, which is a surface sampler capable of retrieving materials from a depth of about 10 cm. CoE and National Marine Fisheries Service (NMFS) personnel conducted the sampling operation. Three samples, including IL-VV- 1, -2, and -3 were obtained from the outer reach of West Channel. Samples IL-VV-4, -5, and -6 were taken from the inner reach of the channel leading to the entrance of the Ilwaco Boat basin. A single sample from each of the six sample locations (see attached map) was extracted from the Van Veen corer and placed in separate 1,000 ml Ziplock bags for transport to the U.S. Army Corps of Engineers Materials Laboratory in Troutdale, Oregon for physical analysis. Three of the samples IL-VV-4, -5, and -6 were by field examination, believed to contain more than 30 percent fine-grained materials and were therefore placed in EPA approved clean 500 ml jars for preservation of chemical constituents. Samples for chemical analysis were placed under ice in coolers for

transport to the Corps' contract laboratory, Columbia Analytical Services, (CAS) in Kelso, Washington, for analysis.

**Sediment Testing** The sediments collected were subjected to a dredging analysis at the Troutdale Materials Laboratory. The analysis included particle size distribution, particle shape, void ratio, resuspended density, specific gravity, and volatile solids content. Samples IL-VV-4, -5, and -6 were subjected to chemical analysis for selected chemicals including, total solids, total organic carbon, acid volatile sulfides, total metals, pesticides and PCB's, and PAH's. Chemical analysis was performed by Columbia Analytical Services.

## Results / Discussion

### Physical Analysis

Referring to Table 1, the predominance of sand-sized particles in IL-VV-1, -2, and -3 and the predominance of silt-sized particles in IL-VV-4, -5 and -6 is readily apparent. This areal distribution of particle sizes is similar to results from previous investigations in West Channel and Ilwaco Boat Basin, where it was noted that the particle size increases with increasing distance riverward and downstream, toward the mouth of West Channel. Volatile solids content of the sediment in the channel increased from 0.4% in sample IL-VV-1 at the downstream end of the channel to 4.9% in IL-VV-6 the upstream end near the boat basin. This is to be expected, since the water in the inner channel occupies a lower energy zone where organic materials settle out of the water column.

### Chemical Analysis

**AVS** The acid volatile sulfide (AVS) content of IL-VV-4 was 210 ppm which indicates an excess of sulfide available for binding metallic ions into relatively inert sulfide compounds that are not biologically active. (See Table 1.)

**TOC** Total organic carbon is an indicator of the sediment capacity to concentrate contaminants from the water column, thereby making them unavailable to biota. The TOC of the three samples had a median value of 1.41 was well under the 3% considered as the lower TOC limit for a sediment to be classed as an organic sediment.

**Metals** Table 2 shows the results of analysis for selected metals. Sample IL-VV-6 had the highest aggregate metal content, but none of the samples, including IL-VV-6, either reached screening levels, or even approached concern levels for metals.

**Pesticides / PCB's** The results of analysis for organochlorine pesticides are shown on Table 3. The pesticides of the DDT group were detected at very low levels in all three samples and in all cases the result showed the concentrations to be far below screening levels. Only 4,4'-DDE was found in IL-VV-4 at 0.6 ppb, while 4,4'-DDE at 0.8 ppb, 4,4'-DDD at 0.5, and 4,4'-DDT at 0.6 ppb was found in IL-VV-5. Heptachlor at 0.3 ppb, DDE at 0.8 ppb and DDT at 0.5 ppb were detected in IL-VV-6. None of the samples were found to contain PCB's.

**PAH's** Although PAH's were detected in each sample, they were far below the levels of concern for both total PAH and the PAH compounds of interest. Table 4 shoes the results of PAH analysis on the three sediment samples.

**Quality Control** The laboratory reported no quality control issues for the analytical procedure carried out on the sediments sampled in the West Channel of Baker Bay.

## Discussion

### Physical Analysis

Sediments in the outer channel are mostly sands, while the sediment in the inner channel is composed primarily of silts and clays. Relative sand and relative fines percentages have changed little from previous studies. The fine-grained sediment coupled with nearly 5% volatile solids found in the inner channel provides an environment conducive to enrichment of chemicals of concern. However, there has been no significant change in concentrations of these chemicals since 1972, though some pesticide and PAH species detected have changed or concentration levels have diminished.

### Chemical Analysis

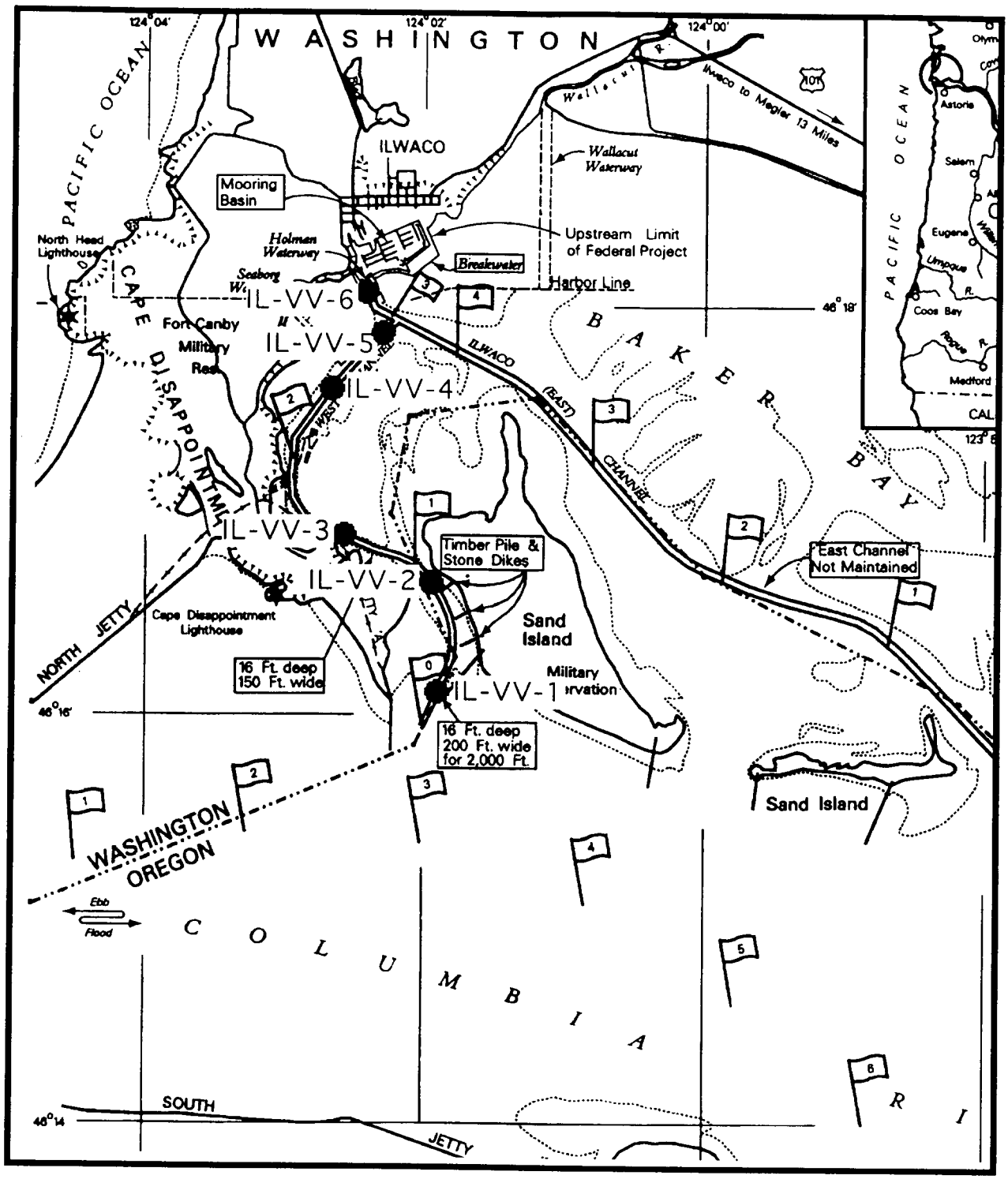
Previous investigations have detected cadmium and mercury in concentrations above the Oregon background level for sediments from the vicinity of the upstream end of the West Channel. At that time it was recommended to monitor the shoal, but additional testing in 1992 and this investigation failed to detect cadmium in the samples and mercury was present at values that were below concern levels. All other metals that were detected during the 1997 investigations in West Channel were found at levels below screening levels. Of these, mercury at 0.1 ppm in IL-VV-6 was the only metal found at a concentration even approaching the threshold screening value, (0.15 ppm). Both the individual compounds detected and concentrations reported of the organochlorine pesticides vary among the study results. Values for Heptachlor and the DDT compounds found during this study, while present below concern levels, represent a change from 1992, when only Endosulfan II at < 2 ppb was reported in one sample from the Ilwaco Boat Basin, and none of the DDT compounds were detected. Organochlorine pesticides were also detected around Ilwaco Boat Basin Entrance and upstream in Chinook Harbor during previous studies.

## Recommendations

The sediment in West Channel is relatively free of contaminants and none were found to be above screening levels during this study. Based on these findings, the sediment from West channel is suitable for unconfined in-water disposal.

Table 5. Concentrations in high PAHs in Ilwaco Boat Basin sediment.

| | PAHs | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample | Fluoranthene | Pyrene | Benz (a) Anthracene | Chrysene | Benzo (b+k) Flouranthen | Benzo (a) Pyrene | Indeno Pyrene | Dibenz Anthracen | Benzo Perylene | **Total** |
| | ppb | | | | | ppb | | | | |
| IL-VV-04 | 75 | 84 | 36 | 41 | 65 | 49 | 42 | 8 | 35 | **435** |
| IL-VV-05 | 29 | 28 | 12 | 16 | 27 | 18 | 17 | 3 | 15 | **165** |
| IL-VV-06 | 34 | 36 | 15 | 19 | 34 | 23 | 22 | 4 | 20 | **207** |
| 1997 Mean | 46.0 | 49.3 | 21.0 | 25.3 | 42.0 | 30.0 | 27.0 | 5.0 | 23.3 | **269.0** |




SAMPLE LOCATIONS JUNE 1997